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PREFACE.

Another year has been added to our labours, and it is again a pleasant duty to lay before our readers a brief account of the progress of the two professions, to the service of which we are devoted. It will naturally be expected that in a year of severe financial embarrassment, succeeding also to one so fertile in important results as was the last, there must necessarily be a falling off in the amount of what would otherwise have been effected, and a delay in the execution of many works, the completion of which is thereby retarded. Our own exertions, however, we have not suffered to flag under circumstances so dispiriting, but trust that so far as has depended on us, the present volume is worthy of its predecessor, and of the patronage with which our endeavours have been crowned.

In considering the general features of architecture, we find that the invasion of the Renaissance style, which we announced last year, has actually occurred, but has singularly been accompanied with, or rather smothered by, a resuscitated taste for Elizabethan external and internal decoration. Considerable attention has also been devoted to the early antiquities of Moresque architecture. Our own ecclesiastical antiquities, we are happy to mention with praise, have been chosen as the special object of enquiry by a Society of Clergymen at Oxford, and thus we are led to hope for an improvement in taste, in a quarter which hitherto has had but too great a part in producing the present degeneracy.

A striking and interesting circumstance to every well wisher of the arts, is the great zeal with which both associated bodies and individual members of the profession have engaged in the struggle for maintaining the true principles of competition. Among these cases have been the Nelson Testimonial, St. George's Hall Liverpool, and the Royal Exchange, in the still pending contest respecting which latter, we believe we may say with truth, "Quorum pars maxuma fui." On learning the extraordinary attempt to impose a tax of a guinea on applicants, for copies of the Instructions of the Committee, we immediately obtained copies both of the instructions and the plans, and left them at our office for the free use of any applicant—a course of conduct for which we feel an abundant reward, in the vote of thanks unanimously bestowed on us by the Manchester Architectural Society. From these exertions hitherto, no immediate fruit has resulted, but much has been already attained from the influence which they have had in awakening the public mind from its lethargy, and calling its power to a subject so importantly affecting the national glory and the general taste.

Great progress has been made this year in bringing the accessary science of geology to bear upon architectural pursuits, and with a success which must have an influence on the future progress of each respectively. Government issued a commission, composed of geologists and architects, to examine the quarries of England, for the purpose of ascertaining the stone best fitted for the construction of the new Houses of Parliament. This commission has produced a report which must long be a standard of information to the profession, and a valuable model in future enquiries. The Goverment has also formed a Museum of Economic Geology, attached to the department of Woods and Forests, in which the commissioners specimens are collected, and to which future accessions will be made. Special courses of lectures on the connection of these two subjects have been delivered by eminent geologists: at the Royal Institute of British Architects by G. F. Richardson, (reported in our Journal), and at the Architectural Society, by E. W. Brayley, jun. Great attention is also paid to these subjects in the several faculties of civil engineering. Although not yet brought into immediate connection with architecture, we feel it our duty to allude to the discoveries in photograpy by Daguerre and Fox Talbot, and to those in engraving by voltaic electricity made at Liverpool. In the British Museum great improvements have been effected, and a Museum of Antiquities has been formed by the city authorities, in Guildhall. We regret, however, that the Soane Museum, the proper Museum of Architecture, as yet manifests no progress. The elementary drawing and professional schools throughout the country have exhibited a remarkable improvement, as have the schools of design, and the class of decorative artists appears to have attained a higher standard than it ever before reached. An act has been passed for giving protection to the copyright of manufacturing designs, and it is to be hoped that this symptom of a better system of legislation for art, may be pursued successfully. We may mention here as another legislative act, although not in perfect regularity, that an amendment has been made in the Brick Duties Act.

Great numbers of churches have this year been erected, and more are in progress, but of works of a high class few have been completed. We may however mention the Reform Club; the Club Chambers Association; the Athenæum and Unitarian Chapel, Manchester; the Highgate Cemetery; a Conservatory at Chatsworth for the Duke of Devonshire, one of the largest in the world; and a Colossal Monument in Scotland, to the Duke of Gordon. Many elegant commercial buildings have been erected; and an increased taste has manifested itself for public gardens, cemeteries, and other branches of landscape gardening. It is with regret that we are still obliged to complain of the little regard that is paid to the maintenanoe of the public taste, by the managers of the funds for the new churches. As to the other arts they are totally neglected, and architects have generally to complain of the niggardliness and inefficiency of the means placed at their disposal. In fact the advocates for new churches, like the fitters out of emigrant ships, seem to think that plenty of stowage is of much more importance than either convenience or safety. The members of the establishment have a rich inheritance of artistical wealth left to them by our ancestors, and they are morally bound to maintain its dignity, yet so far from doing so, they make little provision for the future, and take little care for the preservation of what they have in hand. We have to regret this year the demolition from such neglect of the nave of St. Saviour's, Southwark, a shrine rich in its antiquarian and historical associations, and the injury by a most terrific hurricane in the early part of the year of the Cathedrals of York, Chester, and St. Patrick's Dublin, and of the Town Hall, Birmingham, and subsequently of the Cathedral of Ripon. Repairs and restorations have been effected of Wolverhampton, Collegiate Church, Madley Church, the Pilgrim's Chapel Maidstone, St. Mary's Redcliffe, the east end of Guildhall, and many of our Cathedrals. A Government grant has been made for the restoration of the Cathedral of Glasgow, a work meritorious in itself, but an act of local favouritism, which has been vainly solicited for other parts of the empire. But a small grant would have preserved St. Saviours. Some slight improvements have been made in Whitehall, but no measure has been taken to render more worthy of the public a line of communication which possesses many interesting monuments, and recalls many historical scenes. The palaces of Whitehall and Northumberland House, both have a back view upon this site, and here also are situated the statue of James 2d, the United Service Museum, and the Water Gate. The principal foreign edifice completed this year, has been the Winter Palace of St. Petersburg, a work of great splendour and of rapid execution, a wonder of power if it were not an emblem of the weakness of the Russian empire. While this monument of selfish barbarism has been erected, what has been done for the temporary and permanent welfare of that immense realm? Canals have been projected a hundred years, and the only railway is that leading to the palace.

We have to deplore the loss of two members of the profession, each of whom has left a name, which must long live in its history. William Wilkins was the architect of Downing and University Colleges, of the University Club, St. George's Hospital, and the National Gallery; Rudolph Cabanel most distinguished himself as a theatrical architect, and by the improvements he introduced in many of the technical branches of architecture. Mr. Hardwicke has succeeded Wilkins as a Member of the Royal Academy, and Mr. Charles Cockerell as Professor of Architecture. Architects have as usual been lax in the literary career, but many valuable works have been produced, among which we may mention the new edition of the Public Buildings of London, by W. H. Leeds; the Public Buildings of the West of England, by John Foulston; the Traveller's Club, by W. H. Leeds; the Ancient Half-timbered Houses of England, by M. Habershon; the Suburban Gardener, by J. O. Loudon; the Architectural Remains of the Reigns of Elizabeth and James 1st, by C. J. Richardson; and the new edition of Repton's Landscape Gardening, by J. O. Loudon.

When we come to contemplate the government measures affecting the engineering interest, we are at once struck by a combination of jobbery, such as no year has hitherto so abundantly produced. Defeated in the House of Commons on the Irish Railway business, they managed to perpetrate the Shannon Navigation job; and again repulsed by the public voice on the Steam Vessels Accidents Commission, hydra-like they bring out a new report on Railways, teeming with all the elements of fertile mischief, at the very period when their own officers had exposed in the case of the Caledonian Canal, the consummated evils of a long process of ignorance and mismanagement. One of their last acts has been the appointment of a commission, to investigate the Harbours on the south coast of England, and another to decide on the competing railway lines to Scotland and Ireland. The results of these two measures the experience of their predecessors has taught us to look to with dread, and we have little hope from their origin of any error in our prognostic. It is to us a matter of consolation that we have not been remiss in opposing so far as in us lay, measures so fraught with iniquity, and we believe we may say with some little effect, but it depends neither on our temporary exertions, nor on those of others to combat this growing evil, it requires the united energy of every person interested, to resist a series of measures which are confined to no party and to no set of men, but are part of a system taken up with the robes of office and uniformly pursued by the most opposite in opinion. The civil engineers have an immediate interest in exerting themselves for this object, as the certain result of government success in this system must be to reduce the members of the profession here as abroad, to be the liveried sycophants of the government, instead of the independent officers of the public at large. To resist these attempts on the part of the government authorities, a Railway Society has been formed, although, we believe, not conducted with the spirit necessary to ensure success.

A circumstance greatly affecting the mechanical members of the profession, is the great development given to public taste for subjects, by the successful results of the Leeds and other Mechanics' Exhibitions. Some experiments, interesting to the profession generally, have been made on the explosion of mines, and charges of powder under water by voltaic electricity.

The agitation in the early part of the year respecting the Great Western Railway enquiry, subsided on the decision of the proprietors of that undertaking, to continue the plans of Mr. Brunel. The second Report of the Committee on Railways is only valuable from its statistical facts, which show indisputably the necessity for lowering the present high fares. Above one hundred and fifty miles of railway have this year been opened, of which the London and Croydon, and Aylesbury branch have been opened throughout, and the following partially, the Eastern Counties to Romford; the York and North Midland from York, to the Leeds and Selby Railway; the Southampton from Hartley Row to Basingstoke, and from Winchester to Southampton; the Great Western from Maidenhead to Twyford; the Manchester and Leeds, from Manchester to Littleborough; Birmingham and Derby; Midland Counties; and Glasgow, Paisley and Ayr, from Ayr to Irvine. The system of galvanic telegraphs on the Great Western Railway, established by Professor Wheatstone, has completely succeeded. Several foreign railways have been opened, among which are the Versailles, Amsterdam and Utrecht, Taunus, and Emperor Ferdinand's from Vienna to Brunn. For ordinary roads active exertions are now being made to introduce wood pavements.

We have already mentioned that a commission has been directed, to examine the harbours between the Thames and Portsmouth, and we may farther state that the hydraulic department of engineering has this year effected many important improvements, and shows an energy which promises much more. The works in the Wash are continued with success, and active measures have been taken for the improvement of the north west coast. The Mersey, Ribble and Wyre have been deepened, and important plans are in agitation for effecting the remaining objects. After many suggestions from different quarters, actual experiments have at last been made on the propelling of vessels on canals by locomotive engines on the banks, and with such success as to leave little doubt of the permanent establishment of this mode of transit. Experiments have also been made on the use of steam vessels on canals. At Cardiff, extensive docks have been formed at the expense of the Marquis of Bute. One of the finest hydraulic works of the year, has been the river wall for the new Houses of Parliament. In France much attention has been directed towards the improvement of their harbours, and a preliminary grant of nearly two millions sterling has been made for this purpose.

Steam navigation maintains the interest which it excited last year, and has received many important accessions.—A vigorous attempt has been made by government to establish over it a spy and job system, but it is to be hoped that the miserably trifling results of their intrigues, will induce them to give up this barefaced attack; no exertion must however be omitted by all parties steadily to resist the obnoxious measure. The utility of iron steam vessels seems to have been fully established, and they have been most extensively used, particularly for river navigation.—Many also have been sent to distant parts of the empire, and to foreign countries. Their success has led to the employment of iron as a general material for ship building, and the example of the Ironsides has been followed by the building of many other iron sailing vessels. The experiments on the Archimedes and other vessels have been continued, but have led to no permanent results, the French steamer Veloce was unfortunately burned, but a sailing vessel called the Vernon, is making a voyage to the East Indies, provided with a new kind of propeller. Professor Jacobi has made some experiments on the Neva, with a boat propelled by electric apparatus, but these like the previous attempts of the Americans have been hitherto inefficient. The steam navy has been greatly increased, and the dockyards improved, at Woolwich a central establishment has been formed. Among the vessels launched are the Cyclops (the largest steam frigate in the world), the Hecla, the Stromboli, and the Prometheus. For the East Indian navy have been built the Sesostris and the Queen. The adoption of large hollow shot as an armament for this class of shipping has greatly increased its efficiency. Sweden, Russia, and Holland, are among the foreign powers who have shown attention to their steam navy, to which our English vessels have served as models. Transatlantic steam navigation has been increased by the accession of the British Queen steamer, and government has entered into a contract for the conveyance of the mails by steam from Liverpool to Halifax, Boston and Quebec. The company for steam navigation to India by the Cape, has been discontinued, and their large class steamer sold; for the line by the Red Sea, however, the East India merchants have raised a hundred thousand pounds. Dunkirk and Rotterdam may be mentioned as rising steam ports, and Hull has by this mode of communication, successfully increased her eastland trade. The French have made their steam voyages to Russia productive of great commercial advantages in the sale of articles of luxury, and they have greatly extended their steam commercial marine.

Engineering literature has been increased by the production of many valuable works, most of which, even in the present progressing age of science, must remain standard works in the library. The mental labours of the profession have not indeed been of less importance than those in the field, and as great care has been shown to leave our successors good instructions as good examples. We may enumerate: Sections of English Railways, by George Bradshaw; the London and Birmingham Railway, by Thomas Roscoe and Peter Lecount; Illustrations of Mechanics, by the Rev. T. Moseley; the Practical Treatise on Bridge Building, by E. Cresy; on Steam Boilers, by Josiah Parkes; the Theory, Practice and Architecture of Bridges, by James Hann and William Hosking; On Oblique Bridges, by George Buck; On Arithmetical Perspective, by C. E. Bernard; On Steam Engine Boilers, by R. Armstrong; On the Construction and Formation of Railways, by James Day; and on the Construction of Oblique Arches, by John Hart.

The faculties of Civil Engineering, established in different Universities during the last year have gone on with success, and that at King's College, London, has particularly distinguished itself by improvements in instruction, and by the zeal of its professors. The University of London has announced its intention of granting diplomas for attainments in Civil Engineering, but on what basis they proceed we have not yet been able to learn. If the previous course required for this be similar to that required for their other degrees, it may be very difficult, and very useless; an engineer would rather have in his employment a working man than a college diplomatist. Attempts are now being made to establish a College for Civil Engineers, which it is to be hoped may be conducted on such principles as to render it useful.

A monument to Telford, has been completed, and placed in Westminster Abbey, and a handsome testimonial has been presented to a living engineer, Robert Stephenson, for whom also a statue is contemplated. Biographies and memoirs have been published of Watt, Telford, Trevithick, and James.

The proceedings of the several professional societies, this year, have been such as to maintain their previous high reputation. The several architectural bodies, the Royal Institute, the Architectural Society, and that at Manchester have applied themselves with vigour to obtain a fair system of competition, and have shown every attention to the improvement of their members, by courses of lectures on the collateral sciences, and by the distribution of prizes. The Royal Institute of British Architects has conferred a testimony of esteem on one of its officers, Thomas Leverton Donaldson, whose services have been long and publicly known. To the Manchester Architectural Society we feel indebted for a tribute of praise to which we have already referred. In Ireland an Institute of the Architects of that country, is in a promising state of progress, but we regret that the efforts for the establishment of a similar one in the United States, have proved abortive. The Institute of Civil Engineers has maintained a high rank, and the president has worthily followed the example of his brother president, the noble Earl De Grey, in his sedulous attention to the duties of his office and the interests of the society. The Military Engineers have published the Third Volume of their Transactions, which well keeps up the reputation of its predecessors. In the United States an attempt is now being made to establish an Institute of Civil Engineers, which we earnestly hope may be crowned with success.

Having dismissed the general interests of the two professions, we believe we may refer to our exertions with some complacency. We announced last year that the pressure of matter would oblige us to increase the size of the Journal, and we have accordingly, with the exception of one number, issued during this year an enlarged edition at one shilling and sixpence. That this was called for by the wants of our subscribers has been proved by the successful results of this measure, and we trust that we may appeal to our columns whether we have exerted ourselves in a manner worthy of this support. In the present volume will be found nearly five hundred closely printed pages, and above two hundred wood engravings, among which are those of the Synagogue in Great St. Helen's, the Athenæum Derby, the Pont du Carrousel, Bow Bridge, the Arc de l'Etoile, the Nelson Column, and the Club Chambers Association. There will also be found the Reports on the Great Western Railway Enquiry, on Steam Vessel Accidents, on the Caledonian Canal, and on the Stone for the New Houses of Parliament; a series of papers by Ralph Redivivus, Candidus, and on the Theory of the Steam Engine, by A. Aristides Mornay; on Railway Curves, and on Harbours, a Memoir of Trevithick, the Designs for the Nelson Memorial; and translations from the French of Arago's Life of Watt, and De Clairac's Ancient Marbles.

To our correspondents we have been much indebted for their valuable contributions on many occasions, and we can assure them, sincerely, that nothing shall be wanting on our part, at all times to show every attention to their communications. The Journal has always been open to every thing of merit, and, we trust, we shall never be found remiss in doing justice to any subject committed to our charge.

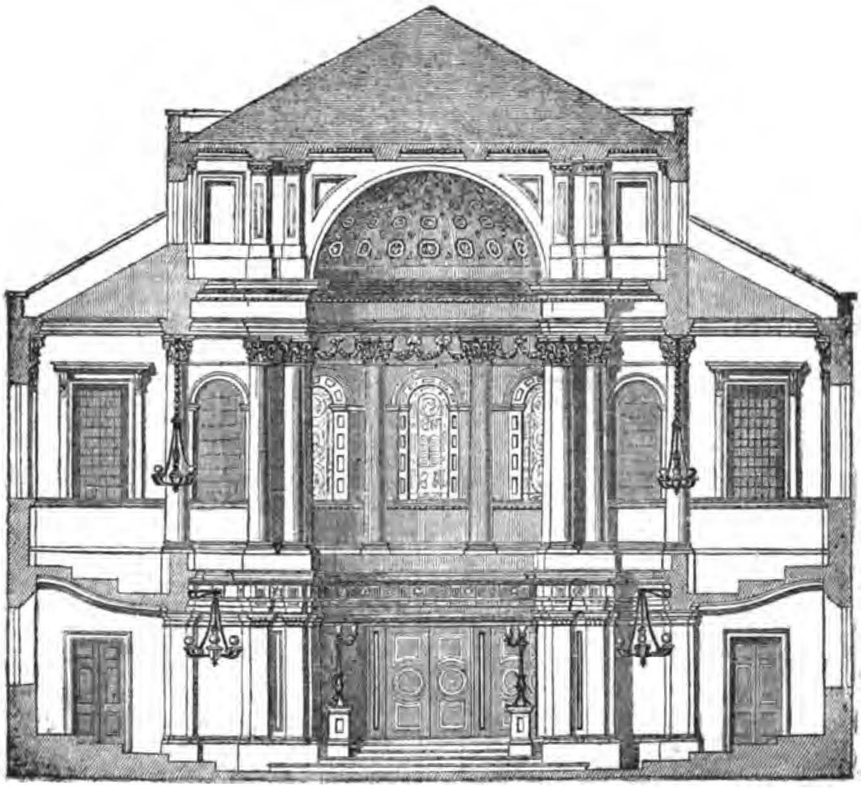
THE

CIVIL ENGINEER AND ARCHITECT'S JOURNAL.

THE NEW SYNAGOGUE,

GREAT ST. HELEN'S, BISHOPSGATE-STREET.

J. DAVIES, ESQ., ARCHITECT.



SECTION.

Scale of Feet.

10 5 0 10 20 30

On turning to the Index of our last, or we should say our first volume, our readers will there find the pages referred to, where we have already spoken of this building. To the second account there given of it we have now little more to add, except that the cuts will supply information as to various particulars not pointed out at page 339.

The section shows the general style of the interior, and the design of that end at which the ark is placed, also the arrangement of the lamps, and of some of the candelabra; but it conveys no idea of the effect, either as regards splendour of colour or perspective appearance. Most of our readers, however, will, so far from requiring to be reminded of this, be able to complete the picture for themselves, from the sketch here given; or should they not have done so before, they will now most likely take an opportunity of visiting the building itself. We ourselves have not seen it since it was opened for service, but should judge that it must look particularly rich when lit up; though at such times the effect of the painted windows within the ark must be lost—not, however, necessarily so, because a few gas-burners placed before them on the outside would show to perhaps even greater advantage than by day, and would diffuse a brilliancy and glow over the upper part of that recess. We cannot conclude without congratulating Mr. Davies both on the opportunity he has had for displaying his taste, and the able manner with which he has turned it to account.

The references to the plan of the ground-floor of the front building and lower part of the synagogue are as follow:—

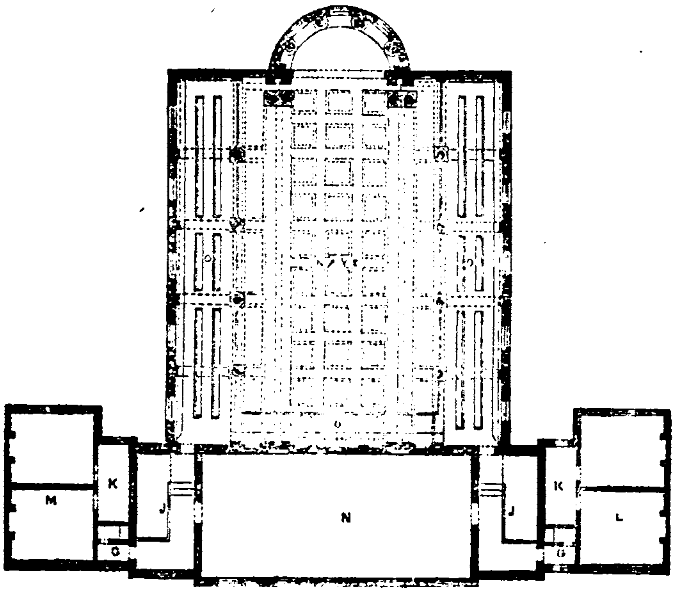
A. Open vestibule or loggia, with arches on coupled Tuscan columns; 29 × 14.6′.

B. Inner vestibule or corridor, communicating with J. J., the staircases to the galleries.

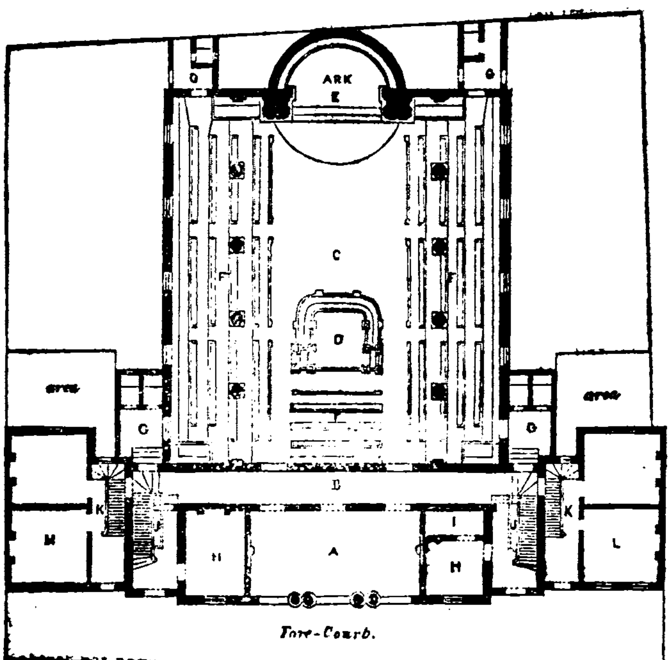
C. The open area or floor of synagogue, 23 feet wide, between the lower sittings, F. F.

D. The readers' platform.—G. G. Waterclosets.—H. Office.—I. Strong closet.—K. K. Staircases in the private residences.—L. Secretary's residence.—M. Warder's residence.

In the other plan is the committee-room, 46 × 22 feet, and O.O.O. the ladies' galleries.



PLAN OF UPPER FLOOR.



PLAN OF GROUND FLOOR.

Scale of Feet.

0 10 20 30 40 50 60

REVIEWS.

A Treatise on the Law of Dilapidations and Nuisances. By DAVID GIBBON, ESQ., of the Middle Temple, Special Pleader. London: J. Weale, 1838.

Architecture has its jurisprudence as well as medicine, and equally as connected with the rights of property, as a matter of police, it has been necessarily the subject of extensive legislation. Coming more within the province of the lawyer than of the builder, and being a subject in which the latter is not *tam Marte quam Mercurio*, we derive the greater pleasure from seeing it in the hands of one who is best capable of doing justice to its technicalities. The utility of its study is so evident, that there is indeed scarcely a day in which its necessity is not impressed. Its extent, too, is so great, that almost every branch requires a separate treatise, and it comprehends the laws of contracts, awards, fixtures, dilapidations, nuisances, buildings, sewers, drainage, prescriptive right, highways, &c.

Mr. Gibbon has already obliged the profession with a work on the law of fixtures, and we are now indebted to him for one on dilapidations. It does not diminish the confidence derived from its predecessors, and is written in a plain and intelligible style, and supported by numerous legal authorities.

In the introduction, the author has given a general view of the law on this subject, and then enters into the detail of its branches in the subsequent chapters. In the first chapter we find the law of dilapidation as it affects ecclesiastical structures and lands. The second exhibits, with equal skill, this law as it regards leases, either for life or during a term of years. From this chapter we shall make a few extracts, and show our readers with what ability Mr. Gibbon has treated his subject, although we must necessarily omit the references to the notes. These, indeed, form a most valuable and extensive portion of the work, and illustrate, by various authorities, the law as explained by the author.

For the natural decay of buildings, which is the inevitable effect of time or for fair and ordinary wear, a tenant for years is not, generally speaking chargeable; but for extraordinary decay, caused by suffering the premises to be exposed to the elements, or for accidents happening during the term, the tenant is liable. Suffering houses to be uncovered, whereby the spars or rafters, planchers, or other timbers, become rotten, is waste; but barely suffering them to be uncovered, without rotting the timber, is not waste. Where, after the determination of a yearly tenancy, the landlord had an estimate made of the sum necessary to put the house into complete and tenantable repair, and brought his action for that sum, Lord Kenyon said, "That it was not to be permitted to go for the damages so claimed. A tenant from year to year was bound to commit no waste, and to make fair and tenantable repairs, such as putting in windows or doors that have been broken by him, so as to prevent waste and decay of the premises; but that, in the present case, the plaintiff claimed a sum for putting a new roof on an old worn-out house." In another case, where plaintiff declared on a contract by defendant to deliver up premises in same state as he received them, and merely proved a tenancy from year to year, Gibbs, C. J., nonsuited the plaintiff, saying, "That the obligation was stated too largely. Can it be contended," he continued, "that a yearly tenant would be bound to rebuild if the premises were destroyed by accidental fire, or if they became ruinous by any other accident? He is only to use them in a husband-like manner;" that is, with ordinary care. In Anworth v. Johnson, an action against a yearly tenant, it appeared that the stairs of the house were worn out, new sashes were wanted, the doors were rotten and falling to pieces from decay, latches, keys, and locks, were broken and damaged, and a panel of a door was broken. Lord Tenterden, in summing up, said, "It appears this was a very dilapidated house, when the defendants took it, and they have had a very considerable quantity of work done upon it. The first question is, what are the things an occupier of a house from year to year is bound to do? He is only bound to keep the premises wind and water tight. A tenant, who covenants to repair, is to sustain and uphold the premises, but that is not the case with a tenant from year to year. A great part of what is claimed by plaintiff consists of new materials, where the old were actually worn out; for that the defendants are clearly not liable. But if you think that defendants have done all that tenants from year to year ought to do, considering the state of the premises when they took them, the defendants are entitled to your verdict." * *

The covenant to repair must be construed with reference to the nature and condition of the building as to age, &c., though it must be concluded that the house was in proper and durable repair at the time of the demise. If it appear that the covenants have been substantially complied with, and the buildings are in as good condition as, considering their age, they might reasonably be expected to be, the landlord will have no right to complain of dilapidations. For this we have the high authority of Tindal, C. J., in three several cases. In Harris v. Jones, the covenant was to leave the premises in good and substantial condition. It appeared, on the part of the landlord, that glass in the skylight was broken to the amount of 40s., that iron rails, tiling, and coping, were dilapidated. On the part of the tenant it was proved, that he had laid out considerable sums in repairs during the term, and that the premises were, in the whole, in tenantable repair, and in a better state than when demised. The Lord Chief Justice said—"The question is, whether the covenant has been substantially complied with? The defendant was only bound to keep up the house as an old house, not to give the plaintiff the benefit of new work." The Jury found for the defendant. Again, in Gutteridge v. Munyard, the same erudite Judge remarked—"Wherever an old building is demised, and the lessee enters into a covenant to repair, it is not meant that the old building is to be restored, in a renewed form, at the end of the term, or of greater value than it was at the commencement. What the natural operation of time, flowing on effects, and all that the elements bring about in diminishing the value, constitute a loss, which, so far as it results from time and nature, falls upon the landlord. But the tenant is to take care that the tenements do not suffer more than the operation of time and nature would effect. He is bound, by seasonable applications of labour, to keep the house, as nearly as possible, in the same condition as when it was demised. If it appear that he has made these applications, and laid out money from time to time upon the premises, it would not, perhaps, be fair to judge him very rigorously by the reports of a surveyor, who is sent on the premises for the very purpose of finding fault."

Again, in Stanley v. Twogood, where the covenant was to preserve, keep, and have the house in good and tenantable order and repair, Tindal, C. J., held that the question was, whether the house was in a substantial state of repair, as opposed to mere fancied injuries, such as a mere crack in a pane of glass, or the like. That although the state of repair at the time of the demise was not to be taken into consideration, yet it would make a difference whether the house were new or old at the time of the demise.

In Marke v. Noyes, Abbott, C. J., held that under a covenant substantially to repair, uphold, and sustain, the tenant was bound to keep up the inside painting. This, it will be perceived, is requiring such a tenant to do more than the incumbent of a benefice. The decision does not appear to have been very deliberate, and is not altogether consistent with those subsequent judgments of Tindal, C. J., and therefore I think cannot be safely relied on. It is usual in leases specially to provide for painting at stated intervals.

From these cases it will be seen, that principles of law are not strictly enforced in considering what are dilapidations; that of minute defects the law takes no notice, "de minimis non curat lex." Therefore, unless the premises have been much neglected or misused, and are in a much worse condition than they ought to be, it will not be safe for a landlord to take legal measures against his tenant: although, where there are substantial dilapidations, these minute defects may and should all be taken into account.

The following explanation of the law, with regard to the manner in which the tenant is bound to repair dilapidations or restore their value, does not appear to be supported by any legal decision of the judges, and this we regret, for it is a point of great moment to the profession. Certainly, most of the decisions of Tindal (Chief Justice), have a tendency this way; and there is very little doubt that if the question was to come before that judge, he would take the same view of the law as laid down by Mr. Gibbon.

Where any part has fallen away, the tenant is not bound to replace it with new materials, but only with materials of the same value and in the same condition as those deficient ought to have been, had they only been subject to ordinary decay and wear, except from accident or exposure to the weather. In determining this, reference must be had to the age of the building at the time of the lease granted, and to the duration of the lease, and so much ought to be deducted from the cost of new materials as it may be supposed they would be depreciated in value by ordinary wear during the period the materials to be supplied have formed part of the building. Mr. Woods thinks, that in hardly any case could the landlord require more than three-fourths of the new value, and none would occur in which one-fourth ought not fairly to be demanded.

Chapter III. explains the law regarding dilapidation by tenant, without impeachment of waste.

Chapters IV. and V. point out the law when the property is mortgaged, and held by joint tenants and tenants in common.

Chapter VI. relates to party-walls and fences. The author explains numerous points of law concerning the Building Act, which probably has caused more misunderstanding and litigation than any other Act of Parliament; several attempts have been made to amend it, but all to no purpose. We shall give one extract from this chapter, to point out an error regarding the time at which it is imperative to deliver accounts concerning the re-building of party-walls:—

Within ten days after the party wall is built, or so soon after as conveniently may be, the builder is to leave at the adjoining house, &c., a true account of the number of rods in the party wall, &c., for which the owner of the adjoining building is liable to pay, of the deductions to which he is entitled, and an account of all other expenses and costs.

The express directions of the Act are—that the account shall be delivered *within ten days after the party-wall shall be built;* it says nothing about "or so soon as conveniently can be." This ought to be impressed upon the minds of every architect or surveyor, for we know instances in which parties have failed in recovering the value, in consequence of the omission to deliver the account within the ten days.

Chapter VII. explains the law relative to churches; Chapters VIII. and IX. highways, bridges, sewers, sea walls, &c.; and Chapter X. is one of considerable importance; it explains the law touching nuisances, in which the author has taken considerable pains and trouble to collect numerous decisions as to what may be considered a nuisance. We shall give two or three extracts to show the able manner Mr. Gibbon has treated the subject.

In determining what acts are nuisances, we must ascertain the extent of the possessions of our neighbour; and here we may refer to the maxim of law, that he to whom the soil belongs is entitled to all the space of air above to the sky, and of the earth below to the centre. His rights extend perpendicularly above and below his own land, and not laterally, so as to claim any use from the earth beneath or the air above the adjoining land. It is, therefore, not only a nuisance to cause an encroachment or injury to the soil of a neighbour, as if John build a house overhanging the land of Thomas, whereby the rain falls upon Thomas's land, and injures it; but also if John corrupt or annoy the air over Thomas's land by noisome smells or deafening noises, it is a nuisance. But if John, by building or otherwise, exclude from the land of Thomas the air flowing over his own land, and the light which comes through that medium, he does no more than he has a right to do.

It is not every disagreeable smell or noise which I cause on my land, and which the wind wafts to my neighbour's, that will give him a right of action; it must arise, it would seem, from some permanent cause, and occasion him continual annoyance and discomfort; and that to a degree sufficient to depreciate the value of his dwelling-house, and render it less eligible in consequence of the neighbourhood. I cannot be restricted in the fair and reasonable use of my land by any delicacy of sense or peculiarity of habit of my neighbour. A swine-sty, limekiln, privy, smith's forge, tobacco-mill, tallow furnace, and glass-house, set up near a private residence, have respectively been held nuisances. And so a mill for steeping sheep-skins, by which the air was corrupted; a building for manufacturing acid spirit of sulphur, which occasioned noisome and offensive smells; a place for slaughtering horses. It is not essential that the stench raised should be unwholesome; it is sufficient if it renders the enjoyment of life and property uncomfortable. * *

Easements over a neighbour's land can only be acquired by grant or by prescription, which raises the presumption of a grant. Grants of easements are either express or implied. An express grant needs not observation; a grant of an easement is implied in the following case. Where a man, having built a house upon his own land, conveys that house to another, he thereby impliedly grants the easement of light over his own land to the windows of the house, as it then stands, and neither he, nor any person claiming under him, will be permitted to derogate from his grant, and build upon the adjoining land to the obstruction of the light. And, in like manner, where an unfinished house is granted with openings for the windows, or ground is leased upon condition that the lessee shall build thereon in a specified situation according to a certain plan, the gantor or lessor, or those claiming under him, cannot build upon the ground adjoining, so as to darken the windows of the house, when finished according to the plan. And where a house and the land adjoining are conveyed at the same time to different persons, and the land is described as building land, the purchaser of the land cannot build so as to obstruct the windows of the house, because it must be presumed that the easement of light was conveyed as appurtenant to the house, and the land was conveyed subject to that easement. * *

The prescriptive period of twenty or of forty years must be the period next before the commencement of the action or suit in which the claim is brought into question. And, therefore, where a party brings an action for the obstruction of his light, he must prove that he has had the uninterrupted use of the light for the twenty years immediately preceding the action.

The usage must have been uninterrupted, but no act or matter is deemed an interruption, unless it has been submitted to, and acquiesced in, for one year after the party interrupted has had notice thereof, and of the party making or authorising the same to be made. Thus, if windows have existed for twenty years, an occasional obstruction will not affect the prescription; but if any such obstruction has continued unabated for a year, the prescription will be wholly destroyed. In like manner, if the owner of the house has pulled down his house, and not rebuilt it with windows in the same situation within a year, or has blocked up the windows for a year, his right will be gone. Though a disuse of the right for a shorter period would not, I apprehend, be deemed an abandonment thereof, so as to interrupt or destroy the prescription.

A prescription for the use of light may be destroyed by an alteration of the manner in which it is enjoyed, as by altering the size or situation of the apertures through which it is received. Thus, where a party, having the right to light, carried out the wall of his house, and made a bow window in the new wall, in the same elevation as the former one, it was held that the easement was gone, since he had no right to receive the light through the new window. But it has been considered that the enlargement of an ancient window will not of itself destroy the prescription, so as to entitle the owner of adjoining land to obstruct the passage of light into any part of the space occupied by the ancient window. And where a building, which had been a malt-house, was converted into a dwelling-house, Macdonald, C. B., ruled that it was still entitled to so much light as was sufficient for the purpose of making malt, though not to any greater quantity. And where a party was entitled to lights by means of blinds fronting a garden, and took away the blinds, and thereby opened an uninterrupted view into the garden, Lord Kenyon held that the proprietor of the garden was not justified in making an erection which diminished the light heretofore coming into the house through the blinds. From the modern decision of Garritt v. Sharpe, it would seem that, in all these cases, it ought to be left to the jury to say whether the nature of the aperture is essentially changed. Where there is a right to pen back water by means of a dam, and the dam is destroyed, the party has no right to erect another dam in a different situation. And where one has a right to ancient pits by the side of a rivulet, for the watering his meadows and cattle, and they are choked with mud, he may cleanse, but cannot enlarge them, or dig other pits.

We have made several extracts, to show the value of the book to the architect and surveyor; it has our entire approbation, and we are encouraged by Mr. Gibbon's existing contributions, in the hope that he will again devote his ability to the elucidation of some other branch of architectural jurisprudence.

Companion to the Almanac, for 1839. Knight and Co.

By this time, most probably, the greater part of our readers will have provided themselves with this little work, and could we be assured that such were really the case, we should not return to it. Yet, as our conjecture is grounded chiefly upon the belief that they would procure it if aware of the highly interesting architectural notices it contains, we shall make a few extracts from it, more especially as there is nothing whatever either on the title or in the advertisements of the publication to point out that it affords the kind of information just alluded to.

The "Companion" may be truly characterised as an exceedingly valuable annual *multum in parvo*, for, besides many scientific articles and statistical reports, it gives abstracts of Parliamentary documents and acts of Parliament, a chronicle of the session of Parliament, a list of public petitions, and a chronicle of occurrences. Another very useful feature, though a minor one, is the necrological table of literary men and artists, both foreign and English. After this mention of the usual contents in general, we shall particularise those alone in the present volume which are akin to the character of our own Journal; we, therefore, point out the two articles on "Steam Navigation" and the "Railways of Great Britain."

The buildings most fully described are the Synagogue, Great St. Helen's; the interior of the Fitzwilliam Museum; the Eastern Institution; the Railway Terminus, Euston-square; the London and Westminster Bank; the Athenæum, &c., at Derby; and the Victoria Rooms, Bristol. Many others, however, are spoken of or commented upon, including those at the Highgate and Norwood Cemeteries. Referring for these to the publication itself, we shall extract only what is said of High Cliffe, Hants:—

The splendid mansion of Lord Stuart de Rothesay, which, after having been in progress for many years, has now so far advanced towards completion that many of the apartments are fitted up. The style adopted for the exterior is not a little remarkable, being formed upon continental models of domestic Gothic, contemporaneous with our English Tudor, and, independently of its novelty in this country, highly striking for the richness and variety of the details, and the care and precision with which they are wrought. The principal fronts are entirely of stone, and that facing the sea has, in addition to a profusion of other decorations, a parapet *à jour*, or of open work, forming mottoes and inscriptions in Gothic characters. On this side subordinate ranges of building branch out from the body of the mansion, so as partially to form a kind of court, enclosed by three sides of an octagon, whose elevations, although somewhat different in design, all agree in being elaborately enriched. Among other distinguishing features is a magnificent oriel, forming an open tribune or balcony gallery on the level of the upper floor. The north, or other principal front has a spacious arched carriage porch, flanked by lofty octagonal turrets, which latter are crowned by ogive dome roofs and finials; and between them is the splendid window, and decorated gable, which form that end of the entrance hall. This hall, which is about sixty feet in length, by nearly forty in height, has also a range of windows in the upper part of each of its sides, the wall beneath them being wainscotted, and panelled with reliefs in stone. The pavement is inlaid somewhat after the fashion of mosaic, in patterned compartments, variegated with numerous badges and devices; and the ceiling, or roof, is of oak timber, carved. At the north, or entrance end, is a handsome stone screen, with a gallery above it, immediately under the great window, which is entirely filled with compartments of painting representing the genealogy of Jesse. At the opposite end is the staircase, consisting of an ascent on each side, in a single flight, with a superb railing of wrought metal highly gilt. Between these flights of stairs is the door leading into the ante-saloon, a spacious octagon fitted up in the Louis Quatorze style, in carved oak and gold, and with costly marble doorcases. This room communicates with the principal apartments—viz., the state drawing-room, library, dining-room, &c.

Dibdin's Northern Tour—(continued).

We now resume our notice of Dr. Dibdin's Tour, and proceed to cull from it the chief information it contains as to the modern buildings and architects of Scotland. Most of the latter, who are noticed, by him at all—for we have not met with the name of Mr. Burn, although we have heard him spoken of as a man of very high abilities and attainments, and zealously devoted to his art—are spoken of in terms of unqualified praise: we hope justly so, for to say the truth the Doctor deals so largely in puff that his praise goes for very little.

Of the wholesale puff we have a choice specimen, when he calls "Auld Reekie," or the "Modern Athens," as it has heretofore been styled, "*a City of Palaces, the* Genoa of the North." Both the italics and the capitals are his own, and are, no doubt, intended to give all possible emphasis and energy to the compliment. Yet one more *mal-a-propos* could hardly have been stumbled upon; since, so far from looking like a city of palaces, Edinburgh has far more the appearance of city of barracks; nor can anything be more dissimilar than the style of its architecture and that of Genoa, the one being as naked and frigid as the other is exuberant and pompous. What could have caused the Doctor to utter such rhodomontade? Was it the effect of one of those *symposia* which he chronicles with so much gusto? Very possibly it might; since, otherwise, it is perfectly unaccountable. One thing is certain, that there is nothing whatever in the book to bear out this assertion; whereas he might very well have cut short some of his gossip, and employed himself in pointing out and describing some of the architectural features that entitle Edinburgh to the epithet of the Genoa of the North. Or else, instead of giving views of its most dismal and downfally holes and hovels, and such exceedingly uninteresting, as well as hackneyed subjects, as the Regent Murray's house, he might have favoured our eyes with some specimens of its magnificence. Without perplexing ourselves any further by questions and remarks that must be rather perplexing to the Doctor himself, we will begin quoting at once.

With all its architectural attractions, the New Town of Edinburgh is defective in two material points. It wants a fine church, and a noble square. The church of St. George, at the western extremity, is a dwarfish representation of St. Paul's at a distance, if its dome only be considered. At hand it shrinks into insignificance, and is flat and tame. There is no bold projecting portico, and the quantity of dull surface above the entrance, to the springing of the dome, is a sad and striking failure. The church of St. Andrew, at nearly the eastern extremity of George-street, is a most inconceivable failure.

This, it must be owned, carries something to the *debit* side of the account, though by no means so much as ought to be, for a great many more deficiencies, defects, and failures, might be pointed out, while there is scarcely a modern building that rises above mediocrity of design, or of which more can be said than that it is endurable. In venturing, however, to find fault, and that, too, in the most unqualified manner, with St. Andrew's, the Doctor quite upsets Mr. Britton's opinion; for if we may rely upon the taste and critical acumen of the latter antiquary, "it is distinguished by its fine tapering spire, and a bold Corinthian portico." For our part, we greatly incline to the Doctor's opinion, and even Britton's own plate of it quite confirms it, since at all events it there looks like "an almost inconceivable failure." In likening St. George's church to St. Paul's, the man of "Bokes" seems to speak by the book, and after the fashion of that which tells us St. Paul's at Liverpool is a miniature imitation of St. Paul's at London. To be sure a dome is a dome all the world over; but the man, and much more the critic, who can perceive any semblance between that at Edinburgh and the one in London, is in great danger of mistaking his wife's bonnet for his own beaver.

That the Doctor did not bestow the epithet he has chosen for Edinburgh unadvisedly, is evident enough from the first sentence in the following quotation, where he speaks of some of the living Scotch architects.

I have more than once called Edinburgh a *City of Palaces.* Of course architecture is the sole means of achieving this splendid result; but if the materials for building were not at once abundant and lasting, as well as picturesque in tint, such an effect would with difficulty be produced. Where to begin? How to describe? *Hic labor—hoc opus est.*"

This, it must be confessed, is exquisitely *naive:* how to eulogise—there seems to have been the puzzle.

But it cannot be done successfully—at least to my own taste. Here is James Gillespie Graham, Esq., with a genius all over Gothic; rich, original, tasteful.* Would that be were employed to case the whole of the Castle in a coat, cut according to the fashion of the early part of the fifteenth century. Then, again, I would have him put an ecclesiastical vestment over the whole of St. Giles's, or the mother-church, in the fashion of the fourteenth century. He would do it *con amore;* nor would he displease his own times or posterity if he raised the tower a good fifty feet, and reconstructed the "imperial crown" thereupon, as it is called, upon more intelligible principles of Gothic art.

In Grecian and Roman architecture a love of taste, and yet more of truth, induces me to place Mr. Playfair at the head; simply because he has not only

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* We cannot withhold the Doctor's own note here introduced. "My friend, Mr. Mackenzie, took me one day to call upon Mr. Graham, more especially to view his design for the new House of Commons on the Gothic plan. It is very magnificent; but perhaps in too detached buildings; while Mr. Barry's, on the contrary, from its continuity, has too much the air of a large manufactory, which, however, may be broke (broken) by a boldness and variety of relief in the external ornaments. Mr. Graham's talents are likely to be successfully employed in the restoration of Glasgow Cathedral." We should like very much to know what are the manufactories of which Mr. Barry's design has at all the air of.

had the opportunity of doing great things, but of doing them well. His Academy of Painting, &c., is doubtless his masterpiece; but for just proportion, it should lose just one-fourth of its length. But the pride and glory of Mr. Playfair's interior, is the Library-room in the University of Edinburgh. It is at once lofty, broad, and commodious, and of a very singular construction in the arrangement of the shelves for the books. There *is* a point where you may stand, and although the room be one hundred and ninety feet long in the clear (longer than any library at Oxford), yet you shall not obtain the sight of a single volume. The ceiling is lofty and gilded; but why does good Mr. Playfair consider burnished gold to be a heresy? In such a magnificent interior you can hardly be too brave and saucy in the upper ornaments.

"Saucy" is a rather queer—certainly not very tasteful expression, except as it may serve to denote that poignancy of flavour so greatly studied by artists of a different class.

Having got among the books in the library, the worthy Doctor flies off in a tangent, without bestowing another syllable upon either "good Mr. Playfair," or any other architect; nor does he touch on the subject of architecture again until he reaches Glasgow, when he speaks of the Exchange as

One of the noblest commercial rooms in Europe, whether we consider its interior or exterior design, its facilities for carrying into effect all the objects for which it was built, or its spaciousness, lightsomeness, and beauty. I was infinitely struck and gratified with it. The architect is no less a personage than David Hamilton, Esq., who without scruple or flattery may be called the Vitruvius of the North.

Scruple he certainly has none, but we suspect that our Doctor does administer flattery in very large doses, weighed out, not by apothecaries' *scruples*, but in pounds avoirdupoise weight. With him, almost every person he names is of superlative merit, therefore he makes his praise so dog-cheap, that those who really merit it find it hardly worth having. Of this we have proof in the very next page, where he goes on to say—

Here, as at Edinburgh, the late Robert Adam has done a considerable stroke of work, in the architectural department; and some things, especially in the Assembly Rooms, and the Andersonian University, are executed with more than his ordinary skill. Of churches there is no proud or particular display; but one or two recent ones, from the designs of Mr. Hamilton, show a great improvement in the department of ecclesiastical architecture. The two principal squares of Glasgow, are those of St. George and Blythswood. The former is in the heart of the city, the latter at its western extremity. Within the former are erected the bronze statues of Sir John Moore and Watt; and at this moment the foundation stone has just been laid for the erection of a lofty triumphal pillar to the memory of Sir Walter Scott. To me the taste of it is perfect. The *Spartans* have here shot a-head of the Athenians.

Judging from the plate given of it, which is said to be an "accurate representation," we must totally dissent from the praise bestowed on this column; for it is nothing more than a meagre fluted Doric column, with a capital of most insignificant proportions and character, and with a base whose tori are enriched with guilloches and other carving! What degree of invention is shown, may be inferred when we say that, like others of its kind, this column also has square abacus to its capital, as if intended to support an architrave. The only recommendation such pillars have is, that any thing like a human figure will do on the top of them; yet they always look top-heavy. We trust that we shall have no such puerile enormity perpetrated in the centre of Trafalgar-square.

Of the cementing in the same city the Doctor says—

The very entrance, over a bridge across a river bestud by one of the most elegant arches of stone ever witnessed, is full of classical feelings; adding in a note, "David Hamilton, Esq., is the architect. He cannot for the soul of him commit a blunder. Mr. Bryce, an architect of Glasgow, has erected a façade of the time of our James I., of which the opposite plate is a faithful copy; and it must be allowed that he has been singularly happy in all its component parts." This last sentence is also accompanied by a very curious note, viz.—"I recommend Mr. John Bryce first to be the architect of every park entrance in Scotland, and afterwards in England. But let it not be supposed that he is confined to the period of 1600-1650. His Tudorian elevations are fraught with the most felicitous features and effects."

What Mr. John Bryce's "Tudorian elevations" may be we know not, having never seen any specimens of them; and with us the Doctor's prescriptions—i. e., his recommendations—obtain very little credit. As a sample of what he can tolerate, if not very eulogistically extol, he presents us with a view of the mansion at Abbotsford, to which, if the original bears any resemblance, it must be perfectly detestable—one of the most hideous specimens of architectural balderdash and bathos ever perpetrated. Happy would it be for the memory of Sir Walter's taste were it razed to the ground.

Since this article was in type, we have received some information relative to Mr. Gregory's splendid mansion at Harlaston, correcting the Doctor's errors and misstatements respecting it. But we must now defer communicating it till next month.

Illustrations of the Public Buildings of London, with Historical and Descriptive Accounts of each Edifice. By Pugin and Britton. Second Edition, greatly enlarged, by W. H. Leeds. In 2 vols. London. John Weale, 1838.

In our last number we informed our readers of the object of this work, and presented some extracts from the preface; we now, therefore, avail ourselves of the opportunity of taking a more general view of the subject. We cannot, however, dismiss the preface without requesting the attention of the reader to the admirable remarks on criticism given by the editor. They point out with force and truth the advantages which the profession must derive from extended investigation, and the necessity of freeing ourselves from the trammels of superannuated pedantry. In this age of steam, we have a right to distrust whatever is old, and particularly when the Elgin marbles have produced a new style of art, and the study of the true antique given a different impulse to architecture.

To the general reader this work must afford many points of interest, but to the architect it presents a double attraction; first, that he contemplates the glories of the metropolis of the empire, and next that he himself may become a contributor to its splendour.—"Io anche son pittore" is a remark well to be expected from the professional spectator of St. Paul's or the new London Bridge. The metropolis has, indeed, in this century attained a grandeur which our fellow citizens may admire, and of which our artists may be proud. It has, as it were, been so created that the extent of its limits are not yet ascertained; we flutter still between the recollections of the past and the existencies of the present day. We are too apt to think of the old city, or to contemplate the vast mass in its political divisions, and thus lose the conception of the immense ensemble.

With no superior in the Asiatic world, and none but inferiors in this, an Englishman may look down upon the modern queen of the world and prize it as one of the phenomena of that empire, which is the greatest that has been established. But it is not on immensity alone, or on artistical riches that this supremacy is based; the historical associations which it recalls are so entwined with the annals of our race as to shed a brighter lustre on its crown. It is well for those who can do no honour to the present day to exaggerate the glories of the past; but to the thinking mind the splendour of an illustrious name is not reckoned by centuries of homage, but by the depth of genius and the strength of thought. We can resuscitate the Attic theatre, or in imagination hear Cicero's eloquence wake the ruined forum from the sleep of ages; but we, who have such susceptibilities, and such a burst of sentiment, can leave the tombs of native bards unhonoured and unsought. If the arts are to be inspired from sources so sublime as the poet's song and the warrior's deeds, we want no Athenian to teach us what is great, nor a Roman to precede us in the art of copying; but we have it here in the streets trod by the busy crowds, in the halls devoted to the national laws, and in the temples consecrated to the public worship. Here the greatest of the modern bards have first seen light—here has been the theatre of their exploits; and in Westminster Abbey more honoured names repose than in any shrine in Christendom. To repeat all these localities, to tell over the sacred ground, would be a task as inexhaustible as the glory of its subject; but we cannot refrain from calling the attention of the reader to some among the many great men who had here their birth-place. Among the poets, artists, and musicians, are—Chaucer, Spenser, Ben Jonson, Fletcher, Milton, Cowley, Pope, and Gray; De Foe, the immortal author of Robinson Crusoe, Bolingbroke, Gibbon, and Lillo; Lord Bacon and Barrow; Hogarth, Bacon, Banks, and Nollekens; Arne, Arnold, Boyce, Aldrich, and Greene; Hampden, Howard, and William Penn.

These are names to which he who can attach no associations should never add the disgrace of belonging to a kindred profession. We think, however, they are such, of which, while no city can boast the equal, so any might feel justly proud. They have left us their immortality, and if we cannot equal them in our works, at least we can decorate that metropolis on which they have conferred the lustre of their names. This is a duty which, we feel happy to say, has been in no way yet neglected, and which every day is meeting with a greater fulfilment, and we may justly feel proud in reflecting that we have not in our days been remiss in fulfilling that service to posterity which our ancestors bequeathed to us. Since the year eighteen hundred so much has been done that it has almost effaced what previously existed, and to such a degree, that a person of the last century would justly feel astonishment at the new world, in which all his former recollections would be lost.

The metropolis, on the east, has been extended into Essex and Kent; on the south it has advanced to the tops of those hills from which it is perhaps again to make farther encroachments; on the west it extends to Hammersmith, and has thrown numerous suburbs to the opposite bank of the Thames; while on the north, again, other villages have been drawn into the vortex, and sacrificed their rural character. These new districts include Pimlico, the several branches of Chelsea, the whole space from Kentish and Camden Towns through the Regent's-park to Bayswater, great part of Clerkenwell and Islington, another section at Hackney and Kingsland, on the east, besides the suburban accessions, the greater portion of the docks, and on the south large tracts from Greenwich to Wandsworth. The whole of this district has been supplied with light and water by new means, and increased facilities of communication by canal and railway afforded with the whole of England. It forms, indeed, a mass extending at least twelve miles in length and eight in breadth, with two millions of inhabitants.

The new lines of street which have been erected are not of less importance. On the south a grand entrance from the continental road leads over London-bridge, through King William and Moorgate-streets to the New-road. Another crosses Blackfriars into Farringdon-street, and a third over Waterloo-bridge into Wellington-street. On the north are the Edgeware-road and Regent-street, while Pall-mall and the Strand have been re-constructed, and two magnificent lines of road branch off through Poplar and Mile-end to the eastern counties. Over the river new bridges have been thrown of various constructions, and include New London Bridge, Southwark, Waterloo, all by Rennie; Vauxhall, by Walker; and Hammersmith, by Tierney Clarke. Our squares and public places, which are justly the admiration of Europe, have been equally increased, and include Trafalgar-square, the place before the Mansion-house, Eaton-square, Belgrave-square, Park-square, Euston-square, and above twenty others.

Nor have the isolated buildings been less numerous: in every department works of importance have been executed. Buckingham-palace, by Nash; the Council Office, State Paper Office, Bank of England, Law courts, by Sir John Soane; the Post-office and Judges' Chambers by Sir Robert Smirke; the National Gallery and University College, by Wilkins; the British Museum and King's College, by Smirke; there are also the Colleges of Surgeons and Physicians, City School, Blind School, &c. The charitable institutions are extensive, Bethlehem Hospital, Christ's, St. George's, Westminster, and others. The municipal buildings have attained great splendour, and include Fishmongers and Goldsmiths Halls. The churches are too numerous to admit of any lengthened enumeration; among them—are Marylebone, by Hardwick; St. Pancras, by Inwood; St. Luke's, Chelsea, by Savage; and St. Dunstan's, by Shaw. The theatres include Covent-garden and Drury-lane, by Wyatt; the Haymarket, by Nash; the English Opera and St. James's, by Beazley; and the Colosseum, by Burton. Commercial buildings and clubs have also increased to an extent unprecedented, and greatly contribute to the ornament of the city.

Public monuments and statues have been erected to the Duke of York, to George the Third, Pitt, Fox, Duke of Bedford, and Canning, while those which are in progress assure the splendour of this branch of decoration.

All the Parks have been improved, and an addition made to them in the Regent's-park, which presents a unique feature in this world of novelty. The Regent's-park and Surrey Zoological Gardens have been formed, and Botanic Gardens are in progress, while the number of Cemeteries must greatly contribute to the health of the inhabitants.

Former edifices have been improved, or placed in better points of view, and made to promote more powerfully the adornment of the metropolis: among these have been St. Martin's, St. Bride's, St. Saviour's, and the Monument.

All these improvements necessarily call for a history in themselves, and to the volumes of Pugin and Britton the profession are greatly indebted for the information conveyed. The rapid growth of the metropolis, however, and the increase of novelties, had long since called for an addition to this work, but until the present period without success. The public spirited publisher now having the property of this work, has, however, supplied this want, and we are happy to say in a manner worthy of himself, and of the object concerned. The editor, too, in taking upon himself the task of producing this work, found that his efforts must not be confined merely to chronicling what is new, but that it might be beneficially exerted in remedying some defects which existed in the labours of his predecessors. He found that in many cases extraneous matter might be removed, which, however interesting to the general reader, was by no means useful to the professional student, and in doing this he availed himself of the opportunity of introducing the new matter without increasing the expense and consequently the bulk of the volume. At the same time he has amended the old subjects, by introducing some further professional information, and rectifying some of the errors which are inseparable from a work of such discursive character.

The subjoined extract relates to St. Pancras Church, and while it cannot fail to prove interesting to the reader, will afford him a fair proof of the manner in which Mr. Leeds has acquitted himself of the task which has devolved upon him:—

Whatever may be alleged against some of the combinations it presents, this church stands unrivalled as a correct example of the richest and most graceful variety of the Hellenic Ionic style; we say *style*, in preference to order, because it embraces so many distant modes, some of which have little else in common than their family characteristic, the voluted capital, and even that marked by striking differences, both in its mass and details. Previously to the erection of this building we had, with the exception of that at the India House, hardly a single Ionic portico of any note in the whole metropolis—certainly no instance of one applied to a church—since for such purpose preceding architects seem invariably to have had recourse to the Doric or Corinthian, in which, perhaps, they showed their judgment; for the Ionic known to us before that from Greece was introduced here, was the most insipid and inelegant of the orders, although complimented with the epithet due only to that from which it proved its descent, by its egregious falling off from it. But were it on no other account, this church would stand pre-eminent among its predecessors and contemporaries for the classical air of its portico, in which no quotidian features are allowed to obtrude themselves; while the three doors are of such exquisite design and admirable execution, that they serve as a climax to the beauty of the whole façade. They are, in fact, specimens of the most refined taste in detail and embellishment. Would that a tithe of the praise could be extended to the side elevations, where, had there been no more than the upper range of windows, that might have been tolerated; but the small oblong ones beneath them are decidedly injurious to the design, marring its Grecian physiognomy. The east end presents both a pleasing and appropriate deviation from the ancient temple plan, and the roof of the projecting hemicycle combines agreeably with the pediment; still the effect would have been all the better had there been only the three centre windows. The low square wings, attached at the angles, give play and variety both to the plan and elevation; at the same time, they do not interfere with the outline of the principle mass. In themselves, these features are exceedingly beautiful, and a very commendable adaptation of one of the choicest architectural relics of classical antiquity. The chief thing to be objected against them is, that the architect has not connected them with the body of the edifice, by carrying on the mouldings of their antæ as a sort of string-course along the side elevations, and resting the windows upon it, which would have required these latter to be raised but a very little higher than what they now are.

The article of theatres has been retrenched in what related to matter of purely general tendency, and its place has been supplied with some judicious comments on the plan and construction of these edifices, which we know cannot fail to be gratifying to whoever has considered the subject. It also contains a well-digested table, exhibiting the relative dimensions of various great theatres.

It must be confessed that our theatres are susceptible of much improvement, being so planned at present that many of the audience can neither hear nor see properly. This has been erroneously attributed to the large size of some of our houses, for in the very largest of them, all might both see and hear distinctly, were it not that accommodation in the way of mere sitting is made for a far greater number than can possibly be accommodated in regard to the purpose for which, it is to be presumed, they come thither—namely, to enjoy the performance. Many are placed, not at too great a distance, but much too near—thrust quite close upon the proscenium and up to the actors themselves; some directly on one side, so that they can see the stage only obliquely; while others are elevated so much above it, both in front and on the sides, as to look quite down upon it, and obtain almost a bird's-eye view of it. These inconveniences are increased, when, as is the case at Covent-Garden and in many foreign theatres, the house expands from, or in other words, contracts towards, the stage, so that those in the side boxes cannot obtain even a side view without turning very considerably to the right or left. Besides which, every variety of such form, the oval, or elliptic, is architecturally disagreeable in itself, being attended with a degree of irregularity offensively perceptible to the eye.

The semicircle is unquestionably the best figure, because it brings all the spectators, even those placed at the extremities of its chord, facing towards, though not exactly in front of, the stage; for it in fact cuts off what can properly be termed side boxes, or such as are at right angles, to the diameter or chord. Yet a simple semicircle would be objectionable on more than one account, because the stage would then be placed on the *longer* side of the area of the spectatory; consequently, as the diameter would give the width of the proscenium (which would be double the depth of the house, measured from the orchestra to the front of the centre box), either the latter must be very great in regard to breadth, or the house itself of small dimensions, or even if not small in itself, yet confined and contracted in comparison with the proscenium and opening of the stage; which inconveniences would bring others along with them, since, were the height of the house to be proportioned to the width of the proscenium, it would become excessive, in comparison with the dimensions in the other direction, and cause the spectatory to appear still more contracted and squeezed up. On the contrary, were it to be regulated by the depth of the house, or semi-diameter, the proscenium would be rendered much too low. This will be apparent to any one, if he turns to any of the plans of theatres here given; by applying his compasses—to that of Covent-Garden, for instance, and taking the line separating the orchestra from the pit, for a diameter—he will perceive it would be reduced to half its present depth, whereby, as he would see on consulting the section also, the height would become preposterous in comparison with such a contracted area.

Still, as the semicircle is by far the most advantageous, it ought to be retained for them, as might easily be done, should the house itself be equal to an entire circle, or somewhat more (as is the case at Drury Lane); and to effect this, nothing more would be requisite than to omit boxes entirely between the chord of the semicircle and the proscenium. Were this done, there would hardly be a seat in any of the boxes that would not command a sufficiently favourable view of the stage; while, in an architectural point of view, all the space so given up or lost, as perhaps it will be considered, would be a decided gain, because it would afford ample field for decoration in connexion with and continuation of the proscenium, so that the whole might be made to form a rich architectural framing to the stage; whereas, according to the present mode, the connexion between the boxes and proscenium is too abrupt, and can rarely be well managed; and whenever the boxes adjoining the stage are comparatively empty, they present a forlorn appearance, which does not at all reconcile us the better to their being in themselves a drawback on the general design. There would be another advantage arising from the system here recommended, namely, that as far as the boxes are concerned, there would be a sort of neutral territory between the audience and the stage, highly favourable to scenic effect and illusion. Every one in the boxes would then be seated where he would behold the stage and performance, not only conveniently, but from a proper distance station. The stage ought to be considered as a picture upon a large scale, and when a man looks at a picture of any dimensions, he neither pokes his nose against it nor does he place himself on one side, so as to view it askew, but in such a manner that he can distinctly behold it. In regard to the stage, however, such certainly is not the case with a very large proportion of the spectators in the boxes. Many of them are obliged to take up with places where they cannot possibly see the scene or *flat*, as it is technically termed, at all, let them twist their necks as much as they will, though *en revanche* they see a great deal more between the wings and side scenes than is either necessary or proper. * *

We shall here put together a few particulars relative to some of the principal theatres hitherto erected; not with the expectation of satisfying the reader, but rather of inducing him to prosecute the object further by his own researches; and the following table, it is presumed, will be found both interesting and useful, as exhibiting a comparative and synoptical view of several of the most important structures of this class:—

	From Curtain to back of Boxes.	Width across Boxes.	Width of Curtain.	Depth of Stage from Curtain.	Height from Pit Floor to Ceiling.	Saloon.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
London.—Opera House	102	75	40	35		
Covent Garden	73	63	32	59	54	56×19
Drury Lane	70	70	32	48	60	90×26
New English Opera	57	55	32			
Paris.—Opera	78	52	40	..	52	96
Theatre Feydeau	52	64	48			
Cirque Olympique	86.6	83	44			
Bordeaux	64	62.6	39.6	70	57.6	
Milan.—La Scala	94	78	44	..	75	100×24
Naples.—San Carlo	90	76	49	76	80	82×20
Venice.—La Fenice	72	67	42	45	49	56×32
St. Petersburgh	102	96	52	99	92	125×30
Berlin	61	58	38	..	43	
Hamburgh	69	68	39	..	56	
Mentz	65	58	38	..	43	
New Orleans	73	71	44	..	66	129×26
Dublin	64	62	33			
Birmingham	44	45	28			
Turin	66.6	52	40	98		
Ghent	68	60	37	..	..	82×40

From this it will be seen that the London Opera House, although of the same extent as the Great Theatre at St. Petersburgh, measured on a line from the curtain to the back of the boxes, is considerably less in its other dimensions, and consequently very different in its proportions; it being narrow in comparison with its average breadth, owing to which, and to the contraction towards the stage, the greater part of the persons in the boxes are not placed even at right angles to, but actually turned obliquely from, the stage; as will be seen by the plan of it, and still more palpably by the section, which shows a considerable extent of the side boxes, whose fronts would not be visible in such representation were they at right angles with the curtain. Another great defect is the absence of proscenium, the boxes coming quite up to the opening of the stage, in consequence of which preposterousness in the plan, all architectural expression and propriety are destroyed, and a disagreeable flimsiness takes place, giving to the whole house the appearance of having been hurriedly fitted up for some temporary purpose. Besides which, this immediate contact of stage and boxes would render it almost impossible to cut off the flames from communicating to every part, should a fire break out among the scenery. In Schinkel's new theatre, at Berlin, the proscenium is formed by exceedingly massive walls; and the spectatory itself has the advantage of not being extended greatly beyond a semicircle. Covent Garden partakes in some degree of the faulty plan adopted in the Opera House, as the boxes between the semicircular portion and the stage are carried, not at right angles to the latter, but sloping towards, and consequently inclined from it. Had the boxes been continued on the sides for no more than a third of their present extent, this would have been of comparatively little moment; but as these sloping sides are protracted to such a distance that an entire circle might be described between the centre box and the proscenium, the spectators in the boxes nearest the stage are better stationed for reconnoitering the audience, than for viewing the scenery or the performance. Therefore, at least three of the boxes on each side should have been shallower than the rest. The plan of Drury Lane is decidedly preferable in every respect to that of Covent Garden, as well in the arrangement of the vestibule, staircases, and approaches, as in the form of the spectatory itself. It would indeed have been better had it not exceeded a perfect circle, that is, had the distance from the centre box to the curtain been no more than the diameter of the pit. Yet, notwithstanding that the general form itself is good, it exhibits an adherence to the erroneous practice of continuing the boxes beyond the semicircle facing the stage. We will not be so rigorous as to insist that they should in no degree be suffered to extend beyond that diameter or line, but most assuredly, the less they were to do so the better.

We have now extracted at some length from this admirable work; but we only fear that, although at some extent for our columns, not sufficiently to gratify the wishes of the reader. We know, indeed, that although ancient knowledge may be useful as the basis of our studies, we shall only be able to carry them on effectively by attention to the progress of the present. To all those, therefore, who are desirous of ascertaining the actual state of art in the metropolis, and of availing themselves of it, we can only refer them to this work, which will not only give them food for their observation, but teach them how to exert it.

It has thus been our lot to criticise a work devoted to criticism, but such is the fate of all publications, and to which our own must submit. Criticism must take its food from everything like death, for, in the words of Horace—" Pallida mors equo pulsat pede regum turres, pauperas que tabernas."

We feel happy, however, that, as brethren, it has not been our fate to disagree; but that on the other hand we are enabled to bear testimony to the correctness with which the editor has carried out the principles declared in his preface. Publishers are but too little looked upon in these things, but we must bear in mind that they are entitled to something more than the organ-blower's meed. There is much judgment to be exerted in the choice of a work, and often much boldness in the manner in which expense is incurred, and he who well carries out a great work is as well entitled to praise for his discrimination and public spirit as the author or editor himself. We are happy, therefore, in affording our tribute to the manner in which the publisher has complied with his duty, and not the less so that he has chosen in Mr. Leeds, one whose exertions deserve to merit the confidence of the public as much as his own.

Collection des principaux Monumens d'Architecture Bisantine, Gothique, &c., de la France. Paris, folio, 11th number.

Ornemens Classiques executées d'apres les Peintures Originales de Jules Romain et de ses Eleves. Paris, 4to.

These publications are the fruits of our Parisian neighbours' rage for the Renaissance. The first is the introductory number of a work on the early architecture of France, and includes the Byzantine, a style of which we know little in England. The second is a collection of the arabesques of Guilio Romano and his pupils; and they are both works of reference of which we have a deficiency here.

Herculanum und Pompeii Vollstandige Sammlung der Vis auf den neutigen Tag daselbst entdeckten Malereien, Bronzen, u. s. w. Enthaltend sammtliche in der Antichita di Ercolano, dem Museo Borbonica und dem ubrigen bisher erschienen Werken, mit Neuern noch unedirten Aegenstanden vermehrt. Von H. Roux et Ad. Bouchet, Deutsh Vearbeitet von Dr. A. Kaiser. (Complete Collection of all the Herculaneum and Pompeian Paintings, Bronzes, Mosaics, &c., described in the Antiquities of Herculaneum, the Bourbon Museum, and the latest Works. Translated into German from the French of H. Roux, sen., and Ad. Bouchet, by Dr. A. Keiser.) Hamburg: Meissner.

This splendid work is to be completed in two hundred numbers of four plates each, great octavo, six of which have already appeared. The first division of the work, containing the paintings, is to consist of architectural ornaments, groups of figures, single figures, friezes, landscapes, and mosaics. The second division includes statues, busts, lamps, &c. The work is cheap and well got up, and cannot fail to promote the knowledge of these elegant styles.

Le fabbriche e i Monumenti cospicui di Venezia di Leopoldo Cicognara. A. Diedi e G. Selva. Venice: Folio (in Parts).

A work on the arts from songless Venice, and where but a few years ago even painting was extinct, is an unexpected occurrence in these days, and we hail with pleasure this promise of new life in the countrymen of Canova. It is needless to say that the public buildings of Venice possess an interest which is not local, but one which speaks to all European associations.

Polytechnischen Journals. Edited by Andrew Romberg, of Hamburgh. (1st Quarterly Part.) Altona: Hammer.

This is a new weekly German periodical, devoted to the different arts and sciences, and contains, besides accounts of improvements in arts, machinery, and manufactures, articles on architecture, and particularly on practical building. It is indeed a kind of extended Mechanics' Magazine, and shows an anxious disposition on the part of our German brethren to profit by our progress, it being the avowed object of the public to take advantage of those opportunities of obtaining information from the manufacturing countries which are afforded by the extent of steam navigation at Hamburgh.

Nouvelles Experiences sur l'Adherence des Pierres et de Brigues. Par M. Morin. Paris. 4to.

This work gives an account of several experiments made by M. Morin, at Metz, in 1834, on the adhesive power of stones and bricks placed in a bed of mortar or cement. These experiments were executed by means of windlasses or ropes affixed to the stones and bricks; and the work further describes the tension which was exerted on these motive powers. As M. Morin gives nothing beyond the recent experiments at London, we have not thought it necessary to go at greater extent into the work, although the minutiæ are treated very elaborately.

LITERARY NOTICES.

We have examined the article on Railway chairs in Crelle's Berlin Architectural Journal, Bd. 11, p. 100, but we have not observed anything of which to avail ourselves. The improvements suggested are of doubtful utility, and great labour has been bestowed in establishing a comparison with other modes of construction. We do not concur in this comparison, and particularly as while the American plan is founded for temporary purposes, and the Belgian suited to a level and sandy country, they can afford no criterion upon which to decide for other circumstances.

The Churches of London, by George Godwin, jun., F.S.A., assisted by John Britton, Esq., F.S.A., &c. Parts 21 to 24.—This work continues to give the same interesting historical descriptions of the ecclesiastical edifices of the Metropolis as the former numbers we have previously noticed. It would add considerable interest to the work if a few more interior views were given, and likewise plans of the churches. The latter might be given in an appendix to the present volume.

A Course of Military Surveying, including Instructions for Sketching in the Field, Plan Drawing, Levelling, Military Reconnoissance, &c., by Major Basil Jackson.—A very useful elementary work, suitable for the student; it contains several valuable hints for military surveying, and description of various instruments, the latter principally borrowed, as acknowledged by the author, from Mr. Simms' work on the use of instruments.

Treatise on Isometrical Drawing as applicable to Geological and Mining Plans. Second Edition, with thirty-five Engravings. By T. Sopwith, F.G.S. —We have no time to spare for noticing this work in the present number. We will endeavour to devote our attention to it next month. It having arrived to a second edition, shows that the work is justly appreciated by the profession.

The Life of Telford shall be noticed in the next Journal.

The Improved Builders' Price-book, containing upwards of 8,000 *Prices and* 2,000 *useful and important Memorandums and Tables*, by W. Laxton, Surveyor and Civil Engineer. Twelfth Edition.—This work has been revised and corrected throughout, and published in a new form, a size adapted for the pocket, which will be a great convenience. It contains a larger number of prices than any other book of the like description.

Mr. Foulston's work on the public buildings in the west of England erected from his designs, will be noticed in the next Journal.

We have great pleasure in announcing that Mr. Wyld has determined upon enlarging his highly useful work the *Index to the Times*. It is to be published as before, monthly and at the same price of one shilling, and will give above three thousand references to the five morning papers, the *Times, Morning Chronicle, Morning Herald, Morning Post,* and *Morning Advertiser*, showing the day of the month, number of the paper, and of the page and column in which the article is to be found.

Among the new periodicals to be started with the new year is the *Sybil*, a monthly publication of literature, philosophy, and the fine arts.

Mr. Timothy Claxton, who is well known by his exertions for the enlightenment of the working classes, has now in the press a book, called *Hints for Mechanics on Self-Education and Mutual Instruction.* Appended to this is some of the most valuable matter relating to Mechanics' Institutions which has yet been published.

ORIGINAL PAPERS, COMMUNICATIONS, &c.

RALPH REDIVIVUS.—No. 12.

THE PANTHEON, OXFORD-STREET.

Perhaps it is a most fortunate circumstance for the reputation of the original structure, and for the credit of the taste of its applauders, that no record of it remains in engravings, save in a few, which are such excessively trumpery ones as to be palpably graphic libels. Nevertheless, making all allowance for most execrably bad drawing and execution, I have never seen anything to warrant one tithe of the praise bestowed on the building, or that could be taken as an indication of either masterly invention or excellence of other kind. On the contrary, supposing any of those representations to have been tolerably correct in regard to general design, I should say that while the whole manifested a littleness, not to say paltriness of taste, there were also numerous improprieties and faults for which much better taste in decoration would hardly have atoned. Such is the impression made upon me by the few views I have seen of the interior, and which I ought therefore perhaps, to take for granted must have very grossly falsified it, it being else next to impossible to account for the unqualified terms of admiration in which it was eulogised. There is indeed one way of solving the mystery, namely, by presuming that for the encomiums bestowed upon it, it was indebted far more to the want of discernment on the part of the public, which blinded them to its defects, than to their discriminating perception of the beauties so liberally ascribed to it. I am all the more inclined to adopt this hypothesis, because I have never seen it critically appreciated anywhere, but merely spoken of in general terms of pompous rhetoric and panegyric. Nothing is easier than to bandy about a set of superlatives and fine-sounding epithets; but in nine instances out of ten it is exceedingly difficult indeed to particularise any one of the excellent qualities attributed to the thing itself by wholesale. In matters of art, if in nothing else, the *vox populi* is not at all to be trusted. It is apt to make up in noise for deficiency in sense. In regard to architecture more especially, this same *vox* was least of all to be relied upon during the *seventies* of the last century, at which period the Pantheon had just risen, and was hailed as a marvel and eighth wonder of the world, at any rate of the London world. It was quite a novelty as a place of amusement, and completely verified the adage of "Omne ignotum pro magnifico." Highly fortunate was it, we repeat, both for its own reputation and that of its admirers, that the first edifice was burnt to the ground; for had not such event occurred, in all likelihood the wonder it would now have excited would have been of a very different kind from that it first produced.

Should we, for want of satisfactory evidence as to what it really was, have formed a too unfavourable and an unjust opinion of it, we can only regret that James Wyatt himself should have behaved with such indifference towards this his first production—certainly not his last in point of celebrity—as not to publish a series of architectural drawings of it on a liberal scale. Had he done so, we should now be at no loss to understand what his Pantheon really was. In neglecting to do so, he was either highly imprudent, or the reverse; most likely the latter, unless we are willing to believe, that the Pantheon greatly eclipsed every thing else he designed in the same style. Without going quite so far as the author of the "Contrasts," who very summarily terms him "James Wyatt, of execrable memory," I cannot help thinking that the architect of the Pantheon was praised greatly beyond his deserts. Had he been less *cried up* in his day, his name would, in all probability, have stood very much higher than it now does at the present moment. He who is certain of applause beforehand, will seldom exert himself to deserve it; while the flatteries of his contemporaries persuade him that there cannot possibly be any hisses in store for him from posterity—that is, supposing him to bestow a single thought on posterity, which is scarcely ever done by any of the petted minions of fashionable patronage. To be sure, there are persons in the world who profess a most philosophic contempt for posthumous reputation. James Wyatt appears to be one of them; his merits seem to have been chiefly negative: he avoided the grosser errors of his predecessors. His generally bald and frigid style of design, which the public of that day were good-natured enough to accept as classical simplicity, afforded no room for grotesqueness and eccentricity, for heaviness and exaggeration. The women had laid aside their formal stomachers and long ruffles, and put themselves in the array, "arm-pit waists," and clear muslin *à la* Adam Buck: in like manner did Wyatt strip architecture of much of its cumbrous old-fashioned finery, till he almost cut off the very hem of its robe.

With the exception of one or two designs for Gothic buildings, all the rest appear to have been put together upon the "save-trouble" principle. They exhibit no study, no *con amore* feeling, no attempt at character; nor do I know of any epithet which would describe them so appropriately as that of "lack-a-daisical." As buildings, indeed, they may be perfectly unexceptionable, but as productions of art they are absolutely nought; nor can I call to recollection one that deserves to be rescued from this sweeping censure. Of the exterior of the Pantheon an adequate idea may be formed from what it was previously to the late alterations, for when the edifice was rebuilt after the fire, the front was restored, with only some trifling alterations from the first design; consequently, it could never have possessed much architectural pretension externally. Whether the porch was erected in strict conformity with the original, I am unable to say; but it certainly was a most contemptible specimen of architecture, with its ugly sham pediment, like a triangular board stuck upon it; and mean iron rails, that seem intended for no other purpose than to afford a stay to the pediment, and prevent its being blown away. This bit of trumpery has been removed by Mr. Sydney Smirke, who has further improved the general appearance by adding four more columns in front to the porch, fluting them, putting them in pairs, and thereby reducing the excessive width of the intercolumns. Even those who are decidedly opposed to the practice of coupling columns must admit, that in this case, there was hardly any other alternative; because, to have reduced the width of the intercolumns by merely dividing them, by inserting a column in each, would not only have rendered them as much too narrow as they were originally too wide, but would have occasioned one of the columns to be in the centre; while the addition of only two columns, so as to convert the tetrastyle into an hexastyle, would not have sufficiently remedied the defect. One defect, to which no remedy has been applied—probably because the architect was not allowed to devise any—consists in the great disparity between the front and lateral elevations of this porch.* The Venetian window above the porch remains as before, and certainly conveys no very favourable idea of the great Wyatt's taste.

As rebuilt by Mr. S. Smirke, the interior of the Pantheon displays much invention, and several good points of design, not only in the large hall or bazaar, but in other parts of it, and not least of all in the conservatory or in-door garden, which forms the approach from Great Marlborough-street. Much more, indeed, might have been made of it, but we ought to be thankful for the practical example of a highly pleasing novelty, instead of objecting to it, that the idea is capable of being greatly improved upon. The idea itself was probably derived from the conservatories at the Colosseum; but that circumstance in no degree detracts from this particular application of it, as Mr. Smirke has produced a design of quite a different character, and in a situation where a garden of this description is most desirable, and where such a one would add materially to the *agrémens* of a house in town; because, while it would present a highly agreeable scene in itself, and might, if lit up, be enjoyed of an evening as well as by day—if not otherwise, at least from the ground-floor windows looking out upon it—it would also serve to exclude the sight of dull brick walls, and other disagreeable objects.

THE ORIGIN AND USE OF THE STEAM DREDGING MACHINE.

COMMUNICATED BY THOMAS HUGHES, ESQ., CIVIL ENGINEER.

The honour of having first applied steam power to the purposes of dredging has been assigned to various engineers at different times, but it will be found on examination that the greater part of those who have hitherto laid claim to be considered the contrivers of this great addition to the resources of the engineer, have no other foundation for their claims than that of having at periods not long subsequent to the erection of the first steam dredging machine, constructed engines on the same principle.

From the evidence of living witnesses, who are no other than the very men who first worked the dredging machine by steam power, as well as from documents in my possession, I can prove beyond the possibility of doubt, that the first steam dredging machine ever used was constructed by my own father, the late John Hughes, in the execution of several contracts which he undertook for the Corporation of the Trinity House.

The following extracts, from a report by my late father, details the necessity which gave rise to the introduction of this new power, and goes on to show the difficulties he met with in the practical application, and how at length they were all overcome by the production of a dredging engine, which may almost be denominated perfect, when we consider the trifling value and importance which can be attached to any improvements made up to the present time.

When the docks at Blackwall were being formed for the East India Dock Company, it was found necessary to deepen the bed of the river Thames at the moorings opposite the dock gates. With this view the Corporation of the Trinity House were employed for nearly two years, at the expense of the Port of London Committee; but at the end of that period they abandoned their pursuit, as being impracticable, after incurring an expense of from sixty to eighty thousand pounds, because their ballast spoons and other implements were not sufficiently powerful nor properly constructed to penetrate the strata, which, at this part of the river, consist of strong blue clunchy clay, intermixed with layers of rock. Well knowing that these strata were impenetrable to all the ballast-lifting implements of that day, and that the Corporation of the Trinity House had, at the suggestion of the House of Commons, advertised for engineers and others to furnish plans for raising ballast upon an improved principle, I immediately, in the absence of my well-known and respectable partner, Mr. William Bough, then attending to a large contract we had at the Dartmoor prison, wrote and suggested to him a mode or principle of a floating steam engine, to work a dredging machine, that I thought would fully answer the intended purpose; to this he readily agreed. I immediately set about preparing it, which I was able to do in about three months; and as soon as it was ready, I proposed to the Port of London Committee to deepen and finish the East India moorings. They accepted my proposals, and I became the contractor. When I was ready to commence operations, the Port Committee came down to see the working of the engine, and were exceedingly sanguine about the success of this (at that time) novel and singular contrivance. Several trials were made in their presence, and I had the mortification to see many parts of the engine, which had cost me much expense and intense thought, torn to atoms, and links of chain, one and a half inch square, broken and snapped off, just as easy as the stalks of so many tobacco pipes, by the expansive power of the steam; finally, the machine was almost torn to pieces, and rendered useless, which was a great disappointment to me as well as to the Port Committee. Having, however, been bound under a penalty to execute the work, it was of no use to reflect on the disasters of this day's trial, which, after all, gave me an opportunity of seeing that the engine had sufficient power to penetrate the strata; but at the same time many improvements were wanting to make the machine equal to its task, it was therefore laid up in Mr. Perry's Dock at Blackwall, and in the course of a few weeks I had many additional friction blocks fixed to prevent breakage, and several other improvements made, which, on the next trial, proved successful, to the greatest degree of perfection, and enabled me effectually to accomplish and complete my contract, to the entire satisfaction of my employers.

About this time Messrs. Milne, Huddart, and Rennie, civil engineers, were employed by the Navy Board to inquire into the cause and nature of the accumulation and deposit of mud, vegetable, and marine substances, at his Majesty's moorings at Woolwich. They were engaged a long time in making the necessary observations, and obtaining the desired information; and subsequently made a long report thereon, which stated that the deposit of mud, &c., in the river at Woolwich, had so increased of late years, as to render the Dockyard useless, and unfit for Government; and where there was a depth of 15 or 20 feet of water, 12 or 14 years ago, there was now no more than six or eight feet. This report ended by submitting to the Navy Board the propriety of allowing them more time to make an actual survey and soundings of the river, which was granted. Messrs. Giles, then eminent land surveyors, were actively employed for nearly twelve months on this tedious and expensive survey. I had by this time constructed, at an expense of eight thousand pounds, a large and powerful floating steam dredging engine exactly on the same principle as the first, on board the Plymouth bomb vessel, which was purchased from Government for this purpose. It was far superior in power to the first, that being only a six horse power, and this one a thirty horse power. I therefore made a proposal to the Board to remove all the deposit at the King's moorings, off Woolwich, and offered not only to reinstate them, but to deepen the river several feet below the original channel. At the request of Charles Cunningham, Esq., the Commissioner at Woolwich, I brought my new dredging machine from Mr. Perry's Dock, where she had been erected, to make trial of the strata and deposit at Woolwich; the trials were continued nearly a fortnight, during which time it was clearly proved, to the satisfaction of the officers of the Dockyard, that the engine was not only capable of removing gravel and sediment, but was actually competent to penetrate several feet into the original bed of the river, which in this situation is an accumulation of mud, gravel, flint, and chalk. In one day we actually excavated and lifted the incredible and astonishing quantity of two thousand tons from an average depth of 30 feet of water, which can be proved by the Government accounts kept by the master attendant and other officers at Woolwich Dockyard. Having so far succeeded we tried no other experiments, but made further proposals to reinstate the depth of the moorings, &c., which

* The same fault displays itself still more offensively in the portico of the Haymarket Theatre. In that of Dover, *ci-devant* Melbourne House, Whitehall, the portico (through which foot passengers pass, as in the one just mentioned, and that of the Pantheon) is much better managed, although it loses much of its effect in consequence of being on a diminutive scale, compared with some of the buildings around it. The façade of Dover House is one of the most tasteful and classical pieces of design in the metropolis. The view of it, in Malton's "Picturesque Tour," shows it to great advantage.

seemed (with the sanction of the officers) to meet with the entire approval of the Board: but by this time the civil engineers beforementioned had brought in their voluminous and conclusive report, stating, that Woolwich was unfit for the purpose of his Majesty's Ordinary, and that the sediment off Woolwich Dockyard had so accumulated of late years, that it would take a period of five years to remove it, and that at an outlay of at least 152,000l.; and after all it would be so uncertain in its effects, that they declined entering into any further particulars, but recommended its being abandoned altogether, and that the Naval Dockyard should be established at Northfleet.

It is well known to every member in both houses of Parliament, at that period, with what violence the propriety of this immense work was agitated, which was estimated at the vast sum of seven millions sterling, or upwards. Pamphlets were written on the subject and circulated in all directions; one, I believe, by the late Lord Melville; another by the late George Rose, Esq.; and several others. We had, however, the satisfaction of being addressed officially, by the Navy Board, requesting us to send them our report to have it compared in all its bearings with the detailed reports of the engineers beforementioned; with this we of course complied, and offered, in open contradiction to our opponents, to reinstate the harbour in eighteen months. This proposition and statement (so much at variwith those of the other engineers) astonished the Navy Board, and they finally declined to decide on the eligibility of one report or the utility of the other; and with this impression, I believe, they laid the whole business before the Admiralty Board. I ought to add, that the plan of the new Dockyard and naval arsenal at Northfleet, was in such a state of forwardness, that the land at Northfleet for the intended docks was actually purchased by Government, and it was at one time fully expected that the works were to commence. But, notwithstanding all these preparations, the Board of Admiralty decided in favour of the mud engineers, with which name we were honoured in some of the pamphlets of that date. The grand work at Northfleet was consequently abandoned, and we, in the end, entered into a contract with the Navy Board, whereby we undertook to restore the Woolwich moorings to their former state. How far this has been accomplished may be easily ascertained by application to Mr. Cunningham, who, I believe, at one time, much to his credit, stood alone unsupported against the opinion of those engineers who advocated the abandonment of the Dockyard at Woolwich.

John Hughes.

The preceding extract will show that the first steam dredging engine with frames, links, and buckets, was used by my father in the year 1804, in a contract under the Corporation of the Trinity House, at the moorings opposite the East India Dock gates.

Of the advantages that have been derived by the Government and shipping interests of this kingdom, from the means afforded by the steam dredging machine, of deepening and clearing the various harbours, I am quite unable to give anything like an adequate idea. With respect, however, to its application by the civil engineer to the numerous operations connected with the improvement of navigation, it is quite certain, according to the experience of upwards of thirty years, since its first introduction, that a more effective and necessary machine has never been placed under his command.

I propose now to notice the further improvements that were made in the steam dredging engine under my own inspection, whilst managing the dredging operations on the Caledonian Canal, under my late uncle, Mr. William Hughes. In order to convey a proper idea of the great value of the system of steam dredging, as practised on this important work, it will be necessary to give some description of the nature of the country through which the canal is carried, from which it will be seen that difficulties almost insurmountable would have occurred to impede the execution of the canal, had not the dredging proved effectual to the full extent of the most sanguine anticipation.

The line of country which had been fixed on for the course of the canal, comprised three deep and extensive lochs or lakes, extending longitudinally with the canal for the length of thirty-seven miles and a half, whilst a distance of about twenty-three miles intervened between the lakes. Thus it was necessary, in order to complete the communication between the eastern and western shores of Scotland, to excavate between one lake and the other, and afterwards to deepen all the shallows that occurred in the direction through which the canal was to be carried.

The method of dredging which had been pursued by my father, as before described, on the river Thames, and subsequently by Mr. Rennie at the Hull docks, was found perfectly successful in every situation where the machine could float above the spot at which the dredging was required. The position of the buckets, however, required considerable alteration before the engine could be rendered capable of cutting her way across a neck of land, or through the various shoals which occurred on many parts of the lakes. It was accordingly found necessary so to construct and fix the ladder or bucket frame, that when lowered to the working position it projected several feet beyond the bows or stem of the vessel—an experiment, of which the ultimate success was at the time considered very doubtful, and concerning which great anxiety was felt by all those interested in the proceedings. It, therefore, afforded universal and infinite satisfaction to find that the engine worked with the most perfect ease, cutting a passage on the very first trial out of a piece of the canal (which had previously been filled with water for the purpose of floating her) through a neck of land into the eastern end of Loch Doch Four. This work having been accomplished, the engine was successfully employed in removing several extensive shoals which occurred in the lake. At the eastern end of Loch Doch Four where the water from Loch Ness falls into it, close to the ruins of Old Ness Castle, occurred perhaps the most difficult case of dredging that can well be imagined. This was occasioned by the necessity of carrying the canal along the bed of the river Ness, which discharges the water from Loch Ness into the lower level of Loch Doch Four. The bed of the river was composed of an exceedingly hard stratification known by the term mountain-clay; and it would be difficult to conceive anything more calculated to resist all efforts to remove it than this very compact and almost impenetrable substance. It occurs in great masses almost without any appearance of stratification, and entirely free from vertical cracks or fissures. Gunpowder applied in the ordinary mode of blasting was found to produce little or no effect on this clay, as it blew out of the orifice made to receive it without loosening any quantity of the mass.

The river Ness flowing over this primitive and hitherto undisturbed bed, falls into Loch Doch Four with rather a rapid current, and against this the engine had to fight her way, while the duty to be performed was the excavation of the river-bed, to a depth varying from four to twelve feet, and very often the sides had to be widened, and in places where considerable bends occurred in the course of the river, a new channel had to be formed with a breadth at bottom of fifty feet according to the regular section of the canal. It was soon evident when the engine was set to work against the current, and required to tear up the hard bed of the river, that the exercise of every possible contrivance was necessary in order to the fulfilment of this difficult task.

It was at first found impossible to keep the vessel, containing the engine, steadily moored against the current, in consequence of the slipping and giving way of chains, cables, and anchors. The machinery, which was of the very best description, and constructed by the Messrs. Donkin, was quite unable to withstand the immense force applied to it, in order to make the buckets cut into and bring up the excavated clay. All the ground tackle, comprising a full complement of anchors, cables, and hawsers, was first-rate, both in workmanship and materials; the links were of the best Swedish iron; all the bolt-holes were steel-bushed; while the bolts themselves were of the best tempered steel, and case-hardened.

The whole of the buckets were not only made of the best Swedish plate-iron, but had strong pieces of tempered steel-plate riveted to their edges. The friction-blocks throughout the engine were manufactured and fixed with most surpassing care, and could always be adjusted to act with the greatest nicety. Notwithstanding, however, all the perfection of this engine, and the constant care with which every operation was performed, the most vexatious and apparently insurmountable inefficiency, was the result of her first labours in the situation above described. It was no uncommon occurrence to witness, in rapid succession, the tearing away of the buckets, the stripping of the cogs from off the wheels, the snapping of the chains, breaking of bolts, and giving way of the anchors and cables, while on more than one occasion the whole string of chain, buckets, and bolts, was carried overboard.

No sooner were the necessary repairs executed upon the shattered machinery than it was again torn to pieces, and after all no impression was made, no effect produced, on the solid and obstinately resisting mass, against which the engine was contending. Without dwelling upon the various unsuccessful contrivances which were introduced, it will be sufficient to mention at once, that none of these proved effectual until the expedient was tried of removing every alternate bucket from off the chain, and fixing, instead of it, two cutters formed of plates of iron and hardened with steel, which projected at right angles to the line of the chain, and, as this revolved, cut vertically into the ground below. Each pair of cutters, therefore, effected two simultaneous incisions longitudinally in the direction of the vessel, and the lip of the succeeding bucket descending immediately afterwards, scoops up the mass separated by the cutters, and carries it to the top of the frame. After this alteration the work of the engine was performed with much greater efficiency than before; but, in consequence of the hard and incompressible nature of the clay above described, the counter resistance offered to the buckets and cutters would have been sufficient to tear them off and otherwise derange the machinery, had this not been prevented by the action of the friction-blocks. By means of these, whenever a visible tightening and straining of the chain throughout its whole length, denoted that some extraordinary resistance was opposed to the motion of the buckets, the engine continued to work and the wheels to revolve, while the chain and buckets remained stationary. The dredging-vessel was then allowed to drop back with the stream, in order to loosen the bucket, which, being thus extricated from the incision made in the ground, passes back without resistance.

The vessel is then hove up to her original position, and the next descending cutters render the previous incision more perfect, and the bucket immediately following these cutters commonly succeeded in tearing up the obstinate mass. Sometimes, however, it happened that the vessel had to be dropped from her work, and hove to it again several times before this effect could be produced.

These operations, tedious and difficult as they were, succeeded in forming the complete communication between the two lakes in the course of about four months. The distance thus dredged was about 800 yards, and the total quantity removed about 20,000 yards. It must, however, be noticed, that the returns of the work done did not exhibit so large an amount as the above, and this is accounted for by the fact, that a great deal of the material loosened and dislodged by the cutters and buckets was carried down by the stream into deep water, instead of being raised in the buckets to the top of the frame. The excavated earth being in this way as effectually disposed of as if it had all been hauled up by the buckets, it may not appear surprising to learn that the current of the river, although seeming, at first sight, so obviously an obstacle to the process of effective dredging, proved in the way described a great auxiliary to the power of the engine.

Another instance of the immense advantage which may be derived in some situations from the employment of the dredging engine occurred at the west end of Loch Ness. In this part of its course for a short distance out of the lake the canal runs side by side with the river, which descends from Loch Oich, the summit lake, to Loch Ness. The canal attains the level of Loch Oich by means of six locks, five of which are situate above Fort Augustus, about half a mile from Loch Ness, and the sixth at Kytra, about half way between the two lakes. The locks were founded and carried up beyond the reach of water before the canal was excavated on either side of them; and here it will be useful to observe the difficulties which would have presented themselves had not the power of dredging been applicable to this work.

In the first place, any attempt to excavate in the ordinary way between Loch Ness and the ascending locks would have been immediately followed by a deluge of water from the river, and it was certain, on account of the open and inadhesive nature of the strata between the river and the canal, that the water penetrating into the excavation made for the latter would have stood at least as high as the level of Loch Ness, which is the lowest drainage it could possibly obtain. Thus the operations of excavating must have been carried on under a depth of twenty feet of water—a case in which manual labour could not possibly be employed.

On the other hand the expedient of carrying the canal on a higher level, by building two of the locks immediately at the end of Loch Ness, and in this way obtaining drainage into the lake, would have been attended with almost equal objections, for the immense coffer-dams which would have been required in getting down the foundations in such a situation would have seriously increased both the time and the cost of execution. As it was, however, by means of the dredging engine the canal was easily excavated to its full depth and breadth, from the end of Loch Ness to the tail of the first ascending lock.

The application of the dredging engine in the case just described leads us to consider one of far greater importance, where a most difficult and extensive work would have been entirely avoided, had the power of the dredging machine been as well known at that time as it has since become. Every history of the Caledonian canal dwells with great minuteness upon the difficulties experienced in building the sea lock at the eastern end of the canal where it terminates in the Beauly Frith, a part of the Eastern Sea. At this place an embankment was actually carried out into deep water, and after sufficient time had been allowed for its consolidation, the excavation for the lock was formed in the middle of it. This expedient, ingenious as it certainly was, would have been quite unnecessary if the lock had been built on the solid ground inland, and a passage had been dredged out into deep water. Although it is probable, considering the state of engineering knowledge at that time, that the plan adopted was the best that could then be devised, it is certain that a much better work could have been constructed in the solid ground before entering the Beauly Frith, and in corroboration of this it may be mentioned, that the sea lock at this day has a considerable dip or inclination towards the sea, an effect no doubt occasioned by the after settlement of the artificial mound in which it was placed.

With respect to the dredging on the Caledonian canal very little more remains to be said. In various places on the west side of Loch Oich its powers were brought into requisition, but to describe the circumstances of its application at length would be merely to repeat what has already been told, with reference to Loch Doch Four, and Loch Ness.

Without any disposition to disguise the fact that difficulties serious and annoying occasionally presented themselves, I am quite safe in asserting that in every case a persevering and determined application of the dredging engine, in the capability of which every one engaged placed the most implicit reliance, succeeded without exception in a complete fulfilment of the duties expected and required. As it may be interesting to know the quantities of work performed by the engines on this canal, the following numerical statement may safely be depended on. The total quantity of dredging on the Caledonian canal exceeded one million of cubic yards, and the engines employed were only two in number, a six and a ten-horse power. The former of these was employed in the dredging out of Loch Ness up to the first ascending lock, in which district the quantity dredged amounted to 170,000 cubic yards and occupied eight months. This engine was also employed in dredging through the shoals of Loch Doch Four, and between this lake and Loch Ness. The ten-horse-power engine was built at Loch Oich, in the year 1816, and was employed in dredging into the lake, through the shallows, and between the summit level and Loch Lochy descending westward. The greatest quantity raised in one day by the ten-horse-power engine on the Caledonian canal was 1500 tons.

In reviewing the extraordinary performance of the dredging engine in every situation where it has hitherto been employed, it appears to afford to the engineer means of the most powerful and extensive capability in the construction of a class of works which must ever hold a place of great importance in the rank of engineering operations. I allude to docks and harbours, in the construction of which, during late years, the greatest acquirements, both practical and scientific, have been called into action. The well-attested performances of the dredging engine clearly establish the fact that this machine, being set to float in a basin or a channel of water, is capable not only of tearing up and deepening the bed, however hard or solid, but also of cutting away the adjacent land, and extending either the length or breadth of the body of water in any required direction. In the same way the engine would be quite competent, when placed out at sea, to work inland, either to clear out the *embouchure* of old rivers, docks, or harbours, or, as a still bolder undertaking, to excavate new channels where the old ones from any cause have been impeded and rendered useless. The design of constructing docks, harbours, and basins of any kind in sheltered situations, at any convenient distance from the sea, may be safely carried into effect, relying on the power of the dredging engine to perfect the communication with the sea, at an expense not exceeding that of ordinary excavation.

To enter into details respecting the cost of dredging in various situations would be out of place in a paper of this kind, which professes to be a mere outline of its advantages. But I shall at any time feel great pleasure in affording to any individual, or public body, who may think proper to communicate with me on the subject, the benefit of my experience and practical acquaintance from earliest youth, with every particular relating to the practice of dredging by steam power.

4, Acre-lane, West Brixton. THOMAS HUGHES.
December 15, 1838.

ON CONSTRUCTION, AND THE USE OF IRON.

Read before the Architectural Society, on Tuesday, Dec. 4, 1838, by R. E. Philips, Esq., Member.

The great end of all the arts is that of making an impression on the imagination and feeling. That imitation of nature frequently does this I believe will be readily admitted; but that on some occasions it fails, I conceive will also be conceded; the true tests of the arts, therefore, does not rest solely upon the production of a true copy of nature, but whether it answers the end of art, which is to produce a pleasing effect on the mind. Architecture does not rank itself under the banners of an imitative art; but, like music and poetry, appeals directly to the imagination. There is in architecture an inferior branch of art, in which the imagination has no concern; it does not lay claim to its appellation as a polite and liberal art from its usefulness, or as an accessory to our wants and necessities; but from higher and loftier principles, we are convinced that a man of genius would render it capable of inspiring sentiment, and of filling the mind with great and sublime ideas. The influence of the fine arts upon the intellectual and moral character of a people, their utility and their value, as conferring upon a state in which they are justly appreciated as the highest proof of civilization, are considerations which cannot be too much entertained. Persons are too apt to regard the art of design as a mere elegance, as the sign of wealth rather than the production of wisdom, and as more the effect of pleasure than utility. It may be well for the members of our profession to consider what means and materials are in their hands, that may prove conducive to these ends, and whether this art has not in its power to address itself to the imagination by more ways than those usually adopted by architects. That the mere theoretical architect combines those qualifications, has not, I think, been proved in the buildings of the ancients, for I imagine that many of the deformities observable in the buildings of Greece and Rome have arisen from their ignorance of construction, and the modes adopted to supply that deficiency, some of which have been contrary to every rule of beauty and convenience. The strength and duration of their erections may, I think, be attributed to the goodness of the materials, and the quantity used, rather than any practical display of mechanical skill: and, at the same time, I cannot help regretting that at the present day, when the flourishing appearance of the arts would lead us to look for a display both of the one and the other, a sad deficiency exhibits itself, and especially when we are continually hearing the former decried, the latter so much commended.

To the Gothic architects we are considerably indebted for the unity of both, for in their works they exhibit a lightness, an art and boldness of execution, clearly proving that neither the singly practical or theoretical architect will ever exhibit to the mind a pleasing object for its contemplation, unless the union of the two becomes apparent to the imagination by the working of its effects.

England, perhaps, exhibits more than any other nation magnificent examples of these qualifications, equally admirable for the art with which they are executed, and the taste and ingenuity with which they are composed. I cannot here refrain from expressing a feeling of regret, that these structures, sacred to the soil, are not more considered, better understood, and held in higher estimation, and more encouragement given to our antiquarians in that peculiar branch, to undertake a correct publication of our ecclesiastical and domestic architecture, before ruin spreads its extending mantle, and preserve to after ages the remembrance of an extraordinary style, now fast sinking into oblivion, at the same time publishing to the world the riches of a great nation in the splendour of her ancient structures, and rendering a real service to the art of design.

That some of our modern architects have developed great skill and considerable knowledge in their erections, I candidly and joyfully confess; for instance, St. Paul's, and many other works of Sir Christopher Wren, present us with a display of numerous examples of admirable works, executed with so much art, that they are and ever will be studied and admired by all intelligent and researching observers.

> " Those massy columns in a circle rise,
> O'er which a pompous domo invades the skies;
> Scarce to the top I stretched my aching sight,
> So large it spread, and swelled to such a height."

To him and many others we owe great improvements in practice, especially in carpentry, which has been carried to a much higher state of perfection than by any other nation; and we are considerably indebted to many of our countrymen for several valuable books, which have been published, explaining the various modes of conducting the several works, and enumerating the apparatus used, together with the properties and nature of materials adopted; and let me here bear an humble tribute to the periodicals which now monthly add to our store; to these, then, the various structures to be found in the United Kingdom, and elsewhere, must the architect devote much of his attention, in order to acquire and collect the rudiments of construction, and other branches of his profession, which practice, experience, and attentive observation alone will render him consummately skilled in.

Perhaps there is no material so much in requisition in buildings as iron; but yet so little attention is devoted to the parts thereof, that although capable of being converted to the most ornamental purposes, at the same time uniting stability with utility, it is made an eyesore, or, in many instances, a severe reproach on the skill and ingenuity of the architect. The use and advantage of a thorough knowledge of the material will be best appreciated by those who seriously consider the dread effects of a failure in its application, as it would happen most likely when the consequences would be most serious; and, perhaps, there is no material which requires more the aid and assistance of science in its use, therefore the greater necessity for a constant study of its properties and capabilities. That very great improvements have been made in its application is every day more apparent, and which may be chiefly attributed to its great acquisition in manufacturing districts, and thereby produces additional reasons for a more minute cultivation of a thorough knowledge of its utility and value. Another reason for its adoption is on the score of economy, for although the opulence of the nation might warrant a supposition of prodigality in its public buildings, yet where thousands and tens of thousands are squandered in the most trifling, contemptible, and ridiculous modes, yet, in respect to the arts, especially architecture, the public liberality has yet been seen only to extend to almost a mere nothing, a foundation certainly much too weak to sustain an edifice either creditable to the national taste or native genius.

The existence of pure iron was formerly questioned; of the fact that such pieces have been found, I believe there remains little doubt, indeed none at all, if we rely on highly respectable authorities. A large piece of native iron was found in South America in 1783, by a Spaniard, which was found to be pure and soft iron, easily cut, and capable of being wrought without difficulty when heated, some portions of which are deposited in the British Museum, as specimens of the block. It has been likewise a matter of doubt whether the ancient Greeks, towards whom we generally look for authorities as to the early progress in the arts, were acquainted with the use of iron.

In the description of the games instituted by Achilles on the death of Patroclus, translated by Cowper, we find the following:—

> " The hero next an iron clod produced
> Rough from the forge, and wont to task the might
> Of King Ætion; but when him he slew
> Pelides' glorious chief, with other spoils,
> From Thebes conveyed it in his fleet to Troy."—Iliad.

If iron had been common among the Greeks, we may assume that a lump of the metal of the size described by the poet or his translator would have been no unworthy prize of heroic contention; but as it is by no means clear that the knowledge of iron for military purposes really existed, much less that the art of subjugating so stubborn a material, was at that time known.

At what period the smelting of iron ore, so abundant in this country, was first undertaken, does not, I believe, appear. It will be readily admitted by those conversant in early history, as well as by those who respect traditional probability, that the earliest uses to which it was devoted were probably weapons of warfare. Although a considerable degree of perfection appears to have been attained at a very early period in the working of iron, the art of casting articles in sand from the metal in its crude state seems to have been either unknown or not practised till a comparatively late period. That it is fitted for every purpose in building is not asserted, especially considering the climate of England; but its usefulness for the support of great weights exposed in situations subject to rapid decay, and for the prevention of fire, must be self-evident, as, in the latter case, we have seen several instances lately, which fully bear testimony to the correctness of this observation, where there is every reason to suppose, that, had not the brestummer supporting the front wall of the house been of iron, the same would have been precipitated into the street, and thereby, perhaps, a sacrifice of many lives. There have been instances of failures in the use of this material, which, perhaps, has much prejudiced the public mind against its adoption more generally in buildings; but yet these may have been cases where it has arisen from a want of a proper knowledge of its properties, and not from any defect in the material itself.

Persons are too apt to imagine that a large piece of iron must possess infinite strength, and the dimensions of the most important parts of structures are frequently fixed upon by guess, and from such causes ensues unpleasant consequences. The chief and principal object is to regard the fitness, strength, and durability, at the same time endeavouring to produce, with those qualifications, a pleasing effect, correctness of design, and lightness of parts, yet at no sacrifice to the stability of the erection. When it is considered that the parts of a building should assume any particular form or position, as well as stress, it will become obvious that something more than mere resistance to fracture should be calculated. In the evidence given before the jury on the failure of the Royal Brunswick Theatre, the architects examined on that occasion differed materially as to the application of iron for the purposes of roofs; yet there are many recent instances where iron roofs have been adopted with complete success. I might mention the roof over the fruit market at Covent-garden, where it is composed of iron and wood, that has a very light and agreeable effect; the fish-market at the Hungerford-market is wholly of iron, with sheet-iron (? zinc) covering. In chapels lately erected, the cluster-columns have been made of iron, six inches diameter, cast hollow, with a stone core for their reception, and the height of which, I believe, are 25 feet; but yet, for the want of a little attention to these matters, every body must regret the bad effect which is produced by the introduction of iron girders, in chapels and elsewhere, without combining a spirit of design with that of utility, and perhaps economy; little or no attention is paid to the adoption of iron columns in shop windows where they become necessary for the stability of the building, which, if properly considered, instead of forming a blot in the design, might be made conducive to its general good effect, and that without detriment to its stability or usefulness.

As regards the qualities of iron, we find the following recommendations:—White cast iron is less subject to be destroyed by rusting than the gray kind; and it is also less soluble in acids; therefore it may be usefully employed where hardness is necessary, and where its brittleness is not a defect; but it should not be chosen for purposes where strength is necessary. When cast smooth, it makes excellent bearings for gudgeons or pivots to run upon, and is very durable, having little friction; white cast iron, in a recent fracture, has a white and radiated appearance, indicating a crystalline structure, it is very brittle and hard; gray cast iron has a granulated fracture of a gray colour, with some metallic lustre; it is much softer and tougher than the white cast iron, but between these kinds there are varieties of cast iron having various shades of these qualities, those should be esteemed the best which approach nearest to the gray cast iron. Gray cast iron is used for artillery, and is sometimes termed gun-metal.

The utmost care should be employed to render the iron in each casting of an uniform quality, because, in iron of different qualities the contraction is different, which causes an unequal tension among the parts of the metal, impairs its strength, and renders it liable to sudden and unexpected failures. When the texture is not uniform, the surface of the casting is usually uneven where it ought to have been even. This unevenness, or the irregular swells and hollows on the surface of a casting, is caused by the unequal contraction of the iron of different qualities.

Too much attention cannot be paid by the architect to the fact of ascertaining the capabilities of every portion used, by the necessary proofs, the importance of which has been frequently proved, the castings having been, to the eye, good and sound, but, under the necessary proofs, were failures, but which reflects no discredit either on the architect or founder, but only shows the high necessity for the before-mentioned caution.

I have been led to make these few remarks from a wish that some more able hand, and well-stored mind would, some evening, instruct us with a better and more elucidated detail of so interesting a topic.

The architect who has his mind thus filled with ideas, and made expert by practice, will work with ease and readiness, whilst he who would have you believe he is waiting for inspirations of genius, is, in reality, at a loss how to begin: whereas the well-grounded architect in theory and practice has only maturely to weigh his subject, and all the mechanical parts of his art follow; without conceiving the smallest jealousy against others, he is content that all shall be as great as himself, who have undergone the same fatigue, confirming the importance of the fine arts, and drawing forth a strong response from the generous hearts of all classes, ere a nation may wear that high intellectual honour which the production of masterpieces in painting, sculpture, and architecture has ever conferred.

May we not trust and be persuaded that we shall have the gratification, at no distant period, of adding a new page of lustre to the English history, there being nothing of glory left to achieve, we may still snatch the only remaining laurel in the midst of the enjoyment of peace and plenty; we may, after a long and severe struggle, enjoy those enchanting, fragrant, and ever-blooming laurels of painting, sculpture, and architecture, entwine them round our country's brow, stamp the age in which we live, and, by the patronage and encouragement given to the mass of talent in all the branches of the arts now in this country, if to the glorious names of Augustus, Pericles, and Leo, we may add that of Victoria, as the most enlightened and liberal patroness of the arts since the bygone days of Italian splendour, and make those days in which she ruled the golden age of England's pride.

RAILWAY CURVES.

SIR,—I have recently been engaged in staking out the line of one of the principal railways now in progress of formation, and in the course of my operations met with some difficulty, in consequence of being compelled to cross several roads and rivers, and certain lands, at fixed points. To accomplish this, I was obliged to make use of curves of different radii for shorter distances than usually adopted.

Now, although it is, doubtless, an object in laying the rails, to make the resistance equal by continuing a good working curve, or gradient, as far as possible, yet I think it would be an improvement upon the system of running directly from a straight line to a curve of 1¼, 2, or 2½ miles radius, if a curve of 3, 4, or 5 miles radius for a short distance (say 5 or 10 chains, or any distance which the locality would make convenient) were made use of to connect them.

I would add, that projectiles (where the resistance is equal) assume the parabolic curve, to which the plan I propose is an approximation.

If any of your more experienced readers would correct any error I may have fallen into, they would much oblige

Your obedient servant,

Dec. 14, 1838. "A SUB."

THE SOANEAN MUSEUM.

Under the head of "Weekly Gossip," in its number for December 1st, the *Athenæum* has made the following remarks respecting this so-called *public* establishment:—"Whilst upon the subject of Museums, let us ask, are the Soanean trustees still nodding 'in the pleasant land of Drowsihood,' as well as their great prototypes abovementioned? (viz. those of the British Museum). How long is the *Public Inheritance* in Lincoln's-inn-fields to remain a close borough for Mr. So-and-so, the curator, and Mrs. So-and-so, the housekeeper? A rich *Architectural Library* was left, we submit, to be devoured by something else than the dry-rot. When shall we have the use and enjoyment of our heritage? Or has the entrance been removed to *terra incognita?* Two years almost has the testator been dead, yet the British people must still be satisfied with permission to visit *their own property* some few months (rather some few days) during the fashionable season! Let us hope that by next spring such arrangements will have been made, as may render a recurrence to this subject unnecessary."

It affords us great pleasure to find the matter so strongly taken up in such a quarter; for were we solitary in our condemnation of the system of nominal access to, but virtual exclusion from, the Soanean Museum, we might be thought to plead rather for our own convenience, than for the right of the public generally. So long as it continues upon its present footing, the whole is a monstrous piece of humbug—an absolute dog-in-the-manger affair, and as such cannot be too strongly reprobated. As far, too, as the *liberal donor's* memory is concerned, it would be infinitely more charitable towards him, to pay no regard to his childish freaks and whims, but throw the Museum open to the public, "every day and all day long," than, by adhering to them, to remind the public perpetually of his stingy disposition, which induced him to tie up the property in such manner that no one—neither the public nor his own family, can enjoy it; the only parties who can really be said to be in actual possession, being Mr. Curator and Mrs. Housekeeper—the servants of the public—who, no doubt, have full leisure to perform "high life below stairs," or, for the matter of that, upstairs, too. If there be a rich *Architectural Library*, which, after what we have heard, we very much doubt, let all those who can benefit by it have free access to it. The only respect in which the Soanean Museum can now be considered a *pro bono publico*, is, that it seems likely to be a bone of public contention. Let us, therefore, fight for it manfully—no, not manfully, but *doggedly*, until one party or the other get the day. At all events, it is a case wherein the next best thing to a decisive victory would be an equally decisive defeat.

SCHOOLS OF ENGINEERING, MINING, AND SURVEYING.

As very great ignorance seems to exist among the would-be political economists as to the state and progress of the schools for engineering, mining, and surveying, we are induced to publish the following remarks:—The Government have the departments at Sandhurst, Woolwich, and Chatham; the East India Company have also a college; the Royal Dublin Society have long given regular courses of lectures and instruction, under the superintendence of Mr. Griffiths; and surveying has been so effectively taught at the Agricultural School of Templemoyle, that the Ordnance Surveying Department there has received considerable assistance from it. Surveying is one of the regular branches of instruction at Elizabeth College, Guernsey; and we believe also at King William College, in the Isle of Man.

But if any deficiency of these institutions exists, it will be fully supplied by the faculties established at Durham, and in University and King's Colleges, London. In the college in progress at Bath, professional instruction is part of the course proposed, and we have no doubt that it will soon be adopted in Ireland or Scotland. The southern mines will also have a school founded by means of the Dunstanville subscription.

We wonder that the admirers of the Polytechnic School had not pointed out the deficiency of agricultural schools in England, while there are shoals in foreign countries, and there are establishments even in Ireland and Scotland. This would be about on a par with their other reasoning, for although the Irish and Scotch may want agricultural schools, the English do not. "It is not the healthy who want a physician, but the sick."

IRISH RAILWAY COMMISSION.

"Having thus endeavoured to explain, that the construction of the best lines of Railway between London and Dublin, and between Dublin and Cork, the latter being established as the fixed port of embarkation, a more certain, expeditious, and convenient, if not a cheaper, communication would be effected with America, than from any port of Great Britain directly, unless with partial advantages from Bristol only; and that even from Bristol, circumstances are likely to induce many vessels to touch at Cork. We may, then, safely urge the construction of these Railways as a consideration of national importance, quite independent of the amount of direct profit from increased business which the intercourse thus created is likely to produce.—*Page 66, Irish Commissioners' Railway Report.*

I shall now endeavour to examine and investigate the general utility of this plan recommended by the Irish Railway Commissioners, as its main object is put forward on merely assumed data, evidently for the purpose to induce the Government of the country, either to embark in the project, or to advance public money to carry it into execution; and as it is an undertaking not only gigantic, but of a very formidable kind, it ought to be subjected to the test of the stern scrutiny of reason and discussion; because it appears to involve the making of 140 miles of railway through Wales, and also 316 miles through the south of Ireland, and a consequent expenditure of more than ten millions sterling. I shall, therefore, be brief, and approach the subject at once by calling public attention to the time of travelling from London to Cork by railway, as compared to the sea voyage by steam to the same port. The merits of the direct voyage from London to New York—the superior advantages of the route from London to New York, by the Western railway to Bristol, and then direct by steam across the Alantic — the central position of Liverpool, in the British empire — its great American trade, and the many advantages it possesses as a point of general departure for America, and its becoming the great emporium of steam intercourse with the states of the new continent. To the nautical and geographical statements to illustrate and show that the recommendations of the Irish Railway Commissioners, as to Cork being established as the fixed port for embarkation, would be productive of no benefit, either as to general convenience, economy of time, or expense to passengers departing from the port of London, Bristol, or Liverpool, bound to America; and that even the making of 456 miles of railway through Wales and Ireland, would neither lessen the time nor the expense of steam navigation intercourse between the principal ports of Great Britain and those of North America; but on the contrary, if viewed on the basis of national utility, would be attended with immense trouble, inconvenience, and expense, not only in general to the travellers of England and Scotland, but also as to the transmission of packages by that route from Great Britain to America.

It is stated in the Irish Commissioners' Railway Report, that if the line of railway they recommend be made from Dublin to Cork, "and the most rapid possible communication opened between London and Dublin, persons or packages might then reach Cork from London in about twenty-nine hours, allowing twenty miles per hour for railway travelling." The Railway Commissioners have not given any detail of the calculations regarding how the journey from London to Cork by railway could be performed in twenty-nine hours, it may therefore be worth while to examine that statement put forth by them.

	Hours.
Railway conveyance from London to the Irish Channel .	11
Steaming across to Dublin	12
Travelling from Kingstown to the Cove of Cork . . .	9
	32

The Railway Commissioners mention that a saving of two or three days would be made in going by railway from London to Cork, as compared with performing the same voyage going by sea. This, upon investigation, does not appear to be the case, for the distance from London to Cork straight through the English Channel is about 595 English miles, which a powerful steamer could perform in about fifty hours in favourable weather, and which would only be a saving by the railway of about eighteen hours instead of two or three days; so that this statement of the Commissioners does not even appear to stand investigation when compared to the circuitous route of touching at Cork.

Looking into this question, and viewing it in another way; supposing passengers and packages leaving London in a steam vessel bound direct for New York in America, they would reach it even sooner than if they were to travel by railway to Cork, and then embark for America; because Cork lies 230 miles north-west of the middle entrance of the English Channel: and again, a ship steaming from London bound for New York, and calling at Cork, incurs an immense loss in running from the Land's-end to that port, her course then requiring to be changed from W. by S. to N. W. 4½ west for a distance of about one hundred and eighty miles, and in place of making southing, which she ought to do if sailing in a direct course, she would be making northing to the amount of not less than 190 miles, taking it from the centre of the mouth of the English Channel to the harbour of Cork. The direct voyage from London to New York would, therefore, possess many advantages in lessening the time compared to the same voyage being performed by going round the Land's-end and calling at Cork; or even going by railway through Dublin to that port, and then embarking for New York. Let it be further observed, that besides the *great expense* of this railway land journey from London to Cork, that the embarkation to cross the Irish Channel, the disembarkation at Kingstown, arrival at Cork, and again, the re-embarkation at the Cove, would entail much more trouble, loss of time, expense, and inconvenience to passengers and packages taking this route, than the Irish Railway Commissioners appear to be aware of. But let any one acquainted with travelling just examine for a moment this plan recommended by the Commissioners, and it will appear, that there is neither reason for it, nor any kind of advantage to be derived from its adoption, and much less to the interests of the state; that there should be 456 miles of railway made, costing more than ten millions sterling, at the public, expense, upon such a senseless project, and which could never be of any national benefit whatever in accelerating the communication between London and New York, or the other ports in North America.

Can this favourite project of the Irish Railway Commissioners, so strongly advocated and put forward by them, of London passengers and parcels going through Dublin to Cork, and embarking for America, stand one moment in competition with the route from London by the Great Western Railway to Bristol, and then direct by steam to New York. A glance at the map of Great Britain and the chart of the Atlantic, will show the very great superiority of this line of communication between London and New York, as compared to any other that has yet been laid before the public, and which is now working practically to a great extent, with the most triumphant success. The Great Western Railway from London to Bristol, is wide and level, which will ensure to it a very considerable velocity per hour. The time of travelling on it from London to Bristol may be taken at about four or five hours, and then 28 hours steaming W. by S. towards New York, would place the passengers on board of the steamer at the end of 32 hours after departing from London, not less than 150 miles S. by W. of Cork. I ask, what is the Royal Commissioners' London, Dublin, and Cork project, requiring 456 miles of railway to be made, and costing more than ten millions sterling, compared to this plan, which is now, to a great extent, in full operation.

The Railway Commissioners' reasonings as to the advantages of Cork, compared to Liverpool, are equally fallacious as those which they have expressed regarding London and Bristol. As Liverpool is the largest commercial port on the west of Great Britain, and possesses a very large American trade, I shall offer a few observations in comparing it with Cork, as a fixed point of departure for America, and which the Commissioners very erroneously think will become the great port of communication with the states in the new continent.

	Hours.
Passengers crossing from Liverpool to Dublin, say . .	11
From Kingstown to the Cove of Cork . . .	9
Amount of time from Liverpool to Cork . . .	20

A powerful steamer departing from Liverpool and bound for New York would, in 26 or 27 hours, with moderate weather, reach the same longitude as Cork, but with a favourable wind 50 miles more southerly; so all that would be gained in point of time would be about six or seven hours, and as to the expenditure of fuel it would only be about 25 or 26 tons. But on the other hand, looking to the many eminent advantages which Liverpool possesses, and above all to her central position in the British Isles; united already to London and Hull by a railway, and also will be with Glasgow shortly—possessing a steam navigation intercourse with Dublin, Belfast, Glasgow, and all the principal ports on the west of Great Britain, and those on the shores of Ireland, her immediate connection with all those great manufacturing districts within the interior of England, the work-shop of the world, and justly exciting the admiration of people from every region of the globe. Looking at her wealth, the extent of her commercial activity, her rapidly growing trade, points out Liverpool, without requiring 456 miles of railway, and a ten million expenditure, to be destined to become the emporium of Britain, for steam navigation intercourse with all the rising states of America. The writer of this is as thoroughly convinced that such will be the case as any mathematician can be of any of the axioms of geometry.

The recommendations and assumptions of the Irish Railway Commissioners as to this important question tend eminently to mislead, not only the government of the country, but also the various companies, and the public. But if they had taken the trouble of examining with the least attention the chart of the Atlantic, exhibiting the eastern and western shores of America and Europe, and the map of the British Isles, they never could have fallen into such a gross misconception regarding the best and most direct routes of communicating by steam between London and New York, and also between Bristol and New York.

Are the Railway Commissioners not aware, that by the chart the course from the middle of the western entrance of the English Channel to New York is about W. by S.? and from Cape Clear, in Ireland, it is about W.S.W. 6¾ west? and further, that the middle of the Atlantic entrance of the British Channel, is north of the parallel of New York about 585 miles, Bristol 743 miles, and Cork 775 miles? and that any northing made in sailing from London or Bristol to New York, by calling at Cork, is a dead loss equivalent to double that amount, because a ship has as much southing again to make by such a deflection from the true and direct course? As to a London, a Bristol, or a Liverpool steamer getting business at Cork to compensate them for such a deviation and delay, is altogether out of the question, particularly looking at the state of the present existing trade in Ireland. The additional supply of fuel which the Commissioners think the Atlantic steamers outward-bound from London would require, and which they recommend should be procured at Cork, it may be observed, in reply, that the steam ships even from London can carry quite enough of fuel to carry them from that port to New York, without incurring a loss in northing of nearly 200 miles, by calling at Cork; and that Falmouth, in this respect, would afford the supply much better, if required, and without loss of time or lengthening of the voyage. Looking at the geographical position of both Liverpool and Bristol, steamers from those ports would stand less need than those of London in calling at Cork for fuel.

It is presumed these observations show there can be no beneficial results from the making of 456 miles of railway through Wales and Ireland, costing more than ten millions sterling, in lessening either the time or expense in going from London or Bristol to New York, by making Cork the port of departure; unless it be to involve the unfortunate existing executive of Britain in an expense of more than ten millions sterling, and to support one of the most extraordinary projects or jobs that ever was proposed, or even ventured to be recommended to the government of any free country. Yet it has been so far countenanced by those in power, that augmented salaries and honours have been bestowed, marking their approbation of the measure.

In justice I deem it right to give the following quotation:—"The Viscount Melbourne and the Chancellor of the Exchequer state to the Board, that whilst they consider the importance of a safe and expeditious line of communication between London and Dublin to be such as to justify the interference of the public, they are by no means prepared to recommend any survey of a line of railroad. Several private bills have passed, and works are either in contemplation, or are actually undertaken, upon the successful completion of which a direct line of railroad from Dublin to London must depend. They therefore consider that any interposition on the part of the state, even if it were limited to the single object of a survey, would have a tendency of interfering with private enterprise, and discouraging the application of capital, when it may be required for the general improvement of the country."—*Report on Liverpool, Holyhead, and Port Dynllaen Harbours*, 21*st. Feb*, 1837.

W.

NATIONAL MONUMENTS.

SIR,—No one who knew London fifteen years ago but will see with pleasure how much it has been improved since then, especially near Charing-cross, and that truly noble structure, London-bridge. It would, however, puzzle a foreigner (and it puzzles me who am not one) to account for the incongruity which exists in the names of the principal streets and squares, and of the buildings and monuments that are placed near one another. For instance, how comes it that we are to have a monument of Nelson and Trafalgar-square in front of the National Gallery? Had the building been an Admiralty-office, nothing could be more appropriate; but a name bearing reference to the fine arts, and a monument of Hogarth, of Reynolds, or of some other of our famous artists, would have been more fitly applicable to a gallery of paintings. If bronze statues should (as they generally do) represent none but princes, warriors, or statesmen, King Charles's statue might have been removed further from the scene of his disastrous death, and turned towards the immortal works of the painters he so liberally patronized.

However, I suppose that, in spite of all that can now be said, Trafalgar-square will retain its name, and Nelson's statue will be placed there—at the risk of strangers to our history who have visited our chief towns (Edinburgh, Dublin, Liverpool, Birmingham, &c.) supposing England to have produced so few great men that we have been obliged, in order to have statues enough, to make a dozen for each of them. With the Greeks and Romans, our masters in architecture and sculpture, bravery only was virtue, and warriors the greatest of men; but are we Christians of the same opinion? Why have we not statues of Bacon, of Locke, of Newton, of Howard, or of King Alfred, in our squares and public places? or, if we must have soldiers and sailors, why not one of the great and virtuous Collingwood—of that warrior who, as a husband, a father, a commander, a patriot, and a subject, merits the unalloyed admiration of posterity, and whose whole character and conduct may well be held up as a pattern worthy of all imitation? Surely the monument in Trafalgar-square should be dedicated to both the admirals and to their brave companions also—to the men whose patriotism was not excited by the hope of immortalizing their names, as well as to those whose names were in the mouths of friends and enemies, and will be handed down with those of Cæsar, of Hannibal, and of Napoleon.

With regard to the form of the monument, I would protest against sticking a statue on the top of a column at such a height that it is not to be seen with comfort—unless it be the statue of a cocked-hat, a wig, or a pigtail, for then the farther from sight the better. More especially would I protest against a column with an unornamented shaft, with a detestable iron railing above the abacus, and this supporting a round-topped sentry-box; from the inside of which the half-naked sentinel appears to have emerged in a fit of melancholy madness, with the intention of falling on the pavement below; when the wind blowing on his shivering carcass and on the clothes that hang about his legs, shall overcome his endeavours to stand upon the slippery convexity, and take his feet from under him. If the Nelson monument is to be a statue on a column—1st, let the shaft be ornamented; 2nd, let it not be heavy Doric (*alias* English); 3rd, let the abacus itself form a stone parapet instead of a railing; and, 4th, let the statue stand or appear to stand (from the best points of view) almost immediately above the column, and on a flat surface not much raised from the abacus. Not that I approve of any Stylitic monuments, unless in honour of Simon himself. The Greek column is perfectly unfit for an isolated monument, and I do not know that the Greeks themselves ever made such use of it; nor yet the Romans, until the time of Trajan, when the arts began to decline. A column has an abacus as a preparation for a great weight to be placed above. Without this superincumbent mass it is incomplete and useless; but an isolated monument should be complete in itself, and it should terminate in a point or something nearly approaching one. Prejudice apart, how much more beautiful is the Turkish minaret, the Egyptian obelisk, or a Gothic spire, than a solitary Greek column! For my part, I prefer a well-built factory chimney when the smoke curls from its top, and gradually mixing with the air above it, leaves one with nothing to expect. It only wants a well-imagined railing to carry the eye gradually from the solidity of the edifice to the lightness of the vapour.

While so much has been done for the ornament of the city of London, it is to be lamented that Sir Christopher Wren's monument should still retain its pot of brass flames—the disgrace of English taste—the laughing-stock of all foreigners. It would be infinitely better with a statue; and whose would be more fitly placed there than that of Wren himself? There would be something like justice in that, and the great builder's ghost could not grumble, even though in another world he has improved his taste, which in this was certainly far inferior to his science and his skill. Yours obediently,

B.

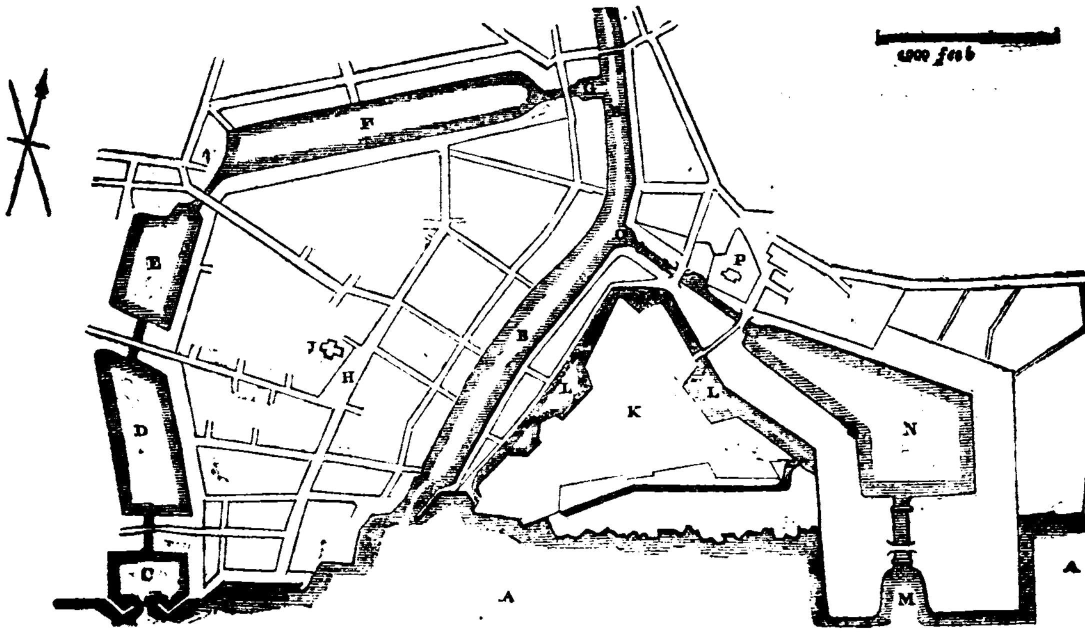
IMPROVEMENTS AT AUGSBURG.

Great activity has prevailed here in improvements, and it shows that in cultivating the fine arts, King Louis does not neglect the useful. An important sluice has been constructed on the river Lech, supplying a thousand feet of water in a second, for the use of the factories. The Protestant and Catholic cemeteries have both been enlarged, and the dead houses ornamented with Doric façades. The great cotton factory begun in April is roofed in, and will contain 30,000 spindles and 800 looms, and is to be worked by water by means of two of Fourneyron's newly invented Turbines, which will give 200 bic feet of water per second at 15 feet fall. To carry off the water, a cut is to be made a mile long, 42 feet broad, and 12 feet deep. A new street has been formed to communicate with the Jakober suburb, and the railway to Munich is in a very advanced state.

PLAN OF A PROPOSED NEW DOCK AT KINGSTON-UPON-HULL.

DESIGNED BY JAMES OLDHAM, CIVIL ENGINEER,

To be called the QUEEN'S DOCK; *showing its connexion with the Rivers, and the present Docks of the Port.*



(REFERENCE TO THE PLAN).

A, River Humber.—B, the Old Harbour, or River Hull.—C, Entrance Basin to the present Docks.—D, Humber Dock, Area 7a. 0r. 24p.—E, Junction Area, 6a. 0r. 5p.—F, Old Dock Area, 7a. 0r. 24p.—G, Entrance to River Hull.—H, the Market Place.—J, the Church.—K, the Citadel.—L, Moat. —M. Basin to the proposed Dock.—N, proposed new Dock.—O, Entrance to River.—P, Church.

The convenience for trade afforded by the extensive system of docks, has perhaps more contributed than its local situation to the prosperity of Liverpool, while it has fully counterbalanced the difficult entrance of the harbour. Bristol, too, has equally found it necessary to extend its attention towards these entrepots, and it is only, perhaps, owing to the want of a corporation as rich as those two cities, that Hull has not taken advantage of such indispensable adjuncts to trade.

The present Dock Company was established in 1774. Their capital is 90,000l. ; divided into shares of 500l. each. They have constructed three docks, occupying twenty-three acres, with quays and warehouses, all out of the profits, at a cost exceeding 450,000l., and they pay a dividend of twelve per cent., besides reserving the like sum to pay off a debt of about 70,000l., contracted to make their last dock.

It is not surprising that the accommodation supplied by this company should be considered insufficient, when at Liverpool alone there are one hundred and eleven acres of dock room and eight miles of quays. The increasing trade of Hull, and its position as the great midland outlet, evidently point out the deficiency, and we need not be surprised if, from the consequent inconvenience, loss of trade has ensued ; for Hull does not, like Liverpool or Bristol, bear no rival near the throne, but has at her very doors two powerful competitors, in Grimsby and Goole, which not only attract much of the growing traffic, but threaten the usurpation of the whole.

Here, as Bristol, the existing institutions are attended by defects that tend still farther to aggravate the deficiencies they cannot supply, and like the case of the Great Western, the largest class of steam vessels are unable to enter the present Docks at all, though taxed to an immense amount for benefits which they never receive ; for other large ships the accommodation is glaringly insufficient, and the notorious want of quay room is entailing upon shipowners and merchants a delay and expense to which they will not longer submit.

Under these circumstances it has been determined to apply to Parliament in the next session for the establishment of a Company, to be incorporated under the name of "The Queen's Dock Company," with power to construct a new Dock or Docks, thereby putting an end to the mischiefs complained of, and at the same time affording to the promoters every prospect of a handsome remuneration : the capital to be 180,000l., in shares of 100l. each.

The intended site is a piece of ground of about 30 acres, chiefly extra-parochial, lying to the east of the garrison, and extending down to low-water mark in the Humber. The water in front is, at low water, in spring tides, of the depth of four fathoms, and the works will be so far carried out as to give the entrance to the proposed Dock the full benefit of that depth of water. In this situation a sufficient quantity of land can be obtained to afford the amplest quay room, with every other necessary appendage for landing, storing, and loading merchandise of every description. A communication will be made between the river Hull and the proposed Dock.

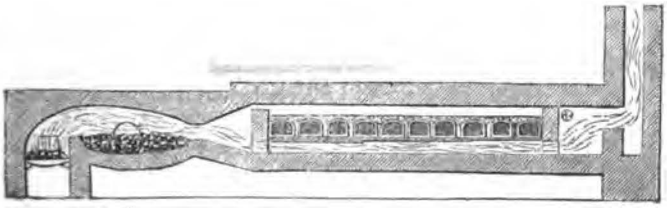
The Dock will contain about twelve acres ; the principal entrance will be through a spacious basin extending into the Humber, to a line drawn parallel to the extremities of the piers of the Humber Dock. The basin will communicate with the proposed Dock by a lock of the width of 65 feet, the depth of 35 feet, and the length between the gates of 300 feet, capable of admitting the largest men-of-war or steam ships. The Dock will be excavated to the depth of 35 feet. It will communicate with the Old Harbour at its northern extremity by a short canal and lock of the ordinary dimensions. The quays on the eastern and western sides will be 210 feet wide, affording ample space for warehouses and sheds. There will also be sufficient space on the south side of the Dock for Graving Docks communicating with the Dock for ship-building upon the most extensive scale. The Dock and Quays will be surrounded by a lofty wall, rendering them in every way adapted for the bonding system.

It is not our business to point out advantages, or to lead the opinions of capitalists, but it is a necessary professional duty to see that a project is required or that it is likely to be remunerated ; and we certainly consider that in this instance, as the plan is justified by the most urgent necessity, that so it is likely to meet with the happiest results. The income of the present Docks has increased from 24,789l., in 1832, to 37,808l. in 1837 ; and this latter year was by no means distinguished for its commercial prosperity. The situation of Hull is certainly of the highest importance, for it occupies with the Thames that position on the west of the North Sea, which Hamburgh and Bremen do on the east. With this advantage in position, by its river communication and by the railways, which on one side of the Humber will unite it to Liverpool and the Atlantic, and on the other, by the intended Hull and Nottingham Railway, give it through a rich agricultural country the monopoly of the midland manufacturing district, Hull wants but energy and spirit in its merchants to become the mart of the Baltic and the German Ocean.

THE NEW MODE OF PRODUCING WROUGHT OR MALLEABLE IRON DIRECT FROM THE ORE.

Patented by Mr. William N. Clay.

Fig. 1.—LONGITUDINAL SECTION OF BALLING AND PILING FURNACE, WITH RETORTS.



The retorts are covered with a layer of sand.

Fig. 2.—PLAN.

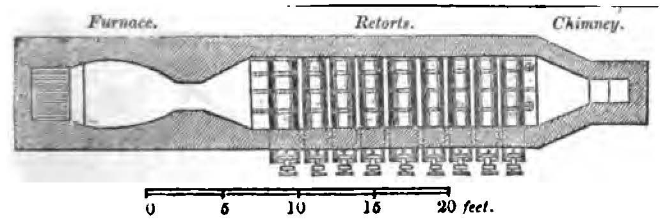
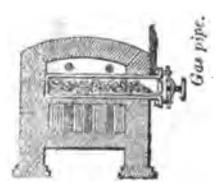


Fig. 3.—TRANSVERSE SECTION OF RETORTS AND HORIZONTAL FLUES.

The O are small apertures to allow a portion of the flame to pass over the top of the retorts. The retorts may be increased or diminished, as the waste heat is greater or less.



REMARKS BY THE PATENTEE.

Iron is popularly divided into two descriptions, cast and wrought.

Cast, or pig iron, is principally a combination of the metal with carbon, which it absorbs from the coke or charcoal of the blast furnace. Wrought iron has been hitherto produced by freeing cast iron from the carbon, &c., with which it is combined: the nearer it approaches to a state of purity, the better wrought or malleable iron will it be.

The richer ores of iron contain the metal combined with oxygen; if that oxygen were separated, the metal would be in its malleable state as wrought iron.

And yet, the advance of science has left this great branch of our national prosperity so far behind, as to suffer the manufacturer still to continue the practice of impregnating the iron with carbon in the first instance, which carbon must afterwards be separated, by tedious and expensive processes, to produce wrought iron of good quality.

But there are other evils in the common mode. It is necessary for the manufacturer to have a sort of glass floating on the molten iron at the bottom of his furnace, to prevent the oxydation of the recently produced metal by the blast. This glass is formed from the earths with which the ores of iron are mixed, and limestone to flux those earths: so that, ores of a very superior quality cannot be used by themselves, but only in part, to enrich such poor ores as have more earths combined with them than are necessary for their own fusion. Thus it is, that the Hematites, and other rich ores, found abundantly in Lancashire, Cumberland, Cornwall, &c., reach no higher a marketable value at the place of their production than the common earthy ores of the coal districts, although they contain twice as much iron, and that iron of a very superior quality.

Again, English iron is, from its mode of reduction, almost certain to be injured to a greater or less extent by combination with sulphur; the earthy ores, which form nine-tenths of those generally used, are impregnated with that deleterious mineral to a great extent; the coals from which the coke is formed are likewise more or less sulphurous; and this gives the high estimation and value to charcoal iron, or such as has been reduced in the several processes by the agency of wood instead of coal.

It is the object of the patent taken out by Mr. William Clay, to produce wrought iron of best quality, direct from the rich ores hitherto so little used from the causes beforenamed, by a process simple, rapid, and economical.

To make wrought iron of such quality, for instance, as chain cables are made from, five several operations are necessary, besides the preliminary one of making the coke for the blast furnace, namely—

1. Roasting the ore.
2. Smelting in the blast furnace.*
3. Refining.
4. Puddling, balling, hammering, and rolling.
5. Cutting up, piling, and rolling.

All these processes requiring a separate application of heat.

It is stated in the article on iron, the 106th number of the "Library of Useful Knowledge," a work written with great clearness, and an intimate knowledge of the subject, that 8 tons 17cwt. 3qrs. 3lbs. of coals are required for the production of one ton of finished bar iron; doubtless, the introduction of the hot blast has reduced the consumption of fuel in the smelting operation considerably, and the adoption of anthracite coal may decrease it still further. It seems, however, yet doubtful, whether the best bar iron can be produced from "hot blast pig:" at all events, very small proportions of that description are as yet used in the fabrication of iron of superior quality.

On the patent plan, the operations are reduced to three; namely—

1. Reducing, or preparing the ore in retorts, or other close vessels.
2. Balling, hammering, and rolling.
3. Cutting, piling, and rolling.

The first of these processes is accomplished by the otherwise waste heat of the two latter, so that only two separate applications of heat are required; and the second operation on this plan commences with the iron in as forward a state as the fourth of the old mode, whereby the cost of fuel and labour, and the enormous outlay of capital in land, blast furnaces, and machinery required to bring iron on the old mode to the third stage, are all avoided.

It is now necessary to state how this is to be accomplished.

Referring to the plan, it will be seen that between a reverberatory furnace of the common construction employed in "puddling," "balling," or "piling" iron, and the chimney, a range of retorts are placed, which are heated on their exterior by the otherwise waste heat of the furnace.†

Into these retorts are thrown 100 parts of Ulverstone, or other rich ore, and 20 parts of coke dust, ground charcoal, anthracite, or other carbonaceous matter, well mixed together. The retort is closed, and the vapours generated escape as gas. In the course of from thirty to forty-eight hours, as the heat is greater or less, the carbon will carry off the oxygen, and leave the iron in a metallic state.

It has then to be taken to the balling furnace, where it welds up, like scrap iron, and in fifteen minutes is ready for the hammer; thence it undergoes the customary process of rolling.

It is then cut up, piled, and rolled, and the operation terminates with the production of bar iron of superior and extraordinary quality.

The fourth operation of the old process, "puddling," takes from one and a half to two hours to perform; the second operation of the patent, only fifteen minutes; consequently, the consumption of fuel will be much less than if refined iron were used. It would be idle to compare the simplicity and economy of the first stage of the patent process, with the cost of the three stages required to make the ironstone into refined iron on the old mode, when we find by referring to page 28 of the work alluded to, that of the 8.889 tons of coal consumed in the whole process, 6.989 tons are used up to the refining, so that the 1.9 tons required for the subsequent operations, may be calculated on as more than sufficient for the patent plan—to which may be added (if the furnaces themselves do not supply sufficient cinders), the one-fifth part of the weight of the ore used, to mix therewith, as carbonaceous matter.

An objection may be made by an iron master that the mode is not wholesale enough—that the retorts contain only hundred weights, while his mighty tower furnaces hold tons. If the question were the production of pig, or cast iron, there might be some weight in this; but the superiority of the patent mode refers more particularly to the production of wrought iron; and here, the largest maker in the kingdom must await the laborious and tedious operation of the puddler—him he can only supply with a few hundred pounds of iron every two hours; so that, the retorts have only to furnish the same quantity, to keep up with the puddling furnace of the present system; if necessary, it might be shown that a balling furnace, on this plan, will produce considerably more than a puddling furnace on the old one.

* In this operation, the expenses of limestone and breaking it have also to be incurred.

† To show what this waste heat is, it is only necessary to state, that the chimneys of these furnaces in the iron districts are compelled to be lined with fire-bricks to the top.

It now only remains to notice the quality of the iron. In no one respect is it inferior to "best common," and in many of its properties it is equal to Swedish or charcoal iron; its tenacity is so great, that of four trials made with patent iron (1 inch chain), at the corporation testing machine, Liverpool, not one broke with a less strain than 26 tons, and one link required 28 tons 12½ cwt. to break it, the standard test for that size being 16 tons.

Experiment on Mr. Clay's method of making bar iron.—150lbs. of Ulverstone ore and 40¼lbs. of wet coke (losing 12½ per cent. in drying) were put into one of the gas retorts in Dale-street, on Saturday, Nov. 24, at five in the morning, and remained in till ten on Tuesday evening, or sixty-five hours. The heat was maintained at a full red, or common gas-making heat. The above quantity reduced at the Mersey forge (two miles distant) produced in thirty-four minutes two balls of iron—one of 32lbs., and one of 26lbs.—58lbs. The former rolled to 1¼ inch puddled bar, weighed 30lbs., and was then brought down under the tilt to ⅝ inch square, and samples taken when broken. The yield 38⅝ per cent.

Comparative result of melting iron in a cupola with a mixture of anthracite coal and coke, and with coke alone, obtained from repeated trials:—

Old method of filling and working the cupola with coke alone.	cwt.	qrs.	lb.
Charge with coke	6	0	0
Ditto limestone	0	2	0
Ditto iron	5	0	0
Ditto coke	0	1	20
Ditto iron	3	2	0

And continue filling ¼ cwt. 20lb. of coke to every 3½ cwt. of iron, as long as necessary.

New method of filling and working the cupola, with a mixture of coke and anthracite raw coal.	cwt.	qrs.	lb.
Charge with coke	2	0	0
Ditto anthracite raw coal	2	2	0
Ditto limestone	0	2	0
Ditto iron	15	0	0
Ditto coke	0	1	0
Ditto anthracite raw coal	0	1	0
Ditto iron	8	0	0

And continue filling ¼ cwt. of coke, and ¼ cwt. of anthracite raw coal, and 8 cwt. of iron, as long as necessary.

The cost of coke fuel for melting each ton of iron, reckoning the coke at 30s. per ton, is 3s. 8d. The cost of the mixed fuel, reckoning the coke at 30s. per ton, and the anthracite coal at 25s. per ton, is only 1s. 8d. per ton, causing a saving of upwards of 50 per cent.; and the anthracite coal being almost pure carbon, has the further effect of improving the quality of the iron.

This experiment was tried at Messrs. Weber's foundry, Liverpool. The anthracite coal was obtained from the Ystalyfera Iron Works, near Swansea, now erecting under the direction of Mr. E. O. Manby, civil engineer.

N.B. The cupola which is now at work, according to the improved method above described, is 2 feet 2 inches wide inside, 8 feet high, and is blown by a fan blast through a twyere 6½ inches in diameter. The blast was not heated. The quality of the iron was decidedly improved by remelting with anthracite.

FURTHER REMARKS ON THE SLOPES OF EXCAVATIONS AND EMBANKMENTS ON SIDELONG GROUND.

Sir,—Having carefully read Mr. Bowman's contribution to your number for this month, on the above subject, I am induced again to address you. Mr. Bowman having stated the method he has described as being more expeditious and more accurate than that described by me in your Journal for November, in reply to his statement, that it is more expeditious, it could only have arisen from Mr. Bowman's not having practised the method I described; as instead of planting the instrument at each estimated width from the centre, as in the method described by him, I set up the spirit level in such a position as to command the ground backwards and forwards for several hundred feet, in which distance there would necessarily be several widths to set out; but this can be done only on moderately hilly ground. The method I adopt, where the ground is very abrupt and sidelong, is to plant my level so as to command the centre stakes, and as many of the upper widths as possible, which I rectify in the manner I have previously described; I then remove my instrument so as to command the centres and as many of the lower widths as possible, which I alter in a similar manner; in this way the widths on sloping ground, however rapid the fall may be, can be set out with great facility.

It must be very apparent to your readers that once planting the spirit level can be done much more expeditiously than (I speak within compass) half a dozen times with the theodolite—not taking into account the much longer time requisite in planting the latter instrument than the former. As to the greater accuracy, if Mr. Bowman does not impugn the method I think there is no doubt but that with the spirit level is infinitely superior, bearing in mind that the calculations with the latter in the field (simple as they are) is not trusted to the head only, but the readings of the staff, registered (on a waste sheet), and the necessary deductions or additions made; but without this latter precaution I cannot understand why a mistake would be less likely to occur in first reading the level staff, then setting the instrument to the angle of the slope and again reading the staff, than it would be to simply note the difference of level, multiply it by the slope, and correct the distance accordingly. In conclusion, although I would be sorry to be thought discourteous towards Mr. Bowman, whose method I highly appreciate, and in some localities would undoubtedly practise it, yet I much doubt its useful application in the majority of instances.

I remain, &c.,

Charlotte-street, Bloomsbury, December, 1838. PETER BRUFF.

MOMENTUM OF FALLING BODIES.

Sir,—Oblige me by allowing your Journal to be my medium for submitting the following remarks to the perusal of your correspondent C. E. C., and your other, I hope, numerous readers.

Mathematical works tell us that the momentum of a body in motion is proportional to its weight multiplied by its velocity. I doubt this, and the following is my reason for so extraordinary a scepticism:—

The velocity of a body at rest (or, to avoid a contradiction, of a body all but at rest) is evidently $= \frac{1}{\text{infinity}} = 0$. If m were as $b v$, the force or pressure of a body just moving from a state of rest would be 0; for, as we have already seen, v then $= 0$, and $b \times 0 = 0$, whereas in fact it is b.

I believe that the momentum of a body can never be less than its mass, and that it is equal to the body's mass added to the product of a certain function of the body multiplied by the velocity—or, algebraically expressed, that $m = b + M\,bv$.

I have some years ago endeavoured to measure the ratio of the momentum to the velocity per second of time. I repeated an experiment after reading your correspondent C. E. C.'s letter, and the following is an account of it and the results I deduce from it:—

Having attached one end of a cord to a weight of half-a-pound, I tied the other end to the hook of an accurate improved spring balance, by Salter, and having made the distances from the hook to the weight successively 16 feet, 8 feet, 4 feet, 3 feet, 2 feet, and 1 foot, let the weight fall these distances, and observed that the scale marked nearly 24lbs, 19lbs, 14lbs, 12lbs, 10lbs, and 6½lbs, so that the power acquired in falling the distances was for a velocity of 32 feet per second = 23¼lbs; for 22⅝ feet = 18½; for 16 feet = 13½; for 13¾ feet = 11½; for 11½ feet = 9½; and for a velocity of 8 feet per second = 6lbs. Dividing the velocities by the weights, we find that a body falling (or a body in motion) at the rate of one foot per second acquires a force equal to 10-7ths and 13-8ths of its mass, or, perhaps, very nearly once and a half its mass or weight. The momentum, then, is equal to the sum of the weight and the product of the weight multiplied by once and a half the velocity per second, or $m = b + \frac{3bv}{2} = b + \frac{3b}{2}\sqrt{32s}$, where s = the space fallen through.

A monkey of 200lbs. weight falling 25 feet on a pile head will, therefore, strike it with a force equal to the weight of 200lbs. $+ \frac{600\text{lbs.}}{2}\sqrt{800} = 8{,}685$lbs. nearly; and a weight of 100,000lbs. falling one-hundredth of a foot would strike with a force equal to a pressure of 100,000lbs. $+ \frac{300{,}000\text{lbs.}}{2}\sqrt{0.01 \times 32} = 184{,}840$lbs.: or it will require a force of 184,840lbs. to lift 100,000lbs. one-hundredth of a foot, with the velocity of fifty-six-hundredths of a foot in a second. By the old formula of $m = bv$, which has been erroneously applied for m is as bv, this weight would be moved at the above rate by a dead weight of 56,000lbs, 44,000lbs. less than its weight.

I remain, yours obediently, B.

COL. C. W. PASLEY, C.B., F.R.S., &c., AND MR. GEORGE GODWIN, JUN., F.S.A.

[We have been requested to insert the following letter, addressed to Col. Pasley, in reference to the disputed point touching the first use of concrete in England.]

Sir,—Permit me, although personally a stranger, to claim your attention for a few minutes.

In your recently published and most valuable work, "Observations on Limes," you have honoured me by referring to an essay on concrete, for which the Institute of British Architects awarded their first medal in 1836: and in the course of your remarks have taken occasion to contradict a statement showing (if true) that concrete was used by the late Ralph Walker, Esq., at the East India Docks, in the year 1800, and to complain of the omission of the name of Sir Robert Smirke, to whom you, perhaps justly, ascribe the credit of having introduced the use of concrete in its present shape to this country.

When I commenced the essay in question, which was in 1835, I found materials for the attempt exceedingly scant and meagre. I was unacquainted with any modern work containing useful reference to the subject (at that time I had not met with your lithographed "Course of Practical Architecture"), and found few persons able to give me authentic information. Two or three distinguished architects, to whom I applied, and who since then have extended to me the favour of their acquaintance, declined affording me any particulars; and Mr. Ranger, known to have knowledge on the matter, refused positively, although with great politeness and some show of reason, to give me the slightest explanation of his own system, or the least item of information generally, so that I was compelled to trust for the most part to my own resources and observations. Under these circumstances I did not attempt to give to any one individual merit for its introduction, but, recording briefly such points in connection with this question as fell under my notice, passed on at once to treat of its composition and its uses, with an impression that what was said, would elicit such other information as might enable us hereafter to arrive at truth and fill the hiatus.

The assertion that concrete was used by Mr. R. Walker in 1800, was made, as you have seen in the essay, on the authority of Mr. Macintosh, the contractor, who, at the time I applied to him, was engaged in the construction of the Greenwich Railway. On the day that he related the circumstance (Oct. 5th, 1835), we were together directing the composition of concrete for the foundation of the archway over the Grange-road, Bermondsey, and the matter was so fresh in his recollection—was so far from a thing of doubt—that he allowed me to make notes as he proceeded with the conversation. These notes, Sir, I have sought for and found, and from them I see that Mr. M. said more upon the subject than I have printed—quite sufficient, indeed, to show that there was no misunderstanding on my part; and I beg leave, therefore, to copy for you one or two of his sentences, in order that you may judge for yourself. "I executed concrete," said he, "thirty-six years ago at the East India Docks. The ground was a mud bank, with here and there gravel and sand, affording, therefore, most unequal bearing; but the concrete has, nevertheless, answered admirably. I think this was the *first* time concrete was used in England, indeed I know it was. Trenches for outer walls were merely filed in with gravel, sand, and water, no lime, and this has stood well;" and he then went on to speak of the quantity of lime which he considered best, &c., &c. Upon this, then, Sir, my statement rests. I had no wish, nor the slightest motive to add to the reputation of Mr. Walker, still less, if possible, to withhold credit from Sir Robert Smirke, for whose talents (in common, I believe, with the profession generally) I entertain the highest respect and admiration. The information which has been furnished you, and which is set forth in your book, seems to show that Mr. Macintosh was mistaken, unless, indeed, the measure was determined on after the specifications were issued, and was adopted merely in some particular places by way of experiment; but as I have nothing farther to add on this head, I must content myself with affording the above explanation, and leave time to reconcile the apparently conflicting evidence.

In regard to the omission altogether of Sir Robert Smirke's name, of which you justly complain, I am bound to confess that I was not aware, at the time of writing the essay, that Sir Robert Smirke was more intimately connected with the subject than were several other architects also not referred to, although I knew well that he had used concrete in several places; in excuse for which want of information, I can only offer the circumstances mentioned at the commencement of this letter. Immediately after the publication of the "Transactions of the Institute," wherein the essay appeared, I learnt that Sir Robert Smirke *had* paid particular attention to concrete; and in a second edition, which closely followed the first, I introduced his name in a paragraph concerning the foundation of the Custom House; and later still—namely, in the second of a series of papers published in the "Architectural Magazine," and headed "Hints on Construction," I appended the following note to a remark, that "Ralph Walker, Esq., and Sir Robert Smirke, were among the first, if they were not *the* first, who employed concrete, and advocated its use in England," serving, I trust, to show my desire to correct the omission so soon as it was discovered. This is the note:—"The name of this distinguished architect (Sir Robert Smirke), in connection with the re-introduction of concrete, was omitted, through want of positive information in the essay on that subject, printed in the 'Transactions of the Institute of British Architects,' and the author of it seizes the opportunity here offered to rectify the error."

Here, Sir, I should have left the subject, as I felt it would be impertinent to thrust myself forward to state that on which, perhaps, no one might care to have my opinion, and knew that nothing which I could say, or omit to say, would increase or lessen the high reputation of Sir Robert Smirke. As, however, you have been pleased to draw attention to the circumstance in a book, which probably will be read universally, I feel called upon not only to render you this explanation, but to make it as public as circumstances may permit, lest any should imagine, were I silent, that I still saw no reason for connecting Sir Robert Smirke's name with the first use of concrete in its present shape in England.

I trust, Sir, that under these circumstances you will not deem me wrong or rude, for intruding at this length on your valuable time, but that you will accept my profound respect, and believe me, Sir, your faithful humble servant, GEORGE GODWIN, Jun.

Brompton, Nov. 26, 1838.

THE LONDON AND BIRMINGHAM RAILWAY.

The following account of the construction of the works in the neighbourhood of Blisworth, we have extracted from the fourth part of "Roscoe and Lecount's History and Description of the Railway," which we have before favourably noticed. Besides the usual illustrations, the present part contains a very useful map of the line of the country through which the railway passes, reduced from "Cheffin's Official Map."

This cutting is one of the largest on the line, and according to the original estimate, would have contained 800,000 cubic yards; in consequence, however, of the necessity which was found of adding to the length of the wide part of it, which was considered to be essentially requisite during the execution of the work, together with the materials arising from numerous slips in the upper part, the total quantity removed approximated to 1,000,000 cubic yards.

The greatest depth is about 55 feet, and the length a mile and a half. The materials excavated consisted of clay and limestone. The clay and rock may be described generally as running into strata nearly on a parallel with the line of rails, which rise from each end of the cutting towards its centre, at an inclination of 16 feet in a mile.

The different beds of rock in the excavation abound with fossil shells, in a good state of preservation, consisting of nautilus, terebratula, oysters, &c. There were also two or three fossils of very considerable magnitude discovered, which were of the Saurian tribe, and were found embedded in a stratum immediately on the top of the rock. This rock is a species of half-formed stone, of considerable hardness when dry, but becoming soon softened when exposed to the air and damp.

The quantity of stone excavated was about one-third of the contents of the cutting, and considerable difficulties occurred at this point of the line. The rock was found not to reach to the depth of the excavation, and underneath it lay a deep bed of clay, in some parts to the thickness of 20 feet, through which the rails had to be carried. To secure this from bulging out, it was necessary to build retaining walls of considerable thickness along the sides of the excavation, which are inclined at two slopes; that portion which reaches from the railway to the top of the rock is at one quarter to one, and for that above the rock the inclination is at two to one, a ledge or benching, of nine feet in width, being formed where the two slopes meet. The object of the benching is to catch any loose portions of the clay which might be detached from above; they have also been found very useful in affording foundations for walls of pebble-stone, which it has been found necessary to erect upon them in many places, to retain the numerous slips of the clay above.

Immediately below the solid rock, in some parts of the excavation, is a bed of loose shale, mixed with a considerable quantity of water, and to such an extent, that pumps had to be constantly employed to allow the work to progress. The shale has been taken out, and the rock underset several feet, to allow retaining walls of stone to be built in its place; these walls, in fact, support the rock above, and as a further security, an inverted arch has been built beneath the railway to the opposite side, in a similar manner to the inverts of tunnels. As soon as the retaining walls were built, a drift was formed behind them three feet six inches high by three feet wide, forming a culvert to receive the water, which still keeps abundantly flowing out of this strata; and at intervals there are openings left in the retaining walls to conduct the water to the side drains of the railway, where it is carried off.

During the first year and a half, the progress of this excavation was extremely slow, owing to the want of proper energy on the part of the contractor, combined with general bad management. The time was frittered away without anything like a proper quantity of work being done; and if this was evident at the commencement, when there were no particular difficulties to grapple with, what might be expected towards the end, when nothing but the most energetic measures could insure success? At last the Company were obliged to get rid of the contractor of the Blisworth excavation.

From the moment it came into the Company's hands, no trouble or expense was spared to remedy the evil of the previous slow progress; and nothing could exceed the animation of the scene which the works presented when in their most active state. From 700 to 800 workmen in vigorous employment, numerous barrows and waggon runs in continual motion, a steam engine in constant activity pumping out the water, locomotive engines at either end, dragging long trains of waggons full of earth, or bringing the empty ones back, and blasts of the rock continually deafening the ear. In fact, the whole cutting seemed alive; and the busy hum of labour, resounding from the one end to the other, gave ample testimony to the zealous exertions of the engineer. Of course the expense was considerable. The article of gunpowder alone was, in many cases, 25 barrels, of 100lbs. each, per week; enormous quantities being used before the rock could be removed.

The mode of blasting made use of was by drilling a hole in the stone, about one inch in diameter, the depth being determined by the thickness of the bed This was done by means of a round iron bar shod with steel, which was lifted up and then struck down, in the hole, water being used with it to cause the stone to cut more readily, till the hole was drilled to the requisite depth. When sufficiently deep it was dried out; a piece of fuse of the requisite length was then put in, and the gunpowder poured all round it, and secured by a covering of pounded brick or stone. Several charges being thus prepared, the ends of the fuses were lighted, and the workmen retreated to a sufficient distance for security. In a few minutes the whole exploded, rending up large masses of rock, and sending the lighter pieces high into the air.

This excavation is crossed by five bridges, some of which are of considerable span, and presents a fine appearance from the railway. They are composed of a mixture of the stone of the cutting and brickwork. It was originally intended that the whole of the materials which came out of the excavation should be used in the formation of the embankments at each end of it; but owing to the slowness with which the work advanced while under the contractor's hands, it was found necessary to throw about 150 000 cubic yards into spoil. The land for receiving this, together with that necessary to make up the corresponding deficiency in the embankments, of course still further increased the expense of the work.

The stone, gravel, and clay which were taken from the south end, had to be conveyed an average distance of about a mile and a half, and considerable difficulty was found in the formation of the embankment near the village of Ashton, owing to the unsound state of the valley which formed its base. Immense quantities of materials were teemed daily, which, as in the case of the Wolverton embankment, totally disappeared, and the natural surface of the ground actually burst up outside the limits of the railway, in consequence of the enormous pressure. A culvert near the spot was entirely destroyed from this cause.

The embankment at the north, or Birmingham end of the excavation, has more earth in it than the other; but the substratum on which its deepest part rests is of a better description, and no slip of any importance took place in that portion of the works; but a culvert of considerable length was in great danger of being crushed in; the expedient, however, of completely filling it with pebble stone was resorted to; notwithstanding this precaution, it was carried considerably out of its straight direction, so much so, that the light can but just be perceived when it is looked through. It may, perhaps, be thought uninteresting to mention works of so small a magnitude as culverts; but no person, who has any knowledge of the difficulty of their erection, when they have to sustain the weight of an embankment of 40 or 50 feet in height, could feel otherwise than nervous during the process of placing the material over them. An engineer could be wished no worse fortune than to be required to construct culverts upon a soft foundation under a deep embankment.

From this view of the nature and extent of this contract, and the means which were resorted to, in order to make up for the serious delay which occurred while the work was under the contractor's hands, every body will be prepared to expect that a sum of nearly 100,000l. has been expended beyond the original estimate; and been expended wisely, too, as the loss would have been considerably greater if these exertions had not been made. Viewing the work altogether, it affords one of the finest specimens of engineering this country can boast of. It is a spot beset with difficulties of every kind, and the bold and effective manner in which it has been executed, is a bright example of the talents of the Engineer-in-Chief.

PAPIER MACHÉ ORNAMENTS,

For the Actæon, Liverpool and Glasgow Steam Ship.

We have been favoured, within the last few days, with an inspection, at the manufactory of Messrs. Jennens and Bettridge, of a set of panels, in *papier maché*, intended for the decoration of the Actæon, Liverpool and Glasgow steamer; which, as works of art, have not, we believe, been surpassed by anything of the kind ever produced at this celebrated establishment. The panels are 28 in number, four of which are very large, and consist of historical subjects, some original, and others copies from the works of celebrated masters. The first represents, the triumphal entry of Alexander into Babylon; the second exhibits a view of a Grecian sea-port, and the arrival of a victorious fleet; the third describes the Olympic games, the combats of gladiators, &c.; the fourth gives a representation of the Hippodrome, the temple of Victory, and chariot races. Each of these subjects is depicted by the artist with the vividness and freshness of life. The various groups of Grecian, Egyptian, and Persian figures, the richness and brilliancy of the costumes, the colossal statues, temples, and columns, in their architectural grandeur and beauty, furnish a vivid representation of the barbaric pomp and magnificence of bygone ages. The smaller panels are divided into the classes, devoted to the illustration of particular subjects. The first series represents full-length figures, emblematic of Victory, Commerce, and the Arts and Sciences, surrounded with beautiful ornamental work, drawn in imitation of *alto-relievo*; the whole surmounted with the arms of Liverpool and Glasgow. The second embraces mythological subjects, representing the triumph of Neptune, Juno, and the Graces, Actæon, &c.; the whole adorned with an emblematic framework. The third comprises mosaic heads, and emblems ornamented with arabesque foliage, birds, flowers, and fountains. Viewed separately, each of these paintings is an exquisite specimen of the advanced state of this department of our manufactures and the fine arts; and, as a whole, they form unquestionably one of the most unique and splendid collections of the kind ever produced. The panels will not, we believe, be removed for a few days from the show-rooms of the manufactory, where artists and other visitors may have an opportunity of inspecting them.—*Birmingham Herald.*

PRUSSIAN RAILWAY.

The *Prussian State Gazette* publishes the text of a *law for the regulation of railway companies in the Prussian dominions.* It consists of 49 articles, and is framed in such a manner as to guard the public as much as possible from the speculation and jobbing to which undertakings of this nature are so liable to give rise. Among the more essential stipulations which it makes with this object in view, it provides, that while the shares may be made payable to bearer and free from stamp duty, no promises of shares before the undertaking of a railway is authorised, nor provisional acknowledgments are to be issued. Every subscriber for shares is to be bound personally to pay 40 per cent. of the nominal capital subscribed for by him, and he cannot get rid of this obligation in favour of a third person or of the company, under any pretence whatever. In case of a railway not being terminated within the time fixed in the grant of privilege, the government is to have the power, after a delay of six months, of ordering the road to be finished by public contract, at the charge of the company. The privileges of the post establishment may be exercised by railway companies under certain conditions. Railways are to be charged with an impost proportioned to the amount of the reserved fund of the company, but only after the railway shall have been opened three years, and that the state of its returns admits of it, and no other taxes are to be laid upon it. This impost is to indemnify the state for the diminution of revenue caused by the railway in the post department, and to form a sinking fund for the paying off the capital employed in the construction of the road. The state reserves to itself the right of purchasing the railway after a lapse of 30 years, on paying to the company 25 times the amount of the mean annual divideud received by it during the last five years of the 30, the state at the same time taking upon itself the liabilities of the company, but becoming absolute owners of all its property, including the reserved fund. No grant of a rival line can be made for the first 30 years; but after the first three years other companies may acquire the right from the state of conveying passengers and merchandise by the same line, on paying a fixed rate of charge to the original company. One of the concluding stipulations of this law is, that no damage occasioned to the railway by measures adopted, even by order of government in time of war, is to be paid for by the state. This law affects all grants of railways already made, as well as those to come.

OXFORD-STREET EXPERIMENTAL PAVEMENT.

The importance of ascertaining the best species of pavement for the carriage-roads of the metropolis is some excuse for the confusion, accompanied by the smoke and offensive odours from the cauldrons, which have prevailed at the east end of Oxford-street for the last two months. The inhabitants have, however, been great sufferers thereby; but we may now congratulate them that, at last, all the ground is assigned and set out for the different varieties, while many of them are completed, and the rest are in progress. Commencing at Charles-street are the *asphaltum blocks of Robinson*, one half laid straight, the other diagonally. This is followed by *granite pavement* nine inches deep, jointed with Claridge's asphaltum; then is to succeed a granite pavement of stones only $4\frac{1}{2}$ inches deep, also to be jointed with the same substance, Mr. Claridge being of opinion, and desirous of proving, that his cement is sufficiently strong to bind even these shallow stones into one solid mass. To this succeeds the *Bastenne Company's* portion; the blocks in this part are in the form of bricks, but somewhat larger; they have been laid both ways, straight and diagonally. Next follows the *granite pavement*, laid by the parish, which is undoubtedly one of the finest specimens of work of its kind to be found in London. It consists of three parts:—1. Stones laid in the ordinary way, on a well-formed bed of concrete. 2. Similar stones laid diagonally on a bed of the same material; the joints of both these portions are filled with a grouting of lime, sand, &c. 3. Stones laid in the usual manner, but on the earth without any official bed, and the joints are filled in with fine gravel. The whole of this work has a good curved surface, and the regular thickness of the stones has evidently been carefully attended to. The next experiment, going towards Tottenham-court-road, is what is called the *Scotch asphaltum granite* (said to be a patented article). This composition has the appearance of stone, and the blocks are about six inches thick, nine inches broad, and 18 inches long on one face, while the other is only 13 inches long. In laying them (which is done with Parker's cement), every alternate block is reversed, so that every second block lies solid on its base, or longest face, while the others fit in between them as keystones, and, when joined, each may be said to support the other. The next division is the *wood pavement*, composed of blocks of fine timber Kyanized, they are of a hexagonal form, 7 inches diameter and 15 inches deep, part is laid on a bed of 1½ inch planks. Then follows the *Val de Travers Asphalte*, which will occupy the remaining portion of the street devoted to the experimental pavement. This last article consists of blocks, about 10 inches square and five inches thick, formed of a bitumen thickly studded by broken pieces of granite; so that, when laid, it may be looked upon as a sort of Macadamised road, where, in lieu of earth for filling the interstices between the broken granite, and making the whole of a solid mass, a strong binding composition has been employed.

MONUMENT TO DR. VALPY.

A committee of the pupils and friends of the eminent classical scholar, Dr. Valpy, being desirous of testifying their esteem for his memory, have employed Mr. Samuel Nixon to execute a statue of him. The statue is of stone, from the quarries of Roche Abbey, Yorkshire, and represents the Doctor, the size of life, in a standing posture, and draped in the robes of a doctor of divinity. The sculptor had not the advantage of seeing the Doctor during his life, but he has been able to avail himself of a bust by one of the Westmacotts, and of a portrait by Opie, so as to give a satisfactory likeness. At the same time he has been freed from those conventional and habitual trammels by which friends and relations too often distress the artist. The figure and drapery are formed with ease, and their details are carefully executed, and altogether it is a work by which the subscribers may feel gratified, and Mr. Nixon honoured. It is intended to be placed in the parochial church of St. Lawrence, at Reading; but this site seems by no means to meet with the approbation of the press, so that the subscribers may, perhaps, be induced to give it a more public destination.

STEAM SHIP "LIVERPOOL."

The voyage of this steam vessel to New York appears likely to throw some light on the subject of the most judicious means of economising fuel. In the first unsuccessful attempt of that vessel, she appears to have consumed hourly a very large quantity of coal beyond what had been the estimate of the engineers; and to which circumstance was attributed her return to Cork. The cause of this extraordinary expenditure of fuel will be hereafter worthy of consideration, as it may lead to some valuable information.

On her voyage from Cork to New York the following facts have been elicited. The voyage occupied 16 days 17½ hours, during which time 464 tons 17 cwt. of coals were consumed, being about 23¼ cwt. per hour, and which was less than the engineers had, in the first instance, calculated on. On her first starting from Liverpool she had, it appears, 563 tons on board, of which 350 remained when she put back for Cork. One remarkable feature in the economy of steam, and of course, of fuel, appears to have been the use of the expansion-valves, and which varied from 42 to 24 inches. The application of these expansion-valves, from some hitherto unexplained cause, were not brought into operation on the first unsuccessful voyage on any occasion. The following extract from the log wi l show what an important feature these valves, and the means of using steam expans.vely. present on long voyages:—

Extract from the Log of the Liverpool, on her voyage from Cork to New York.

	Fuel consumed. T. C. Qrs.	Hours.	Miles by observation.	Daily average expansion.
Nov. 6	3 2 2	2½	20	42 Inches
7	29 18 0	24	180	41
8	21 8 0	24	184	34½
9	27 8 0	24	216	35
10	27 18 0	24	207	39
11	28 12 0	24	228	42
12	28 16 0	24	242	42
13	27 13 0	24	140	42
14	27 11 0	24	144	34
15	24 17 0	24	144	31
16	24 12 0	24	151	35
17	24 8 0	24	202	34
18	25 8 0	24	175	28
19	26 8 0	24	212	25
20	26 12 0	24	176	25
21	28 16 0	24	200	24
22	30 4 0	24	165	24
23	24 6 0	15	170	24
	Tons 464 17 2	423½ Hours	3156 Miles	

The engines of the Liverpool are of the largest power yet in use, being 467 horse power, diameter of cylinder 75 inches, and length of stroke 7 feet or 84 inches; considering that the greater part of the voyage was under circumstances of tremendous head seas and gales of wind, the daily consumption appears a fair one.

Since writing the above the Liverpool has returned to England. She departed from New York on the 6th, and arrived at Liverpool on the 21st of December. She steamed 3239 miles in 348½ hours, and consumed 445 tons 9 cwt. of fuel, and had remaining, when she reached Liverpool, sufficient fuel on board for 11 days more, or 2456 miles additional distance.

THE BANN RESERVOIRS, COUNTY OF DOWN, IRELAND.

MR. BATEMAN, ENGINEER.

The river called the Upper Bann, is peculiarly liable to great irregularity in the quantity of water; presenting, sometimes almost a dry bed, while, at others, floods are pouring down with destructive violence.

The principal mills and bleach works are situated near the town of Banbridge, where the river is closely occupied, above and below the town, for about ten English miles.

Very considerable inconvenience was occasioned, during the summer months, and other dry seasons of the year, by the inadequate supply of the river; and, to remedy this inconvenience, it was proposed to construct reservoirs.

The greater part of the merchants and land proprietors connected with the district, having formed themselves into a body, in the spring of 1835, instructed Mr. Fairbairn, of Manchester, to examine and report on the most favourable sites. Three sites were, consequently, fixed upon—Lough Island Reavy, near Castlewellan and the Deers' Meadow, near Hilltown, as impounding reservoirs; and Corbet Lough, a few miles above Banbridge, as an auxiliary reservoir. A bill was brought into Parliament, which received the Royal assent, on the 4th of July, 1836, empowering the company to raise 40,000*l.*, in 50*l.* shares, and to levy a rate on each foot of occupied fall, not exceeding 10*l.* per annum, the interest of the money expended being limited for the protection of the fall-holders, to 7½ per cent. per annum.

The construction of the Lough Island Reavy reservoir, the largest and most important of the three, has been carried on with vigour, and is now nearly completed. This, before the construction of these works, was a natural lake of about 92½ statute acres; but the area of the reservoir will be about 253 statute acres, the surface of the water 35 feet above the level of the old lake, and the average depth of the whole about 27 feet. It will be capable of containing upwards of 290 millions of cubic feet of water, and will keep up the water of the river, during the whole year, at about six or seven horses' power to each foot of fall. The construction of the Corbet Lough reservoir, by saving the night water from Lough Island Reavy, or that portion which would be running past the mills, when they were not working, would increase the power of the river to nine or ten horses' power, upon each foot of fall, below the outlet, from Corbet Lough.

The land, for the Lough Island Reavy reservoir, including the value of some chief rents, payable by the company, has cost about 6,000*l.*; and the expense of constructing the various works—viz., embankments, feeders, roads, &c., will amount to between 14,000*l.* and 15,000*l.*

There are four embankments to retain the water in the reservoir, measuring together about 1,560 yards in length, and containing about 219,000 cubic yards of earth and stone work. The principal bank is 700 yards long, and contains about 112,000 cubic yards. The inside slopes are faced with stone pitching, varying from two to three feet in thickness, according to the sheltered or exposed situation of the banks. They are formed in concave horizontal layers, about three feet thick, with an upright "puddle wall" in the centre.

The water is discharged by two cast-iron pipes, of eighteen inches in diameter, within an ashlar granite culvert, extending under the principal embankment, the valves being at the outer end, and enclosed in a handsome vault or building of the Egyptian style of architecture.

To supply the reservoir, the river Muddock is directed into it by a feeder, or new river course, 1 mile 550 yards in length, 4 feet 6 inches deep, 19 feet 6 inches wide at the top, with stop-gates and waste weirs to regulate the quantity of waters. The surplus waters of the Moneyscalp brook, and of the Slievenalargy brook, are also taken into the reservoir; the first by a feeder of 1,060 yards long, and 3 yards wide; and the latter by a drain of about a quarter of a mile in length.

To convey the water from the reservoir to the river, the old drain from the Lough to the Muddock, about a mile in length, has been made 5 yards wide.

The reservoir, when full, will be one and a quarter English miles in length, half a mile across in the broadest part, and near a quarter of a mile in the narrowest and, with the assistance of a little judicious planting, will present one of the most interesting objects in that part of the country.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

The first meeting for the present session was held on Monday evening, 3rd December, Earl de Grey, president, in the chair.

The noble president, on taking the chair, expressed his satisfaction at meeting the members on that occasion, and briefly alluded to the circumstances which had transpired since the last session. During the recess an attempt had been made to consolidate this society along with another formed for the prosecution of similar objects, but without success. Since they had last met the profession of architecture had lost one of its most distinguished members in M. Passier, a foreign corresponding member. To show the reciprocity of feeling and spirit which existed between the architects of our own and foreign countries, it was stated that the intimation of his death was officially communicated to the society. Another instance of the growing interest and importance attached to the institute was also recently shown in the case of the visit to this country of M. Zant, a foreign professor, who made it his depository. During the recess the council have made arrangements for the delivery of lectures on acoustics and geology, two important objects connected with architecture, and which will soon be delivered. It is also intended to enlarge the benefits of the institute by establishing a new class, to be called the students' class, for the instruction of those who are not forward enough for associates.

Mr. Donaldson announced the list of presents received since the last session, and stated that the noble president had communicated with the Rajah of Tanjore, to whom the institute is under so many obligations, to continue an intercourse which has already been so beneficial.

Mr. Barry exhibited various medals taken out of the excavations for a sewer near the site of the new Houses of Parliament, a description of which was promised on an early occasion.

Mr. Fowler read a highly interesting paper on the art of glass painting, by Mr. Shaw, member, entering at length into its antiquity, general divisions, classification, different styles, and proper employment.

Messrs. Hoadley and Oldfield, of the Hampstead-road, exhibited some beautiful specimens of stained glass.

Mr. Godwin, jun., presented to the meeting an engraving of Girard College, Philadelphia, now in progress of execution, together with the original drawing, which had been left with him by the architect, T. Q. Walters, Esq., for that purpose. Mr. Godwin did this personally, in order that he might inform the meeting of the great respect with which the Institute was regarded by the American architects, and of the endeavours which had been made to form a similar society there. Widely separated as the States are, circulars were addressed to the chief architects in each, inviting them to attend in New York on a certain day, for the purpose of organizing an association; and several of the instigators of the attempt travelled a hundred miles to keep the appointment. The meeting was more numerous than could have been expected. Resolutions were passed, rules drawn up, and then, having first arranged an annual re-union, they each departed to their widely-separated homes. The second meeting, it need hardly be said, when the difficulties are considered, was less numerously attended. The chief members of the society, who were much engaged, found the sacrifice of time too great, and the attempt was ultimately given up, although not before much good feeling had been promoted, and some other good results effected. As Mr. Godwin observed, the whole transaction was so creditable to our Trans-Atlantic colleagues that it was worthy of mention at the Institute of Architects.

The second meeting for the session was held Monday evening, 11th December, Mr. Robinson, V.P., in the chair.

Mr. Godwin, jun., read a letter in explanation of some published views of his upon concrete, and in reply to some remarks on the subject by Colonel Pasley.

The donations to the library contained several works of rare archaiological and architectural interest; and amongst various novel objects exhibited were some drawings of the Cathedral of Carlisle, and in particular of the circular roof, from Mr. Billings; some very superior embellishments and designs in paper-hangings, from Mr. Clark; and a French work from Mr. Bohn, on the antiquities of Mexico, being a continuation of the splendid work of Lord Kingsborough on the same subject.

Mr. Donaldson, the secretary, read a memoir of the late Mr. Thomas Lee, architect, who died in 1834, and who was one of the founders of this institute. He was engaged in the construction of a great many public works, the most prominent of which was the column to his Grace the Duke of Wellington, erected on Wellington-hill, one mile and a half from Blackdown, in Somersetshire, and near the place from which the title is derived. After a very successful and eminent course, this deserving architect was found dead on the shore, near which he had been bathing, near Exeter, meeting an untimely death at the age of 40 years.

An interesting conversation ensued on the subject of the various combinations of the different orders of architecture, on which the probable opinion was given of the formation of an English style, of which there are now so many proofs.

ARCHITECTURAL SOCIETY.

At an ordinary monthly meeting of the society, held at their rooms, No. 35, Lincoln's-inn-fields, on Tuesday evening, Dec. 4, 1838, William Tite, Esq. F.R.S., President, in the chair, a letter was read from Mr. Sims, on various uses of asphalte, which the writer did not, however, consider applicable to ornamental structures, from the ease with which it was affected by heat, from the sun, and other causes. A notice was given that the next subject for a sketch was a design for an entrance to a railway station, without offices. Mr. Phillips read an interesting essay on some essential points connected with structure, which we have inserted in another part of our journal.

The following letter was inadvertently omitted to be forwarded last month, but which was received some time since from the Architectural Union at Berlin, and read at the opening meeting.

TO THE ARCHITECTURAL SOCIETY, LONDON.

The Architectural Society have received our friendly greeting, which Mr. Alexander undertook to deliver. We herewith beg to repeat the same, and likewise to express the wish that, by means of interchange of information, with a view to the promotion of our art, we may cement an intimate connexion between the two societies.

We observe by the laws of the Architectural Society, which Mr. A. presented to us, that, with some variation in form, the society has the same object in view, and consists of similar members to our own. We believe, therefore, that each society may be benefited by reciprocal communications, and accordingly beg that we may be entrusted with inquiries and commissions within the sphere of our profession, and that we may be permitted to use the same freedom.

With the laws of our society we beg herewith to present the first number of the Architectural Album, which is not the work of the members of our society alone, like the architectural designs, but of German architects generally, and which, by means of details, individual buildings, and construction, may be also useful to the workmen.

We purpose sending the continuation of this work, as well as the designs from the collection of the Architectural Union, together with the appertaining letter-press, and we beg your friendly acceptance of the same.

With high respect,

THE COUNCIL OF THE ARCHITECTURAL UNION, BERLIN.

SOCIETY OF ARTS.

The ordinary meeting was held on Wednesday evening, 19th December, David Pollock, Esq., vice-president, in the chair. The silver medal was balloted for, and awarded to Mr. J. Gray, for an improved instrument for taking out teeth and stumps from their sockets. The arrangements allowed of a greater facility for its introduction, and upon extra claws which allowed of freer purchase upon the stump. A letter was read from the secretary of the East India Company, accompanying a sample of tea from Assam for the opinion of the society. A silver medal was next voted to Mr. H. Page, for an improved, easier, and more durable method of lettering marble. A communication was read from Mr. George Aikin, on the recent agricultural improvements in the fens of Cambridgeshire. The natural soil of these parts is dark, being almost gray, and is mixed with a quantity of silt, below being a spongy peat, and great part being on a stratum of blue calcareous clay. The Bedford level, comprising 300,000 acres, was formerly very subject to overflows, and it was only possible to work the land in spring and summer. The greatest quantity of oats that could be procured was from four to five quarters per acre, and the crops were often lost by the floods, but now, owing to improved agriculture, principally resulting from the application of steam power for windmills in drainage, the produce was from five to eight quarters. One great improvement was in the introduction of clay or marl, and where formerly only bad oats grew there could now be obtained excellent crops of good wheat and oats. The proportion and succession of crops were stated, and the thanks of the society were voted for the communication. Communications were next read from Mr. Roberts and Mr. Hickson on the growth of a new variety of potato, submitted to them by the society in January last, but which were referred back for further experiments. The meeting then adjourned over the recess to the 9th of January.

ARTISTS' AND AMATEURS' CONVERSAZIONE.

The first conversazione for the season of this valuable society took place on the 5th Dec. last, at the Freemasons' Tavern. We cannot expect many visitants at this early period of the season, but we were pleased to see it so well attended. There were perhaps not so many publishers present as on ordinary occasions, and fewer novelties, as to engravings; but this deficiency was well supplied by the general interest in the proceedings which seemed to animate the company. Among the engravings was one in the line style, by Robert Graves, A.R.A., from the picture of Shakspeare, taken before Justice Lucy for deer stealing. It does equal honour to the engraver, and to Mr. George Harvey the painter. An additional point of interest attached to this work is that the room and its furniture are studies, by permission of the descendants of the Midas judge from the objects now in their possession. The picture and engraving both belong to the Scotch Association. There was also a picture by Allen, of Whittington and his cat, and another by Cooper, and also an engraving of the Battle of the Covenanters at Drumclog. Stanfield contributed several drawings, and among the minor objects were a portrait of Miss Roberts by Mr. John Wood, a miniature, copied from Gainsborough, by Miss Augusta Cole, and nautical sketches by D. Serres, &c. We were glad to see the ladies come forward to support those elegant arts which instead of meriting the designation of Pliny, "Solatia servitutis," ought more properly to be considered as ornaments of the household, and handmaids of the domestic virtues. As the season advances these conversazioni will, no doubt, be more fully attended by the numerous members; but even at the present early period they afforded full evidence of the pleasure they were capable of communicating, and the good they are likely to effect. It is, indeed, through such means that artists must hope to promote the progress of the Arts, which are no mysteries to be kept secluded, nor objects of difficult comprehension, but as they appeal strongly to the human mind, so by that they must be judged, and to be admired they must first be known.

HORTICULTURAL SOCIETY.

At the ordinary meeting on the 4th instant, Dr. Henderson in the chair, Dr. Lindley read a lengthened report of the effects of the late frost of 1837-8. The intensity of the cold was much greater than in many previous years. It had been proved, notwithstanding the assertion that the ground had been frozen to a depth of two feet, that although on the surface the thermometer was four degrees and a half below zero, it was never frozen for a foot below the surface. In the kitchen ground the frost was not found at more than nine inches, in ordinary soil at ten inches, and in an arboretum of moss not below five inches. The concluding part of the paper was devoted to an examination of the mechanical and other effects of frost upon plants.

MEETINGS OF SCIENTIFIC SOCIETIES.

Royal Society, Somerset House, Thursdays, at 8½ P.M., 10, 17, 24, and 30.
Society of Antiquaries, Somerset House, Thursdays, at 8½ P.M., 10, 17, and 24.
Institution of Civil Engineers, 25, Great George-street, Westminster, Tuesdays, at 8 P.M., 8, 15, and 29.
Royal Institute of British Architects, 16, Lower Grosvenor-street, Mondays, at 8 P.M., 7, and 21.
Architectural Society, 35, Lincoln's-inn-fields, Tuesday, at 8 P.M., 1.
Society of Arts, Adelphi, Wednesdays, at 8 P.M., 9, 16, 23, and 30.

LAW PROCEEDINGS.

ALLEGED BREACH OF CONTRACT.

The following case, relative to contracts, is so important to the profession, that we recommend it to their especial notice:—

VICE-CHANCELLOR'S COURT—Dec. 7, 8.

RANGER v. GREAT WESTERN RAILWAY COMPANY.

Mr. K. Bruce, Mr. Jacob, and Mr. Stevens *appeared on behalf of the Great Western Railway Company, in support of a demurrer put into a bill, which the plaintiff, who is a large contractor with the company, had filed against them, to obtain relief under certain contracts he had entered into with them, principally with reference to works at the Bristol end of the line.* The learned counsel said the demurrer had been filed on two grounds—multifariousness and want of equity. Before reading the prayer, however, it would be necessary to give the court a short outline of the case on which it was founded, as well as to make the alternatives it contained intelligible to the court. The plaintiff, William Ranger, had entered into four contracts with the company for the prosecution of works on various parts of the line. The contracts known in the pleadings by the letters B 1 and B 2, and the supplemental or extension contract, all related to portions of the works on the Bristol end of the line. They were not connected together, but all had reference to a neighbouring district of the country. The fourth contract, distinguished in the pleadings as L 8, from its relating to the London end of the line, referred to works in the neighbourhood of Reading, and was materially distinguished from the other three. In the course of making these contracts the plaintiff found it necessary to obtain sureties to join with him in his contracts with the company. The sureties to the three first contracts were James Cordy and Richard Ranger only, and to the last James Cordy, Richard Ranger, and George Ranger. These sureties and the company were the defendants to the suit. The contracts contained provisions similar to those which were familiar to the court, from having occurred in the Popish chapel case at Hereford,* where the contracting parties submitted to refer every dispute as to the sufficiency of the work to the decision of the architect. The only difference in this case was that the superintending engineer, instead of the architect, was to be the absolute judge of the fitness of the work, and as to the payments to be made from time to time on certificates under his own hand. Nothing could be more absolute than the powers given by these provisions; they were, nevertheless, generally adopted in contracts of this description, and though it might excite some wonder how parties would willingly submit themselves to them, still they had not yet been found in practice to be ordinarily attended with inconvenience. Independently of this power the contract contained a stipulation that the company should be empowered to resume possession of the works, in case the plaintiff made any default in its execution. Under the provisions of this contract the works had proceeded from time to time to a very considerable extent, when, after various disputes and defaults (as the company alleged) on the part of the plaintiff, the company at length, in exercise of their powers, had taken possession of the plants, works, materials, &c., which were situate in that part of the Bristol end of the line comprehended in the contracts B 1, B 2, and the extension contract. Of the works comprised in the other contract in the neighbourhood of Reading possession had not been taken, but they were now in progress and diligent prosecution by the plaintiff. This brief abstract of the case would enable the court sufficiently to understand the prayer of the bill, with this additional observation. In the course of the works the company, at Ranger's request, made payments to him which, as they represented, exceeded the amount of what was justly due to him, whereon they took certain security on the plant, materials, &c., as a kind of mortgage, without taking possession, and of the reserved funds of 20 per cent. in the hands of the company. These matters being all fully set out, the principal portions of the prayer were that the company might elect whether they would permit the plaintiff to continue and complete the several works which on the 2nd of July last he was in the course of completing, or whether they would discharge the plaintiff from the further execution of them, the plaintiff offering to accept either alternative, on being paid the amount justly due to him on the footing of his contracts and agreements, or otherwise on such terms as the court should think fit to direct. And in case the company should elect to permit the plaintiff to continue and complete the works, then that they might be directed to reinstate the plaintiff in the possession of such of the works and of the plant and materials thereon, of which they had taken possession, and to pay him such amount as, upon a just account to be taken as after prayed, should be found to be justly due to

* Reported in Journal No. 8, p. 201.

moneys paid to him or for his use, and all moneys which the company should be entitled to deduct or retain by way of a reserve fund or under their mortgage deeds or otherwise, during the progress of the works, and that all proper accounts might be taken for ascertaining such balance, and that all proper directions might be given for ascertaining the quantity and price of the contract works. And in case the company should elect to discharge the plaintiff, then that he might be wholly and completely exonerated from all future liability to see to the execution of the works, and from all responsibility to arise therefrom; and that thereupon all accounts in relation to the contract and works, or such of them from which the plaintiff should be discharged, might be taken, and that the company might pay the balance, deducting therefrom the amount due on the footing of their mortgage securities, the plaintiff offering, in case a balance should be found due from him, to pay the same, and that the company might be decreed to deliver up to him the plant, engines, &c., of which they had taken possession, and permit him to remove that portion of which they had not taken possession; and that it might be declared the plaintiff was not subject to or was entitled to be relieved in equity against any penalties or forfeitures under his contracts; and that the company might be restrained from retaining or withholding from the plaintiff the possession of his plant, &c., of which they had taken possession, and from doing any act whereby he might be prevented from completing the works or from removing off the ground, or otherwise altering the situation of the plant and materials already upon the ground. The court would thus see the relief prayed turned upon the right of the company to make their election which course they would take, no offer being made to redeem the mortgages, nor any question of account raised, except on this imaginary right to have an election. He should now proceed more in detail with the case made upon the bill. It set out with a statement of the act of Parliament of the 6th of the late King, incorporating the company, and setting forth their powers, under which any three directors might enter into written contracts, which would be binding on the company. It then stated subsequent acts under the several provisions of which, taken together, they had entered into the four contracts with the plaintiff, which it was alleged were signed by the plaintiff, and under the common seal of the company, or otherwise executed on behalf of and assented to by them. The first contract (B 1), dated March, 1833, related to the erection of earth work, tunnelling, building a bridge over the river Avon, &c., stipulated the works should be done to the satisfaction of the company, and of their principal and resident engineer, clerk of works, surveyor, and inspector, and declared that all disputes were to be referred to the exclusive arbitration of the principal engineer for the time being, and the instalments for works done were only to be paid on a certificate under his handwriting. It then contained the usual powers to the company, requiring a sufficient number of workmen to be employed, and preventing sub-contracts without the consent of five directors. Then followed a clause, that in case the contractor should become bankrupt or insolvent, or should neglect or otherwise become incapable to proceed with the works, the company should have power to give him notice in writing to proceed, and if default was made for seven days after such notice, the company were at liberty to employ others to proceed with the works, and any previous payments were to be considered as the full value of any works already done.

With reference to the nature of the engagement into which the defendants had entered, they were found to exist in all trades and professions. The direction being absolute, the company had taken possession on a breach of the contract, and, if they had taken wrongful possession, an action of trover or ejectment was the proper proceeding. The learned counsel concluded by observing that no fraud was alleged either against Mr. Brunel or the company. The plaintiff only disagreed with Mr. Brunel on questions of time and other calculations: he only attacked his skill, or accused him of negligence, but nowhere complained of fraud. In one place he said he was unfairly dealt with; and, as it had been decided in the Hereford case a charge of fraud was necessary, and was nowhere to be found in the present, it could not be relieved against in a court of equity. On all these grounds, therefore, the demurrer must prevail.

Mr. Sergeant Wilde, Mr. Wakefield, and Mr. Girdlestone, severally addressed the court in support of the bill. The learned counsel dwelt upon the importance of the case to the plaintiff, whose property, to the value of 100,000*l*., was arbitrarily seized by the company, and himself left to the mercy of his creditors, whose money he had expended in purchasing that property. The contract, it was contended, was so manifestly unrighteous, and the use made of it was so unjust, that the court was bound to interfere. The plaintiff contended there was no forfeiture. The company, it was charged, was labouring to create one by inequitable means, and this manner of acting, both prior and subsequently to the notice, bore out the imputation of the fraudulent motives which dictated the notice; and when the plaintiff was earnestly praying for some specific information as to the causes of complaints, the defendants were as cautious in concealing them. Upon the point of multifariousness, the decisions of the present Lord Chancellor showed that was a question of convenience, and the company, at least in this instance, had no reason to complain that one bill, rather than four, had been filed against them.

During the discussion, which occupied the whole day, his Honour asked whether the validity of such contracts of forfeiture as these had been discussed in courts of law?

Mr. Sergeant Wilde did not recollect any instance in which the question had been tried.

him, under the contracts or otherwise in respect of the contract works and extra additional altered works and extension works, after deducting all

His Honour said this was a case very much parallel to that of the Roman Catholic chapel at Hereford, where the whole works were seized, and the contractors were left to get what redress they could; and certainly they got none in this court. It was a case of heart-breaking hardship, but his Honour never heard there was an appeal from his decision.

Mr. Sergeant Wilde—Probably the men became bankrupt.

When it was urged by Mr. Wakefield that the principle of law would not permit the parties to constitute Mr. Brunel a judge without appeal,

His Honour asked, then what would become of the case of Heap v. the Archbishop of Canterbury?

Mr. Wakefield relied on the well-known rule as to arbitration clauses.

His Honour, without calling for a reply, delivered judgment, and said he must allow the demurrer for want of equity. He did not think the objection for multifariousness was well founded, or the contracts, though not one and the same, were yet in *pari materia*; and if the court had jurisdiction at all, it could only exercise that jurisdiction upon the contracts altogether, and the parties had, in their dealings under the contracts, blended them together, according to the allegations in the bill. One observation, however, occurred to him: the suit was so framed that if any other parties should make the objection, it can hardly be made without producing that objection to the bill for want of parties which the plaintiff had already submitted to as insuperable. It was impossible not to see that George Ranger had nothing to do with the three first contracts, and if he objects, his name must be struck out of the record; and if he is off the record, the objection for want of parties revives, and thus the bill is placed between Scylla and Charybdis. With respect to the general point, he could not but himself think it was the intention of the company that they should have, in a very great degree, an arbitrary power to dismiss the contractor if they should feel dissatisfied with him; and, to his mind, the language of the clause which related to the notice of dismissal proved it. The clause was thus:—"In case William Ranger should become insolvent, or be declared a bankrupt, or from any cause whatever other than the act of the company, their engineer, or agent, should be prevented from, or delayed in, proceeding with and completing the work according to the contract, or should not commence or proceed with the work to the satisfaction of the company, then it should be lawful for the company to give him notice, requiring him to enter upon and regularly proceed with the work; and in case he should, within seven days after the notice, make default, it should be lawful for the company to employ another respectable workman," and so on. His Honour observed upon the generality of the second member of the sentence, namely, "in case the contractor should not commence or proceed with the work to the satisfaction of the company," and said it appeared to him that the parties in forming the clause were sensible if they allowed it to stand in the spirit of the first member of the sentence they would have taken away from the company their arbitrary power; and if they meant to guard against a despotic and arbitrary exercise of power or whim, how came it that none of the exceptive words in the first branch found their way into that sentence? And it appeared to him that there was very great reason for the company to stipulate for that power, for these works must be performed in a particular time, and it would never do for the company to enter into bickerings with the contractor from time to time whether he was going on with the works in a proper manner; and, therefore, in his opinion very wisely, and with the full knowledge of the contractor, they stipulated for an arbitrary power to give notice; and he could not but think the only reasonable method of construing the words "make default" was to read them with reference to the preceding sentence, so as to make the dismissal to depend simply upon his not going on to the satisfaction of the company. Any other interpretation would be nonsense; for, suppose the company gave notice, and the contractor went on to their dissatisfaction, they must, it is said, give notice again; and so on you have a succession of notices, and the company in a perpetual state of dissatisfaction with the contractor. That could not be the meaning of the parties. It was evidently their intention that that the company should have liberty to exercise the arbitrary power of ejecting the contractor. His Honour then referred to the case of Heap v. the Archbishop of Canterbury, in which, if he recollected aright, a party contracted with the commissioners for building churches that a contract should be performed to the satisfaction of certain individuals. Upon a question of forfeiture for breach of contract, it was urged that the stipulation was arbitrary and unjust; but the answer was, it was quite impossible for the persons on whose behalf the work was done, themselves to form a fair opinion upon it, and they were perfectly justified in stipulating that it should be performed to the satisfaction of some given individual on whom he had reliance, and, if he was not satisfied, they meant, as the contractor was aware, that there should be no appeal. He could not for the life of him think but that the company meant to reserve, and did reserve, to themselves an arbitrary right to dismiss the plaintiff; and although it was stated in the bill that the company had dismissed him with a view to get hold of his property, and so on, that may be true; yet, if they have dismissed him, they have only exercised the right which they possessed, and the exercise of that right was followed with consequences which they did not contemplate, and which were mere accretions in exercise of the right. Just consider the power of arbitrarily dismissing persons in their employment, which parties possess, in many instances, under the law of England. Put the case of common day labourers or servants. You may go home, a complaint may be made, and you dismiss your servant, and refuse to give him a character, yet he has no redress. If you give a false character, that is a different matter. But supposing the power of dismissal in this case were not arbitrary, he could not see how the court could interfere. If the forfeiture was legal, there was no redress at law. A party applying for equity must do equity. And how was a court of equity to relieve against the forfeiture without providing for the execution of the contract? And if the court will not execute a building contract, *a fortiori*, it will not execute such a contract as this. Thus the court was disabled from giving any equity to the plaintiff, because it was disabled from giving that reciprocal equity to the defendant of effectually providing at once for the completion of the railroad without interruption, to which he was entitled. And if the court cannot relieve the plaintiff because it cannot relieve the defendant, there is no portion of the bill on which it can be sustained. The case was nothing more than that the company had illegally, and without warrant, seized the plaintiff's spades, wheelbarrows, &c., and therefore the bill was filed. There was no case for an account. The payments were all on one side for work, and labour on the other. If there was a question of trespass, or if there was a question upon a *quantum meruit*, a court of law was the place where that should be decided; but so long as the work was in progress this court could not interfere. He should therefore allow the demurrer.

This decision, of course, disposed of the motion for the injunction.

Against this decision the plaintiff appealed to the Court of Chancery, the appeal was argued before the Lord Chancellor on the 23rd of August last, and following day. On Tuesday, December 4th last, the Lord Chancellor delivered the following judgment, reversing the decision of the Vice Chancellor:—

This was a demurrer which came before him during the long vacation. He had been induced to hear it, although the sittings were terminated, because it was represented as necessary that the demurrer should be disposed of in order to give the party an opportunity of moving for an injunction; but he was so satisfied from the discussion which took place on the case made by the bill that it was not one in which he should interfere, that he had delayed pronouncing his opinion till now. The demurrer was a general demurrer by the Great Western Railway Company, on account of multifariousness; but he saw no reason for entertaining it on that ground, the company being immediately interested in the whole matter introduced in the bill. It remained to be considered whether the general demurrer for want of equity could prevail. It could not of course prevail, if there was any part of the relief prayed to which the plaintiff was entitled. The bill was certainly singular in its form, because it prayed that the defendants might elect whether they would restore the plaintiff to the situation in which he was in possession of the work, so as to enable him to complete the works he had contracted to perform, or if not, that they should consider the contract at an end; but in either alternative the prayer was, that the accounts which subsisted between the plaintiff and defendants might be taken. In was not necessary to go into the very detailed circumstances laid before him at the hearing, because if any part was capable of giving an equity, of course the demurrer could not prevail. But for the purpose of explaining the view he took of the case on the bill, it was sufficient to state, that the plaintiff alleged he had entered into contracts to do certain works on the railway; that it was part of the provisions of those contracts that the surveyor and engineer of the company should every fortnight ascertain the quantity, or rather the value of the work done according to certain stipulated rates of charge; that the contractor, the plaintiff, should be paid four-fifths, 80l., out of every 100l., for the amount of work so ascertained to be done, the 20l. per cent. unpaid being to remain in the hands of the company until it had accumulated to a certain sum, 4,000l., and on attaining that amount, the engineer having satisfied himself that the work was well done, the contractor was to be paid the whole that was due. In these contracts there were certain conditions imposing great penalties and giving great powers to the railway company. Among others there was this condition—if the engineer should not be satisfied with the mode in which the works were conducted and the progress made, the company were to give notice to the contractor to prosecute the works, and if he did not within seven days prosecute the works, they should be at liberty to enter upon the works in progress. Upon that taking place, not only all the plant, machinery, utensils, &c., employed by the contractor was to become forfeited to the company, but the plaintiff was also to forfeit all that remained unpaid on the work previously done—*i. e.*, that the money actually paid should be considered in full satisfaction of the work up to that time. If the engineer had done that which the contracts required—if he had provided for the payment, according to the contracts, of 80l. per cent. on all the work done every fortnight, the forfeiture would have operated on the 20l. per cent. remaining unpaid; but the case made by the bill was, that this had not been done, and that in fact the engineer, favouring the company and acting oppressively towards the contractor, did not estimate the work done so as to give the contractor 80l. per cent. According to the statement in the bill, a very much larger sum was due to the contractor than 20l. per cent. on the previous estimates, yet the penalty was sought to be enforced on all that was due, not only to exclude the contractor from the 20l. per cent. not paid, but also from a very large proportion of the 80l. per cent. which he ought to have received. How was this, then, to be ascertained? Only by an investigation of the work done, and the mode in which the engineer had estimated it. But that was not the whole case stated in the bill. Independently of the works carried on under these several contracts, which were in writing, there were other contracts not in writing; there was also what was called the extension contract for carrying on the line, which was not in writing, but to be carried on at certain stipulated prices. Under that contract, the bill alleged payments had been made, but very large sums still remained unpaid. The bill stated that upwards of 30,000l. remained due on works actually completed by the contractor; so that if the company were right in doing what they had done, and enforcing the contracts for forfeiture, they were in possession of a large sum of money, which, even in that case, must be coming to the plaintiff, while the amount could only be ascertained by the quantity of work done, and the mode in which payment had been calculated—an investigation obviously which could only take place under the superintendence of a court of equity, for it was utterly impossible such an account could be taken in any court of law. The case, however. went still further than that. The bill stated, that the plaintiff being pressed for money to carry on the works, applied to the company for an advance on loan; they consented, and three several advances were made, secured on the property of the contractor—namely, on the plant, utensils, and tools employed in carrying on the works, and by a mortgage on what remained due to him, the 20*l.* per cent. for work previously done, but that the bill alleged applied only to the plant, implements, and tools for the works under the written contracts: it did not apply to the plant, utensils, and tools employed on the contract not in writing. The company, however, had taken possession of the whole; they claimed all under the penalty as forfeited. Now, the bill contained a statement which, if true, showed that the company had no title under that clause of forfeiture. The forfeiture could only be enforced if the contractor disregarded the monition after seven days; and the bill alleged that within the seven days, taking up the very words of the contract, the plaintiff had put himself in that situation, which, if true, would have prevented a forfeiture. The company therefore had no title under that clause of forfeiture; but if they had no title under that clause of forfeiture, they were in possession of large property, stated in the bill to amount to 70,000*l.*, on which they undoubtedly had a lien for the repayment of the sums advanced to the contractor. The bill also stated that the engineer of the company declared that in making the certificates he should consider what was the state of the account upon all the contracts. The result, therefore, would be, according to the allegations in the bill, that the defendants had illegally and without authority possessed themselves of property which they contracted to leave in the hands of the plaintiff, and an unsettled account remained between them. It was impossible to say, if such a case were made out, that the Court would not administer some relief; it was impossible to say the plaintiff had no equity, and the demurrer could not be supported.

The Vice-Chancellor's decision allowing the demurrer was accordingly overruled.

PRIVY COUNCIL, Wednesday, Dec. 12.

The petition of James Russell, Esq., of Handsworth, came on for hearing before the Privy Council this day. The lords present were Lord Brougham, Mr. Justice Parke, Mr. Justice Bosanquet, Sir Stephen Lushington, and the Hon. Mr. Erskine.

The petitioner prayed for the renewal of a patent "for certain improvements in manufacturing tubes for gas and other purposes," assigned to him by Cornelius Whitehouse, a workman employed by him for the purpose of carrying into effect the manufacture of tubes by machinery.

Mr. Cresswell (in the absence of Sir William Follett) detailed the history of gas-tubing from the period of the application of old gun-barrels for that purpose. The present invention had arisen in consequence of the petitioner having been prevented by the combination of his workmen from meeting the demands of the Gas Companies for tubes, the supply afforded by manipulation being limited, and too dependent upon the caprice of his workmen to allow him to enter into contracts. The great demand for the patent tubing, and its great superiority over the hammered tube, had led to numerous infringements, which, coupled with the enormous extent of litigation consequent on such piracies, had deprived the petitioner of the fair and adequate remuneration he ought to have obtained for so valuable an invention, without which gas-lighting could not have been carried on to its present extent, and which had led to several inventions of great utility.

Angier March Perkins, Esq., Civil Engineer, proved that he was the inventor of an improved method of heating buildings, which had been adopted in the British Museum, Milbank Penitentiary, and in many churches, houses, and other buildings, both public and private, to a great extent, and that his patent was entirely dependent upon the patent tubing of Mr. Russell, without which he could not have carried out his invention.

Francis Bramah, Esq., Civil Engineer, proved that he had inspected Mr. Russell's works, and was delighted with the beauty of the invention; that he had for some years used the patent tubing, and had submitted it to a pressure of 3 tons upon the square inch. Mr. Bramah also spoke to the great reduction in price effected by the patent, and its utility for hollow axles, spindles for machinery, and a variety of mechanical purposes, independent of its value for transmitting heat, gas, or fluids.

The Lords of the Council having intimated their opinion that the value of the patent was in some degree proved by the numerous decisions of the Courts of Law in its favour, the accounts were put in and verified.

Mr. Fletcher, of Dudley, as solicitor to the petitioner, produced the original patents and other documents, and proved that he had complied with the regulations pro[illegible]gated by the Privy Council.

The Att[illegible]ey General then addressed their Lordships on behalf of the Crown, and st[illegible]ed that he was fully acquainted with Mr. Russell's patent, having been employed in opposition to it in different Courts of Law. He could, however, fully attest the value and utility of the invention; and if their lordships should be of opinion that sufficient remuneration had not been afforded, he should, under the peculiar circumstances of the case, rejoice if their lordships would grant an extension, in order that adequate reward might be given to an invention of great public benefit.

Lord Brougham: Their lordships having taken the whole of this matter into account, retain the opinion which they have had impressed upon their minds from the very beginning—that this is an invention of extraordinary merit, doing the greatest honour to the inventor, conferring great benefit on the community; founding in this eminent merit not merely the application of a known principle embodying it in new machinery, and applying it to practical purposes, but involving the discovery of a new, curious, and most important principle, and, at the same time, applying that principle to a most important purpose. Their lordships have on the same side of the question taken into account (which it is material to mention) Mr. Russell's merit in patronising the ingenious and deserving author of this invention, in expending money till he was enabled to complete this invention, and in liberally supplying the funds which were requisite for the purpose of carrying this invention into execution. On the other hand, their lordships have taken into mature consideration (which they always do in such cases) the profit made by the patentee, Mr. Russell, standing in the place of the inventor. They find that it is not a case, as in claims of other inventions of great ingenuity and certainly of great public benefit, of actual loss in some, and of very scanty if any profit at all realised in others, but that a considerable profit has been realised, and upon the whole no loss. It is to be observed that the profit is not, perhaps, very much greater, if at all greater than the ordinary profits on stock to that amount employed without the privileges and extra profits of a monopoly. It is proper to consider that one great item of deduction from those profits also involves great pain and anxiety and suffering to the party, namely, the litigation to which he has been subjected, and which is generally found to be in proportion to the merit and the usefulness of a patent, namely, the temptation to infringe it, and to set at nought the right of the patentee, both in the Court of Chancery, when he applies for protection by injunction, and afterwards in a Court of Law, when he comes to claim compensation for damages; the temptation being, as I have stated, in proportion to the benefit and the demand for the invention. That is an item which has, to a considerable degree, attracted the attention of their lordships in this profit and loss account which has been laid before them in the course of these transactions. Taking the whole of the matter into consideration—the merits of the patentee, the merits of Mr. Russell, and the loss that has been sustained in the litigation—and setting against those, on the other hand, the profits which have been made, their lordships were of opinion that the term ought to be extended, and upon due execution being given to the undertaking, which has been just given by Mr. Fletcher on behalf of the inventor, that the term ought to be extended for the period of six years.

STEAM NAVIGATION.

An iron steam vessel, of 60 tons burden, 71 feet in length, and 10 feet of beam, with wheels at her stern, constructed on the sculling principle, called the Robert J. Stockton, came round from Liverpool to London upon an experimental trip, during the late tremendous weather, and arrived in the river in safety on Monday evening, Dec. 3. The superiority of the wheel introduced into this vessel, in comparison with what is called the Archimedean screw, and other contrivances, was satisfactorily shown, and no doubt whatever is entertained of its extensive adoption. The Robert J. Stockton will in a few days proceed on a voyage across the Atlantic.—*Evening paper.*

Steamer.—On Thursday morning some curiosity was excited at Blackwall, and below, towards Gravesend, by the novel spectacle of a large heavy-laden ship proceeding down the river propelled by a steam apparatus. Her appearance was that of an ordinary vessel, with the exception of a few bars of iron on her sides, crossed in different directions, to which the propellers appeared to be attached. No paddle-boxes were visible, nor was the water thrown up, as in the case of the paddle-wheels—the action seemed to be smooth and equable. This is the first attempt, as far as we know, to adapt the use of steam power to propel a vessel of the ordinary construction; and it certainly does, on reflection, seem extraordinary that some plan for effecting this object should not have been, before now, brought into beneficial use, the enormous expense attending the constant consumption of fuel in steam vessels being the great obstacle to the application of steam power to distant voyages. The ship above alluded to is the Maria, going to India; her machinery, including the boilers, occupies comparatively little space.—*Daily paper.*

Newfoundland Steam Navigation.—The House of Assembly of Newfoundland have voted 600*l.* for the promotion of steam communication between Newfoundland and Great Britain and Ireland.

Bordeaux and New York Steam Navigation.—A public meeting, attended by eighty-nine of the most respectable merchants, was held at Bordeaux on the 29th of Nov., and appointed a committee to take preparatory measures.—*Commerce.*

North America.—The important topic of steam-navigation to the British North American colonies is engaging much attention in Halifax and St. John's. Mr. Howe, who had been advocating in England the expediency of a change in the present system, has returned to Halifax.—*Morning Advertiser.*

West India Islands.—We have seen, within the last few days, a circular containing a prospectus of a plan for opening and maintaining a regular communication by steam betwixt Liverpool and the different West India Islands.—*Liverpool Albion.*

Brazilian Steam Navigation.—The Bahia people were looking forward with impatience for the arrival of some of the steamers which the Bahia Bay Steam Navigation Company proposed to put into operation in that quarter, and there seemed to be every disposition on the part of the residents to give all the encouragement in their power to the undertaking.—*Morning Post.*

French Experimental Steam-Boat.—The steamer Veloce has received orders to hold herself in readiness to sail for Havannah and Mexico, to try the new system of masts adopted by her commander, M. Bechameil. The question whether steam and wind can be combined will thus be speedily solved.—*Armoricain.*

Steam Cutter.—The United States discovery ship in the South Seas, the Macedonian, has an eight-horse steam engine to put into the cutter of the frigate, to ply up the various rivers in New Zealand.

Adriatic Steam Navigation.—The Austrian Lloyd's Company have established steam vessels between Ancona and Trieste.

The Royal William started on the 15th ultimo from Liverpool for America. She was provided with fuel sufficient for 27 days, of which 30 tons 9 cwt. were of Mr. Williams' patent peat stone fuel.

PROGRESS OF RAILWAYS.

Railway to Lewes and Hastings.—The plan comprehends a line of railway, commencing from the line of the London and Brighton Railway, at St. John's Common, and running in nearly a straight line to Lewes, where it crosses the river a short distance below the bridge; it is then carried on through the levels of Laughton, across the Cuckmere river near Selmeston, and from thence through the Eastbourne and Pevensey levels, passing to the north of Eastbourne, and in front of the Castle at Pevensey, and thence in nearly a straight line to St. Leonard's and Hastings. The line selected passes through so level a country, that the works required for its construction are scarcely of greater magnitude than those of ordinary turnpike roads, which is a circumstance of the most material importance, as diminishing the cost of the line far below the usual average cost of other railways. The gradients are also peculiarly favourable. In connexion with this line of railway, it is proposed to construct a ship canal from Newhaven Harbour to Lewes, with a wet-dock and basin at Lewes, a little below Lewes bridge; the canal will contain twenty feet depth of water, and by reason of avoiding the intricate windings of the river, will reduce the distance from Newhaven bridge to Lewes to five miles and a half. By this canal, therefore, Lewes will become, as of old, a port, and the whole of the trade and commerce of the district be brought to the merchant's own door.—*Sussex Express.*

Brandling Junction Railway.—Every exertion is being made to open this line of railway for public conveyance as early as January next. Four splendid locomotive engines, from the factory of Messrs. Longridge and Co., at the Bedlington Iron Works, have this week been forwarded through this town for the Brandling Company; and, from what we can learn, those engines called the Brandling, Newcastle (now being tried on the Newcastle and Carlisle line), Bedlington, and Gateshead, are of a very superior construction, and reflect much credit upon the manufacturers of them.—*Newcastle Journal.*

A Contrast.—Great Western Railway.—The works on the Great Western Railway, near Reading, continue to be at a total stand-still. Some of the labourers are begging about the streets of that town, and others have left, to obtain work elsewhere.—*Reading Mercury.*—The works on the Great Western Railway, between Reading and Didcot, are progressing with a rapidity and punctuality exceeding that on any other portion of the line. There is a report that a temporary station will be erected between this town (Reading) and Twyford in April, but we do not believe it will be required so soon.—*Berkshire Chronicle.*

We understand that the eastern arch of the Maidenhead bridge has been taken down, for the purpose of rebuilding it: this we were afraid would be the case when we surveyed the bridge in June last.

London and Southampton Railway.—Part of an embankment on this line, near Weybridge, gave way, and blocked up the road so as to oblige the passengers by the five o'clock train to leave the carriages.

London and Brighton Railway.—The works on the London and Brighton Railway are proceeding in the most satisfactory manner. There are 1,600 men now employed on the line. Messrs. Thornton are making rapid progress in the Long embankment north of Clayton-hill: and the tunnel shafts at Merstham, Clayton, and Balcombe, are nearly completed. In order to expedite the execution of the works in the Shoreham branch, it is understood that a double set of men are engaged for the cutting on Mr. Fuller's farm at Aldrington, the work being by these means carried on night and day without intermission.—*Brighton Gazette.*

London and Greenwich Railway.—On Tuesday, the 4th of December, the remaining portion of the London and Greenwich Railway, extending from Deptford to the Prince of Orange public-house, in Greenwich, was privately opened, under the superintendence of the directors, who were accompanied by Colonel Landman, the engineer. The new part of the line is laid upon longitudinal wood bearers, supported upon transverse wood sleepers upon a bed of ballast. The top of the arches have been coated with Claridge's asphalte. On the 24th December it was opened to the public.

Great North of England Railway.—The workmen have now commenced laying the foundation of the fifth and last bridge of the Great North of England Railway, near Northallerton, a little to the south of the town, which will cross over the high road leading to Boroughbridge, near to the 220th milestone from London.—*Newcastle Journal.*

Tamworth and Rugby Railway.—So confident are the parties engaged in this undertaking of obtaining their act for carrying the Manchester Railway through Tamworth to Rugby, that a legal gentleman in the neighbourhood of Nuneaton has received authority to contract for the purchase of any land which may be required in that district.—*Birmingham Advertiser.*

Manchester and Leeds Railway.—The portion of this extensive undertaking which lies betwixt this town and Rochdale is in a very satisfactory state of forwardness, and will, in all probability, be opened in May or June next. Of the part betwixt Mills Hill and Rochdale, which was the most heavy and difficult, about three parts in the hundred only remained unfinished in the middle of November. The cuttings and embankments, the latter including the important one of Mills Hill and Castleton Clough, were nearly perfected, and permanent rails will be laid in good time on the whole of those works. The bridges (from a difficulty in obtaining stone) were the only works not in a corresponding state of forwardness. The tunnelling at the summit is proceeding as fast as human skill and activity can promote it, and at Gauxholme a large muster of workmen are daily employed in sinking foundations and cutting stone for the erection of warehouses and other requisite buildings.—*Wakefield Journal.* The line of railway from Manchester to Littleborough is advancing so rapidly towards completion, that, if the severity of the weather do not materially protract operations, it will certainly be ready for opening, between these two places, in the spring of next year. About half of the permanent rails have, we understand, been already laid.—*Halifax Express.*

Manchester and Birmingham Railway.—A deputation of the directors, accompanied by G. W. Buck, Esq., the engineer, met the committee appointed by the town council of Macclesfield, in order to communicate to them the plan for a diversion of the proposed branch to Macclesfield. Mr. Buck's report was read; it stated that the Macclesfield branch enters the main line in a cutting, on a curve, and at the foot of an inclined plane which is upwards of a mile in length. Under such circumstances, approaching trains would be invisible to each other, and, therefore, to prevent accidents from collision, it would be absolutely necessary that the trains coming from Macclesfield should stop before entering upon the main line; but stopping here would be impracticable, on account of the momentum acquired in descending the inclined plane. Again, although no trains might be approaching on the main line, still the Macclesfield trains should enter the main line at a slow speed, which would be impracticable for the same reason. It is obvious that these defects are such as would constantly give rise to serious accidents, and, therefore, ought, if possible, to be obviated; with that view, Mr. Buck recommends that the Macclesfield line shall branch off near the seventh mile, on the Parliamentary plan, at Cheadle Hulme, and thence proceed in a direction nearly south, passing by the Siddall houses, then gradually bearing eastward to Hollingworth smithy, where it should pass under the road to Adlington Hall, and fall into the Parliamentary line a short distance beyond, from which place to Macclesfield the Parliamentary line will be retained. By diverting the turnpike road near the Mill-house, no crossing of it will be required in the whole distance, except at Beech bridge. The length of this deviation will be about $5\frac{1}{4}$ miles, of which the first 26 chains adjoining the main line may be level, and the remaining distance will have an ascent of 20 feet in a mile, or 1·264. From Hollingworth smithy to Macclesfield, the railway may be constructed of one gradient of 1·232, or about 23 feet in a mile. The advantages which will accrue from adopting the proposed line are the following:—The length to construct will be about one mile less. The junction takes place where the main line is straight, upon a level, and upon a small embankment. The maximum gradient will be 1·232, or about 23 feet per mile, whereas on the Parliamentary plan, it is 1·150, or 35 feet per mile. The proposed line will be cheaper to execute and cheaper to work.

Manchester and Birmingham Railway.—The extensive viaduct across the Mersey and valley at Stockport, has been left to Messrs. Tomkinson and Messrs. Holme, of Liverpool, at a little below £70,000. It will have twenty-two arches of between sixty and seventy feet span, the centre arch crossing the river at a height of 100 feet. The lowest estimate was about £62,000, and the highest was about £100,000.—*Macclesfield Courier.*

Sheffield and Rotherham Railway.—The station and its vicinity still continue the great scene of attraction. On Sunday the number of passengers conveyed amounted to 2,500. The number of passengers who have travelled on the railway since it was opened for business, have averaged 1,350 daily. A gentleman has made a wager that 800,000 persons will be conveyed in the railway carriages during the first twelve months.—*Sheffield Iris.*

Birmingham and Gloucester Railway.—The Gloucester portion of the line is rapidly approaching to completion. The earthwork is remarkably light, as is also the masonry, of which the whole is being executed at prices hitherto unknown to railway proprietors. Workmen are engaged all along the line, which is let in small contracts. At Tewkesbury the depot is commenced, and the Lansdown depot will be immediately proceeded with—the drawings being already in the builder's hand. A plain but elegant skew bridge, under the Arle road, is now waiting for the iron work; and we observe the workmen very busy on the large bridge which is to carry the old Gloucester road over the railway.—*Cheltenham Looker-On.*

Chester and Birkenhead Railway.—We understand that Messrs. Clements and Henry, the contractors for the Chester end of the Birkenhead and Chester Railway, are progressing satisfactorily in the heaviest portion of their work—viz., the filling up of the valley, and the erection of the bridge over the Dee and Mersey Canal at Mollington. They are preparing an inclined road, and fitting up a stationary engine at great expense, in order to expedite the conveyance of the earth into the valley. Great progress has been made at the other end of their contracts, near Sutton; a great quantity of earth has been removed, and through the deepest portion of the cutting great preparations of material are now being made, in order to prosecute vigorously the whole line next year; combining the lighter portions of the work between Mollington and Chester, as also on the other end, between Sutton and Plimyard Brook, in the township of Eastham, which terminates their portion of the line.—*Chester Gazette.*

Glasgow and Ayr Railway.—We are enabled to inform the public that this great national undertaking is carried on most satisfactorily, and that the whole expenses yet incurred have not exceeded the parliamentary estimates—a circumstance as unprecedented as creditable to Mr. Miller, the engineer. The same may be said of the first part of the line as far as Paisley, which is executed by Mr. Locke, for the Ayrshire and Greenock Companies jointly. The whole line, we are assured, will be completed by the time the Glasgow end is ready, which will be in the spring of 1840.—The Earl of Eglinton has, we understand, determined on completing the harbour and docks at Ardrossan, and making the necessary arrangements for goods and passengers; whilst the inhabitants of Ayr are also bestirring themselves to render their river harbour as good as it is capable of becoming, and a company is already formed to establish a steam navigation from Troon to Belfast.—*Glasgow Courier.*

Glasgow and Greenock Railway.—The directors, at their last meeting, let the two remaining contracts on this line, Mr. Brassey having gained the Walkinshaw, and Mr. M'Kenzie the Finlayson. Judging from the rapid progress already made by these gentlemen at Arkleston and Bishopton, there is no doubt but the opening of the railway to the public in the early part of the summer of 1840 is secured.—We understand that at the Bishopton ridge nearly 100,000 cubic yards have been excavated, that one steam engine is already at work, for pumping the water and hauling the rock from the tunnels, and that another engine is preparing here at Messrs. Johnston's works.—At Arkleston the same rapid progress has been made, the tunnel shaft is completed, and the tunnel commenced. About 90,000 cubic yards have been excavated, and ballast of a very superior quality has been found in great abundance.—In this town the masonry for carrying the railway over the streets is proceeding rapidly for the season; four arches are turned, several others in hand, and a length of wall is built.—The works are equally stirring at Port-Glasgow, where, for nearly half the length of the town, the masonry is in progress.—In Paisley, the large bridge over the river Cart is built above flood water, which is very creditable to the contractor, Mr. Lyon, who only commenced work late in the season. The bridges over Gilmour-street and Greenlaw-street, together with the retaining walls, are also considerably advanced.—Two cargoes of rails have arrived from Bristol, and several miles of the road will be laid early in the spring.—*Greenock Advertiser.*

Edinburgh, Leith, and Newhaven Railway.—An elegant and substantial bridge, of thirty feet span, under the Queensferry road, about one mile from the city of Edinburgh, has been finished, under the superintendance and design of Mr. James Adam, jun., the assistant engineer, for 1,400*l.* The lowest offer by contract was 1,000*l.* The contract from this bridge to the Water of Leith is now nearly completed. It consists of embankments and excavations of thirty-four feet in height and depth, and has an interesting appearance from the city. The contract at Trinity is also far advanced. The principal depot is situated at this terminus; and from this it is intended to carry the branches to the pier at Granton, and the harbour at Leith. It is also expected that the tunnel will be commenced immediately, at the principal depot at Canal-street. The Edinburgh and Glasgow, as well as the great Newcastle and London line, will terminate at the same spot, which is in the very centre of the city.—*Railway Times.*

West Cumberland Railway.—Another source of distrust towards the coast line scheme is that the parties do not look for obtaining the general support and concurrence of the residents in the districts through which the line is to pass. This may account for the cavalierness of the committee, but it also suggests that some jobbing interest is at the bottom.—*Kendal Mercury.*

Railway to Glasgow.—The people of Glasgow have already begun to evince their anxiety to unite with Carlisle, to communicate with the south, either by Mr. Hyde Clarke's Morecombe Bay Line, or that over Shap.—*Dumfries Courier.*

Scotch Railway.—The Dumfries people are anxious to form a junction with Carlisle, and to give every assistance for this object. It would be worse than superfluous in us to add one word of argument in support of the eligibility of Mr. Hyde Clarke's West Cumberland railway communication with Scotland.—*Dumfries Times.*

Preston and Lancaster Railway.—The operations on this line of railway are proceeding with great activity, and, so far as the work has proceeded, everything has been highly favourable. A great number of men are at work, and the respective contractors are sparing no pains to advance the works with all possible rapidity.—*Manchester Guardian.*

Eastern Counties Railway.—The following is a statement of the progress of the works on this line between London and Romford:—*Works completed in Brickwork, Masonry, and Iron*—A bridge over the Regent's Canal, of iron, 56 feet span; bridge over the river Lea, 70 feet span; Stratford viaduct, of five arches, 36 feet span each; Mill Pond bridge, 46 feet span; Stent's bridge, of four arches; Abbey bridge, 32 feet span; Aldersbrook bridge, 40 feet span; Roding bridge, 40 feet span; Romford river bridge, 30 feet span, in 34 feet embankment; Essex turnpike-road bridge, carried over railway on cast iron girders for a distance of 154 feet; besides 11 bridges over public roads, and six occupation bridges; six other road bridges are in progress, and also the viaduct between Cambridge row and Devonshire-street.—*Earthwork*—Embankment over Regent's Canal to Hatfield's archway, nearly ready for ballasting and permanent way; from Grove-road bridge to Tredegar-square, the embankment up to the ballast line; Coborn-road to Fairfield-place, embankment partially formed; from the west culvert to Forest-gate, the cutting and embankment complete, and the permanent way laid for nearly two miles; from East Ham up to and beyond Ilford, the cutting and embankment crossing the Ilford valley complete, and the permanent way laid for more than a mile.

The portions of cutting and embankment not yet begun amount to not quite a mile and three quarters. About a mile and a quarter consists of a cutting only eight feet in depth, in very favourable soil; a quarter of a mile is embankment, not averaging six feet in height, and the remaining quarter of a mile is that portion of the embankment over the Stratford marshes, where the ground for a depth of eight feet is inclined to "spew up." Considerable difficulty and delay might have arisen by the consequent subsidence of the embankment, but this has been completely obviated by carrying a frame-work of timber, supported upon piles, in advance of the operations. A certain proof of this, is the fact, that between the 11th of September and the 23rd of October, the embankment was carried from the east side of the Carpenters' Company's occupation archway over Stent's Mill bridge, a distance containing 44,680 cubic yards, although the lead was one mile and a half.

In order to insure an early opening of the line up to Romford, four locomotive engines are working night and day in the formation of the embankments.—*Extracted from the Railway Times.*

A Railway Warner.—There is an ingenious contrivance by which accidents may be effectually prevented. It consists of a bar of iron fixed in front of the engine, at a small distance above the rails, crossing the whole breadth of the road, which pushes any obstructing body before it, and, when so obstructed, rings a bell, which gives notice to the engineer. The benevolent inventor allows the use of his contrivance gratis.—*Morning Advertiser.*

Railway Missionaries.—The Bishop of Bath and Wells has appointed the Rev. F. Campbell, M.A., as a missionary among the navigators employed on the Bristol and Exeter Railway. The Railway Directors, and the Church Pastoral Aid Society, have liberally contributed, and it is hoped that the same well-judged efforts will be made elsewhere to reclaim them from their present heathen state.—*Bath paper.*

FOREIGN RAILWAYS.

Railway from Brunswick to Harzburg.—The first section from Brunswick to Wolfenbuttel was opened on the 30th of November. The duke himself was present on the occasion, and the train, consisting of five carriages, set out at twelve o'clock, and reached Wolfenbuttel (seven English miles) in twenty minutes. The duke, the ministers of state, and other distinguished persons, were highly pleased with the result of this trial, which was loudly cheered by the crowd that had assembled to witness the novel sight. On the return, it was resolved to divide the train between two machines, in order to try their power and the goodness of the road. Their progress was accelerated as much as possible, and the seven miles were passed in ten minutes. The road was opened to the public on the 1st instant, and in the first seven days there were 6,527 passengers, and the number would have been much greater, did not the shortness of the days prevent the trains from going more than four times in the day, backwards and forwards.—*Hanover Gazette*, Dec. 11.

Nuremberg and Furth Railway.—The number of passengers on this line in three years has been 1,357,286, and the receipts 173,443 florins. During this period no loss of life has been incurred.—*Globe.*

Havre Railway.—Two important measures were adopted at the recent meeting of the Council of Administration of the Havre Railway Company, which decided that a new survey shall be made of the whole line from Paris to the sea by the engineers of the company, and has also named from amongst its members a committee charged to discuss with the Government the modifications which it may be necessary to introduce into the contract, in consequence of the estimates and plans to which the investigations above alluded to may lead. Till the expenses of the railway shall be laid down with accuracy and precision, the Council of Administration, it adds, has suspended the works which were commenced according to the estimates of the Government engineers, but which might have compromised the capital of the shareholders in an undertaking impossible to be terminated with the funds at the disposal of the company.—*Commerce.*

Havre Railway.—The committee have determined to have the whole line re-surveyed by their *own engineers, not being able to place any dependence on the government engineers.* M. Lebobe has been appointed temporary managing director in the place of Count Jaubert.—*Commerce.*

The German Diet, before it broke up, took a resolution which has caused great joy at Mayence. It consented that the iron railroad of the Taunus should have its terminus in the federal fortress of that city, and even that one of the bastions should be pierced, if necessary, for that purpose. It seems that the Bavarian ambassador declared that he had orders to oppose whatever might, in the smallest degree, affect the security of that important fortress. The Austrian and Prussian engineers declared that there was not the smallest danger in complying with the wishes of the citizens of Mayence; and an eminent Danish engineer clearly demonstrated it.—*Morning Chronicle.*

Austria.—The statutes of the company for the Milan and Venice Railroad have been approved of by the Austrian government, and the works are to be commenced next spring. The journey will be accomplished in eight hours, and the fares are to be exceedingly moderate.

America.—The late accounts from the United States present some interesting details of the progress of the improvements in the free states of the federal union. The state of Pennsylvania has completed the survey of the route of the railroad to connect Pittsburgh with Philadelphia, and the state was about to make an immediate appropriation for making on its own account a railroad to connect it with the Harridburgh and Lancaster road, by which the Ohio and other great rivers will be reaches in 24 hours. The same state has also made a railway to Lancaster, and will continue it from Harrisburg.

ENGINEERING WORKS.

Fortification of Sheerness.—A survey of the Isles of Sheppy and Grain has been going on for some months past by order of Government, with a view of immediately fortifying her Majesty's Dockyard, which is at present without almost the slightest power of resisting an invading foe. Several plans have been laid before the Lords of the Admiralty, but the one that is most likely to be brought before the house next session proposes a line of fortification across the range of hills extending from Minster church to the Swale. A range of batteries here, it is said, will cover the whole island, and would at any time prevent an enemy from landing at the south-eastern extremity. The Dockyard and Miletown are to be covered by strong batteries, and martello towers will be also erected along the shores at given distances. The Isle of Grain is to be fortified with strong batteries, extending in the shape of a half-moon. These will not only cover the entrance of the Thames, but also the Medway. The estimated expense is nearly a million and a half of money.—*Greenwich Advertiser.*

London Docks.—A great improvement has been lately made in these docks, by the erection of a magnificent jetty, supported on massive piles, extending from the south-west quay, eight hundred feet across the large basin, affording a quay frontage on both sides for the loading of outward-bound ships of 1,600 feet. The jetty is 62 feet in width, and three lofty sheds, each 208 feet long by 48 feet wide, for the reception of goods and merchandise for exportation, are in the course of erection; one of these store-houses is already completed. There will be a space of seven feet clear on each side of the warehouses. The erection of the jetty is said to have cost the London Dock Company not less than 60,000*l.*, and it will afford great accommodation to the shipping, and particularly to the Sydney and Hobart Town ships. There are now eight large vessels bound to those places lying alongside the new jetty. They will all carry out a great number of emigrants. There is sufficient depth of water for the largest ships in the jetty, and at spring tides there is twenty-three feet of water. The whole work reflects great credit on the skill and enterprise of the respectable commercial body by whom it was designed. A capital of one million sterling has been expended during the last twelve years in enlarging and improving the London Docks, including the excavation of the eastern bason and entrance, and we understand further improvements are in contemplation. The dock, with the various rows of lofty warehouses and vaults, is the first establishment of the kind in the world.

The Eddystone.—We feel great pleasure in stating that, on examination by the competent authorities sent here from the Trinity Board, it is ascertained that the Eddystone Lighthouse has not sustained the slightest injury during the late severe storm. The report forwarded from this port to London, that it was feared that the lighthouse had been severely damaged, created, as might be imagined, great sensation; and an eminent engineer (Mr. Burgess), and a member of the Trinity Board, were immediately dispatched to ascertain the extent of the injuries, and preparations were made to place a floating light near the rock, if it should be found necessary. On the arrival of the deputation here they proceeded to the rock and commenced their survey, making the most careful examination throughout the structure. They repeated their visit a few days after, accompanied, we understand, by two efficient public officers of the port, and we are enabled to state, from what we consider undoubted authority, that it has been found that the noble structure has not received the slightest damage, unless the washing off the paint from a portion of the upper part of the building, which exhibits a crevice in the paintwork about a yard in length, and damaging two of the panes of glass in the lantern to the extent of a quarter of an inch, be called injuries. The result of the survey will, no doubt, be made public, in order to restore confidence as to the stability of the edifice after the alarming reports which have been made. It may be fairly presumed that the extreme violence of the storm, and its continuation for so many days, created fears in the minds of the men in the lighthouse for their safety, and this, no doubt, gave rise to the rumour that the building had been shaken by the storm.—*Plymouth Herald.*

Plymouth Breakwater.—The utility of this great national work has been fully demonstrated in the late storms. All the vessels in the Sound rode out the gale, though at high water there was a heavy sea rolling over the Breakwater. It is feared, indeed, that it will be much injured; all the cranes on the west end have been washed down by the violence of the sea.

Port Carlisle.—The wet and dry docks and pier are in active progress under the superintendence of Mr. Boyd. The contract for the pier has been taken by Mr. Nelson.

Fortifying the Coast.—Surveys are being made on the east coast of this county and the river Humber for the most eligible sites on which may be erected batteries, in the event of hostilities with Russia. Whether a war now take place or not it is intended to secure the ground in the event of any future occasion. A site at High Paull and the opposite coast will be again occupied as military establishments for the defence of the Humber.—*Hull paper.*

Ardglass Pier.—The lighthouse and part of the pier at Ardglass, in the Bay of Dundrum, which had been nearly completed at an expense of 26,000*l.*, were destroyed by the violence of the late storms.—*Morning Post.*

Semaphore on Shooter's-hill.—The engineers have been surveying the ground between Shooter's-hill and Woolwich, for the purpose of erecting a semaphore, and perhaps a fort, upon that spot. Should a battery be erected there, it would be found that one or two traversing guns will command the river below the Royal Arsenal—*Rochester Gazette.*

Dangerous State of the South Coast.—During the late severe gales, upwards of 100 lives were lost on the Dorsetshire coast, between the adjoining ports of Bridport and Weymouth.—*Times.* [Surely this calls for some remedy. Why are not ports of refuge established in different parts of our coast, as recommended by the Committee of the House of Commons? The utility of Ramsgate and Plymouth has now been fully established, but doubtless the absurd standing orders impede this branch of public enterprize, as they do others.]

Common Road Steam Carriages.—Sir James Anderson, an Irish baronet of peculiar ingenuity and extensive fortune, has completed a vehicle of this class, which will be placed, about ten days hence, upon one of the London roads, and is warranted to perform fifteen miles within the hour. Sir James's experiments to accomplish this object have been so costly, that upwards of 30,000*l.* were sunk on them some months ago.—*Irish paper.*

Waterloo Bridge.—A general assembly of the proprietors of Waterloo-bridge was held at the Crown and Anchor, Strand. Mr. Bredell, the secretary, read the last half-yearly report to the 23rd of August. The report stated that the select committee appointed, on the motion of Sir M. Wood, Bart., M.P., to consider the interests of the Waterloo-bridge proprietary as regarded the City Improvement Bill, had not come to any decision on which they could report. The soundings of the bed of the river had, since 1835, suffered but trivial variations, not exceeding six inches in any direction connected with the bridge, and the latter structure continued without the least defect. A gradual improvement has taken place in the receipts of the bridge. Mr. Plews observed that the approaches to the bridge contained an accumulation of water which had saturated the embankment, and would ultimately reach the abutments and wall of the bridge, if a remedy was not immediately applied. The chairman, in reply, said that the directors had arranged to abate the evil complained of in the early part of next spring.

Sea Ordnance.—At Woolwich Dockyard the workmen are busily engaged in enlarging the bores of 24-pounders for the purpose of lessening the weight of ordnance between four and five cwt., and at the same time enabling them to discharge a 32-pound shot and shell of the same calibre. This is in accordance with a plan some time since recommended by the late Lieut.-General W. Miller, R.A., and which will thus enable the guns to be worked with greater facility.—*Morning Advertiser.*

Hollow Shot.—The Prince George, which has been used to ascertain the effect of the hollow shot and shell fired from the Excellent, has been taken into the South Dock to be broken up. Her appearance sufficiently indicates the tremendous effect of these projectiles, as well as the skill and precision with which the scientific and practical course of instruction pursued on board the Excellent is arming our officers and seamen.

NEW CHURCHES.

Catholic Cathedral.—It is stated in a provincial journal to be the intention of the Roman Catholics to erect a magnificent cathedral in London, and that 100 wealthy peers and commoners are expected to subscribe 1,000*l.* each towards it.

Worcester.—It is in contemplation to build a church on the site of old St. Clement's, in the city of Worcester, to be called the Watermen's Church. This will, it is hoped, prove a great blessing to this hitherto much-neglected people.—*Ibid.*

New Church, Meltham Mills, near Huddersfield.—This church, dedicated to St. James, was opened on the 2nd instant. It is built upon a plan recommended by the bishop of Sodor and Man, and will seat 250 persons; and adjoining it is a school for 600 children, which, by means of sliding shutters, may be thrown open and form part of the church. It is in the Gothic style, by Mr. J. P. Pritchett, York.—It is handsomely finished inside, lighted with gas, and has an excellent organ, by Ward, of York. The expense, which was 4,000*l.*, was defrayed by Mr. James Brook, the mill-owner.—*Leeds Intelligencer.*

Trinity Church, Gray's Inn Road.—This church was consecrated on Thursday December 13th, by the Bishop of London.

Astbury Church Spire.—This venerable structure (which was struck by lightning in August last) the pride of the surrounding district, has been raised to its former beauty and elevation by Mr. Thomas Wallworth, architect and builder, of Congleton.

Brighton.—The new church of St. John the Evangelist, which, through the praiseworthy exertions and liberality of the rev. vicar, is now in course of erection on Carlton-hill, is already nearly roofed in; and, as the works proceed very rapidly, it is expected to be completed for divine worship in six months from the present time.—*Brighton Gazette.*

Preston.—The first stone of a new Catholic chapel was laid on the 3rd ult.

Birmingham.—A new church, named Bishop Ryder's Church, was consecrated on the 18th December. It was erected under the direction of Messrs. Rickman and Hutchins, architects. It contains 1,574 sittings, 813 of which are free. The whole expense of erecting the church amounts to about £4,300.—*Leamington Chronicle.*

PUBLIC BUILDINGS AND IMPROVEMENTS.

Statue to Huskisson.—At the meeting of the Liverpool Town Council, on the 5th, a letter from Mrs. Huskisson to the Mayor was read, requesting permission to place a statue to her late husband under the dome of the large hall of the new Custom House. A resolution was unanimously agreed to, acceding to Mrs. Huskisson's request.—*Morning Herald.*

Coutts's Banking House.—Vast improvements are now going on at Coutts's banking-house, in the Strand, under the direction of Mr. Hopper. Great altitude has been given to several of the offices, by the removal of the floors of the rooms above; iron staircases have been constructed, and the adjoining house, westward, has been thrown into the former extensive premises. Messrs. Price and Manby have fitted up their apparatus for warming the various offices.

Hounslow.—In consequence of the dark state of that portion of the Great Western-road which passes through the town of Hounslow, a public meeting of the inhabitants unanimously resolved to light the town with gas, the expense to be defrayed by a private subscription.

Buckingham Palace is filled with workmen, employed in the repair and improvements now in progress. A portion of the wall extending from the Mews to the Conservatory will be rebuilt.

Kensington Palace.—Considerable repairs are going on in this palace.

Western Literary and Scientific Institution.—A new lecture theatre is to be built at the back of the premises in Leicester-square, under the direction of Mr. Godwin, jun. The estimated expense is 1,000l.

Carlisle.—The progress of the spacious public buildings is most satisfactory; the lecture room, for 800 persons, is nearly completed, and over it an exhibition room 56 feet 6 inches by 46 feet 6 inches, is now being constructed.—*Carlisle Journal.*

New Custom-house, Liverpool.—The long pending question of the warming and ventilating the Long-Room of the New Custom-House, is set at rest by an order from the Treasury to Messrs. Price and Manby, to apply their patent apparatus, a description of which we gave in No. 10 of our Journal. The great extent of this room, and the approaches to it having together a cubic content of upwards of 521,000 feet will require considerable power to raise the temperature sufficiently, and at the same time insure perfect ventilation; but judging from the very successful application of the system to the Elgin and Egyptian Galleries of the British Museum, the work-rooms of the Indigent Blind School, and other buildings of equal extent, there can be little doubt of the desired end being obtained.

Taymouth Castle.—Workmen have been busy during the last summer and autumn in building a wing to this magnificent seat of the Marquis of Breadalbane, to correspond with that on the east side, which formed part of the original building. It is generally understood that the cause of the completion of the building at the present time is to be referred to no less than an expected visit of royalty. Rumour says that it is fixed, so far at least as such movements can be so, that our young Queen is to visit her ancient kingdom of Scotland next year; and in the list of noblemen's residences to be honoured by her presence Taymouth Castle occupies a distinguished place.—*Perth Courier.*

Improvements in Westminster.—Notices have been served upon the tradesmen and other persons occupying tenements between Westminster Abbey and Grosvenor-place, Pimlico, at the instance of the Westminster Improvement Company, who state in such notice that it is their intention to apply to Parliament in the ensuing session for leave to bring in a bill for forming certain new squares, streets, terraces, &c., within the said district, and requiring the person upon whom such notice is served to give his or her assent or dissent to the proposed proceedings on or before the 1st day of January, 1839.

A marble bust of Sheridan Knowles has just been sculptured by Mr. Tate, an artist of Newcastle, for some spirited friends in the north.

FOREIGN INTELLIGENCE.

Danube and Black Sea Canal.—The negotiations between Austria and Turkey are going on with vigour. Austria undertakes the direction of this important work, which is to commence a little below Rassowa on the Danube, close to C ornavoda, and will proceed thence in a straight line to Lake Lorazo, falling ultimately into the Black Sea at Kustendji, where a port is to be established.—*Franconian Mercury.*

Public Works, Egypt.—Mehemet Ali has held a divan, in which it is said that the continuation of the dams on the Nile was deferred for want of money. For the same reason the railway from Cairo to Suez was postponed, but its place was resolved to be supplied by a canal.—*Journal des Debats.*

Gas in the Orkneys.—The town of Kirkwall, in Orkney, is now lighted with gas, which now burns in the *Ultima Thule.*—*Morning Chronicle.*

Restoration of St. Ouen.—The municipal council of Rouen have just approved of the plans for the completion and restoration of the church of St. Ouen, one of the Gothic *chef d'œuvres.* The estimate is 1,400,000fr. or 10,000*l.*—*Morning Herald.*

Russia.—The rebuilding of the Winter Palace, on which several thousand workmen have been employed during the summer, proceeds rapidly, and externally it is nearly finished. The Emperor, who viewed it a few days ago, expressed himself fully satisfied with the progress of the work. It is said that the state apartments of the palace will be ready for use next Easter. The commission which was sent at the beginning of the year 1837 to Teflis, the object of which was to draw up the scheme of a reform in the several branches of the administration in the Transcaucasian provinces, appears to have terminated its labours. Baron Von Hahn, the president, and some other members of the commission, have lately arrived here from Teflis. At the end of last month the Cleopatra frigate, Captain Grey, arrived here from Cronstadt, having on board the Marquis of Clanricarde, the British Ambassador. Count Strogonoff has returned from his extraordinary mission to London.

To-day there is to be a brilliant parade of the Imperial Guards, and the newly erected triumphal gate at the barrier on the Moscow road will be inaugurated. Their Imperial Majesties, and the members of the Imperial Family, arrived yesterday from Zarskojeselo, to be present at both.

Haarlem Meer.—In the second chamber of the States General at the Hague, on the 12th inst., a Royal message was brought up with a project of Cour, for raising a loan to defray the expense of draining the Lake of Haarlem.—*Journal de Commerce d'Anvers.*

The Government has lately purchased in England two iron steam boats—the Inkermann and the Newka. The first is intended to ply between Constantinople and Odessa. It arrived at Odessa on the 9th of this month, having performed the voyage from London in 38 days. The Alexandria steam boat, which ought to have arrived here on Monday, is not here. To-day it ought to set out on its return to Lubeck. We learn here that it has been compelled by a storm at sea to put into Ballischport.—*Hamburgh paper.*

Vienna.—The church of St. Stephen's is to be wholly repaired, and we are happy to find the *Vienna Architectural Journal* contradict the report current in Germany that part of the spire was to be taken down on account of the inclination in the upper part being 3 deg. 3 min. This we believe was caused in the siege by the Turks, and we believe is no more productive of danger than the settling of Salisbury spire, or the vibration of our Monument. The Town House, at Prague, as interesting as a work of art as it is from its historical associations, is also to be fully restored and beautified. The Emperor Ferdinand has at his own cost repaired the romantic castle of Karlstein in Bohemia, one of the best works of the Cinque cento; and instead of being used as a powder magazine, it is to be converted into a museum or national Valhalla, like that at Munich.

Bridge at Presburg.—The engineers have chosen the locality for the permanent stone bridge over the Danube at Presburg, which is to form part of the Vienna and Raaber railway.

Engineering Prizes in Hungary.—The recent devastation of the city of Pesth by inundation has caused the public spirited Count George Andrassy, to offer munificent prizes for the best treatises on the history of these overflows of the Danube, and the means of averting them, and with a generosity worthy of their donor, they are thrown open to foreign competition.

Texas.—A company has been formed to establish a road for waggons, and to carry on trade from Galveston Island through Chihuahwa to Montery on the upper part of the Gulf of California. —*New Orleans paper.*

Egyptian Dock.—M. Mongel, a French engineer, has arrived at Alexandria. The pacha has sent for him to confide to his care the construction of the repairing dock which Sahir Effendi commenced, but could not finish. M. Mongel's reputation leaves no doubt of his success. The viceroy has granted him 36,000 francs a year, and 2,000 for his lodging. If, as he has promised, M. Mongel terminates this work before three years, he is to have besides a gratuity of 60,000 francs.

Versailles Waterworks.—The king has appointed a Commission of engineers to inspect the waterworks at Marly, and to draw up plans for the better supply of Versailles with water.—*Galignani's Messenger.*

Suspension Bridges, Constantinople.—A French painter and architect, M. Hector Horeau, has drawn up the plan of a suspension-bridge, which is to open a new communication between Constantinople and Galata. It is to have several suspensions, and that of the centre is to be sufficiently high to admit of the passage of the largest vessels. The principle advantage of the construction will be to conciliate the naval movements with the public circulation. The plan, which is a sort of revival of that conceived by Michael Angelo for the same spot, is to be presented to the Sultan.

French Mail Coaches.—A decree has been issued authorising the Minister of Finance to pay 400,000 francs, or £16,000, for the establishment of the new mail coaches on the great roads of France.—*Moniteur.*

Quicksilver Mine.—We are informed by Mr. Cooper, that in boring near this place through the soft stone upon which this region of country is based, his auger, at the distance of several hundred feet from the surface, dropped into a lake of quicksilver, fourteen feet and some inches deep.—*Marengo Ala. Gazette.*

Paris.—The clearing away of the small houses surrounding the fine Tower of Saint Jacques la Boucherie appears to have been suspended. On the site of one of the porches of the church a reservoir is now forming for supplying the inhabitant of the adjacent quarters with filtered water.—In consequence of the frost nearly all kind, of masonry work has been suspended at Paris, and more than 15,000 workmen are, now out of employment in the capital.—*Galignani.*

Calais.—It is in contemplation to erect a new light-house at Calais, 200 feet high in the room of the Tour du Guet, which stands only 120 feet above the level of the sea. The precise spot of the new building is not yet decided upon, but a commission has been appointed to select the most eligible position.

The *Journal de Cherbourg* announces that the Minister of War intended to call for a credit of 10,000,000f. for the completion of the fortifications of Cherbourg and the establishment of a new powder magazine.

Greece.—The king has laid the foundation of a monument to Marco Bozzaris, at Missolonghi.—*Times.*

French Fortifications.—There are 121 fortified places in France, of which 21 are of the first class, 48 of the second, and 52 of the third.—*Times.*

Dutch Engineers.—The minister of the colonies, at the request of the governor-general of the French Indies, has published in the *Staats Courant* an invitation to the young officers of the Waterstaat who are unmarried, and if possible not above 26 years of age, to be employed in the colonial possessions, whither they will be sent, and in the first three years with salaries of 2 to 300 florins per month (20*l.* to 30*l.*), exclusive of other emoluments.—*Times.*

Australia.—The estimates of colonial expenditure for the year 1839 are, for roads, bridges, and streets, 25,970*l.* 2*s.* 0*d.*

The King of Bavaria has received, as a present from the Emperor of Russia, a vase of malachite, of extraordinary beauty and size, being twelve feet high with the pedestal.

Professional Press in Russia.—The government publishes the following:—Mining Journal, Engineering Memoirs, and Journal of Ways of Communication (roads and bridges). There is besides a Gazette of the Arts, published 48 times a year, with 100 engravings. Most of these are in French or German.—*Journal des Debats.*

Sleep on Railroads.—The following notice of an invention of accommodation "to sleep," as if at home, while travelling on railroads, appears in a recent number of the *Baltimore American*:—"The introduction of the newly-invented sleeping cars on our railroads makes that kind of travelling almost perfect—all that is wanting now is a dining car. The sleeping cars will soon be placed on the railroad between this and Philadelphia, so that travellers leaving here in the seven o'clock train may go to sleep in this city, and not be disturbed till they reach Philadelphia. These cars are fifty feet in length, and the seats, which are sideways, can, by a simple movement, be converted into *berths*; in each car forty-eight passengers can be accommodated with berths."

ANTIQUITIES.

Carthage.—Sir Grenville Temple has employed six months in executing excavations in the neighbourhood of the site of Carthage, and his labours have been rewarded by a variety of interesting discoveries. In the ruins of the temple Juno Cœlestis, at Ganath, the protecting divinity of Carthage, he found about 700 coins, different articles of glass, and earthenware utensils. But the most remarkable and unexpected of his discoveries has been that of a villa on the sea shore, and fifteen feet under ground. Eight chambers have been entirely cleared, and their form and decorations prove that the house belonged to some distinguished personage. The walls are painted, and the vestibule is paved in superb mosaic, in the same style as those of Pompeii and Herculaneum, and representing a variety of objects, such as marine divinities of both sexes, fishes of different species, marine plants, a vessel with women dancing on the deck, and surrounded by martial admirers, lions, horses, leopards, tigers, zebras, bears, gazelles, herons, and other birds. In the different chambers were found several human skeletons, supposed to be the remains of warriors killed during the storming of the villa. In another house Sir Grenville Temple has also discovered various interesting mosaics, representing gladiators combating wild animals in the arena, with the name of each combatant written over his head. In another part are represented horse-races and men breaking in young horses.—*Galignani's Messenger.*

A Roman Mosaic Pavement.—It will be remembered that Dr. Allnatt published a statement a few weeks since, which appeared in most of the public journals, of some ancient relics which had been discovered at Pangbourn, Berks, by the labourers employed on the Great Western Railway, and which were supposed to be of Roman origin. This supposition has received within the last few days further confirmation by the exhumation of an almost perfect floor of tessellated pavement, situated in a beautiful valley near the Thames, about two miles from the scene of the former discovery. It is conjectured to have been the floor in the chamber of a Roman villa. The pavement is formed of "quarries," or the small, irregularly square, detached tesseræ, so characteristic of Greek and Roman manufacture, and the figures are of the most elaborate and beautiful design. The ornamental portion, constituting the centre of the floor, is eight feet square, of four distinct colours, viz., red, gray, brown, and white. The colour appears to be formed of a species of fire-hardened cement laid upon the surface of the tesseræ, for it is superficial, and does not pervade its whole structure. The discovery has excited much interest: a great many persons from distant parts of the country, artists, and scientific gentlemen, having visited the spot; they are unanimous in declaring the floor to be a beautiful and interesting specimen of ancient art. The site of the house (or, as some imagine it to have been, a military tent) can be traced with tolerable accuracy by the lines of mortar, charcoal, and flints, used in the foundation. Two human skeletons were lying exterior to the walls, near one of which a Roman coin was found, and by the side of the other a curious species of broadsword, which antiquarians suppose to be identical wi h that used by the auxiliary legions. Orders have been given by Mr. Brunel, the engineer, for the whole to be preserved entire.—*Times.*—[It is with great regret that we have since learned that Mr. Brunel has directed this interesting relic to be broken up. Messrs. Grissel and Peto, however, have had a drawing made, which is intended to be lithographed. We are sorry to see this disrespect for objects which are of universal interest to every man of education and refinement. Such deeds of barbarism have been but too frequent, and geologists have repeatedly complained of the ravages which have been committed through the negligence of the engineers. Very little expense would have restored this pavement, and it would have formed an interesting object in the waiting-room of the station. We do not see, indeed, why museums should not be formed at every station, illustrative of the geology of the line.—Editor C. E. & A. Jour.]

Irish Canoes.—A short time ago, when the water was drawn off, for the purpose of deepening a part of Lough Reavy, nearest the discharge pipes, three old canoes, of very antique appearance and construction, being apparently hollowed out of a single tree, were discovered imbedded in the mud. One has been conveyed to Lord Downshire's seat at Hillsborough; another is at Castle-Ward, the seat of the Bangor family; and the third is in the possession of Lord Roden at Tullymore.

The fine remains of the abbey of Savigny, near Mortain, in Normandy, have just been purchased by M. de Caumont, the well-known antiquarian, and will thus be preserved to the country.—*Galignani.*

MISCELLANEA.

Zincography.—The *Baltimore American* states, that a method has been invented of drawing on zinc, said to be very superior in effect to lithography. The mode of preparing the metal so as to fit it for the purpose is said to be a secret unknown but to one person in the country. In the process of stamping, a delicate pink tint is conveyed to the paper, by which the engraving is made to assume the appearance of drawing on chalk.

Sculpture.—The Duke of Devonshire, who was so liberal a patron of Canova has, during his present sojourn in Italy, added several fine productions of the chisel of Thorwalsden, Marchesi, and other living artists, to his already large and valuable collection of marbles.

Brighton Pavilion.—In the storm on the 2nd instant, at a quarter before twelve, a flash of lightning struck the pinnacle over the north gateway of the grounds, and carried a portion of it away, and shattered several panes of stained glass.—*Morning Post.*

Cheap Repairs.—A society has been formed at Paris for preserving and describing the French historical monuments of the middle ages. The economical labours of this patriotic association are well worth the attention of such as may be struggling to resist the havoc of time and man. In their accounts, which we have before us, we find that with a sum of only 68*l.* they congratulate themselves upon having, in six months, repaired the churches of the Lot and Auvergne, those of Montrezor, St. Louis, du Pré, and Beaulieu, the Chateau of Langeais, the Priory of Morlange, the tombs of Oiron, and stained glass of Pont-Audemer.

The tolls of the Andover and Basingstoke turnpike have been let at an increase of upwards of two hundred pounds per annum, in consequence of the additional travelling through Andover, occasioned by the partial opening of the London and Southampton Railway.—*Wilts Independent.*

Seyssel Asphalte.—The Seyssel Asphalte property is occupying the gentlemen of the long robe in France, and it appears doubtful from what has transpired whether there existed any right to transfer it to a company. It is very unfortunate that this was not found out earlier, as, whatever may be its other applications, the asphalte has paved the way to much gambling and serious misfortune to the shareholders. No mines of gold, silver, nor copper, ever excited more sanguine speculation.—*Ibid.*

Heart of Oak.—One of the piles used in the foundation of the old bridge at Lancaster was taken out a short time since, and found to be "as sound as an acorn," although it must have been under water at least 900 years.

Preservation of Sculpture.—Experiments are in progress at the Ecole des Beaux Arts at Paris, with some oily substance to be used for the preservation of marbles and works of art, which suffer so much in the wear and tear of a great metropolis.—*Galignani's Messenger.* [We do not know whether this is one of our neighbours' reinventions of old English inventions anew; but some years ago Henning, the sculptor used a coating of wax on the triumphal arch in the Park, and hitherto with complete success.]

The newly invented light of M. Gaudin, on which experiments were recently made at Paris, is an improved modification of the well-known invention of Lieutenant Drummond. While Drummond pours a stream of oxygen gas through spirits of wine upon unslaked lime, Gaudin makes use of a more ethereal kind of oxygen, which he conducts through burning essence of turpentine. The Drummond light is fifteen hundred times stronger than that of burning gas; the Gaudin light is, we are assured, by the inventor, as strong as that of the sun, or fifteen thousand times stronger than gas, and of course ten times more so than the Drummond. The method by which M. Gaudin proposes to turn the new invention into use is singularly striking. He proposes to erect, in the island of the Pont Neuf, in the middle of the Seine and centre of Paris, a lighthouse five hundred feet high, in which is to be placed a light from a hundred thousand to a million gas pipes strong, the power to be varied as the nights are light or dark. Paris will thus enjoy a sort of perpetual day; and as soon as the sun of the heavens is set, the sun of Pont Neuf will rise.—*Mechanics' Magazine.*

NEW PATENTS.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 26TH NOVEMBER, AND THE 24TH DECEMBER, 1838.

John Small, of Old Jewry, Merchant, for "Improvements in the Manufacture of Thread or Yarn, and Paper, by the Application of certain fibrous Materials not hitherto so employed."—1st December; 6 months to specify.

Peter Taylor, of Birching Bower, in the County of Lancaster, Rope Maker and Slate Merchant, for "Improvements in Machinery for propelling Vessels Carriages, and Machinery, Parts of which Improvements are applicable to raising of Water."—1st December; 6 months.

Ambrose Bowden Johns, of Plymouth, Artist, for "Improvements in colouring or painting Walls and other Surfaces."—1st December; 6 months.

James Hartley, of Bishop Wearmouth, Glass Manufacturer, for "Improvements in the Manufacture of Glass."—1st December; 6 months.

Theodore Cotelle, of the Haymarket, Civil Engineer, for "Improvements in Extracting the Salt from Sea or Salt Water, and rendering it pure or drinkable, and in Purifying other Water."—1st December; 6 months.

John Player, the younger, of Longhor, near Swansea, Glamorgan, for "Improvements in Furnaces and Fire-places, for Consuming Anthracite and other Fuel for generating Steam, Evaporation, Smelting and Heating Iron and other Metals."—1st December; 6 months.

William Pontifex, of Shoe Lane, in the City of London, Coppersmith, for "Improvements in Apparatus and Materials employed in Filtering and Clarifying Waters and other Liquids."—1st December; 6 months.

John McCurdy, of Tonbridge Place, New Road, Esquire, for "An Improved Method or Methods of Generating Steam and applying the same to the Evaporation and Boiling of Fluids, which Method or Methods is or are applicable to Steam Engines and other Purposes where Steam is or may be applied."—1st December; 6 months.

Stanislaus Darthez, of Austin Friars, in the City of London, Merchant, for "Certain Improvements in the Construction and in Arrangement of Axles, Axletrees, and the Naves of Wheels for Carriages."—1st December; 6 months.

John Shaw, of Glossop, Brass Worker, for "Certain Improvements in the Arrangement and Construction of Wind Musical Instruments."—1st December; 6 months.

Luke Hebert, of Camden Town, Civil Engineer, for "An improved Mode or Modes of Fastening Trowsers and other Parts of Dress or Apparel." Communicated by a Foreigner residing abroad.—1st December; 6 months.

Daniel Chandler Hewitt, of Store Street, Bedford Square, Professor of Music, for "Certain Improvements in Musical Instruments."—6th December; 6 months.

John Chisholm and Marin Hyppolite Bellenois, of Pomeroy Street, Old Kent Road, Manufacturing Chemists, for "Improvements in treating Massicott, Litharge, and other Compounds of Lead, for the Purpose of obtaining therefrom Silver and certain other Products."—6th December; 6 months.

Godfroy Cavaignac, of Tavistock Row, Covent Garden, Gentleman, for "Improvements in Apparatus for transporting Materials for various Purposes from one Place to another, particularly applicable to Road Cutting and other Embankments."—6th December; 6 months.

Thomas Sweetapple, of Cotteshall Mill, Godalming, Papermaker, for "An Improvement or Improvements in the Machinery for Making Paper."—6th December; 6 months.

Frederick Neville, of Pancras Lane, in the City of London, Gentleman, for "An improved Method or Process of Manufacturing Coke, whereby the Salammoniac, Bitumen, Gases, and other resident Products of Coal are, at the same time, separately collected, and the Heat employed in the Process is applied to various other useful Purposes."—6th December; 6 months.

Miles Berry, of Chancery Lane, Patent Agent, for "Improvements in the Means of, and Apparatus for, Manufacturing Gaseous Liquids, and for filling Bottles and other Vessels used for holding the same, and retaining the contents therein, and applying the same when required." Communicated by a Foreigner residing abroad."—6th December; 6 months.

James Carson, of Liverpool, Doctor of Medicine, for "A new Mode of Slaughtering Animals intended for human Food."—12th December; 6 months.

Thomas Robinson Williams, of 61, Cheapside, Civil Engineer, for "Certain Improvements in Machinery for Spinning, Twisting, or Curling, and Weaving Horsehair, and other Hairs, as well as various fibrous Substances."—12th December; 2 months.

Henry Count de Crouy, of Picardy, in the Kingdom of France, now residing at 14, Cambridge-street, Edgeware Road, for "Certain Improvements in Filtration." Communicated by a Foreigner residing abroad.—12th December; 2 months.

John Alexander Eleazar Desgrand, of the Boulevart du Temple, Paris, now residing in Paul's Chain, in the City of London, Civil Engineer, for "Improvements in the Production of Motive Power, and in Machinery, for applying the same to useful Purposes."—12th December; 6 months.

James Gardner, of Banbury, Ironmonger, for "Improvements in cutting Swedish Turnips, Mangel Worzel, and other Roots used for Food for Sheep, horned Cattle, and other Animals."—12th December; 6 months.

Thomas Vaux, of Woodford, Land Surveyor, for "Improvements in Tilling and Fertilising Land."—15th December; 6 months.

Crofton William Moat, Putney, for "An improved Mode of applying Horse Power to Carriages on ordinary Roads"—17th December; 6 months.

Barclay Farquharson Watson, of Lincoln's Inn Fields, Solicitor, for "Improvements in Crushing or Preparing New Zealand Flax."—17th December; 6 months.

Edwin Edward Cassell, of Millwall, Poplar, for "Improvements in Lamps."—17th December; 6 months.

Job Cutler, of Lady Poole Lane, Birmingham, Gentleman, for "Improvements in Combinations of Metals applicable to the making of Tubes or Pipes, and to other Purposes, and in the Method of Making Tubes or Pipes therefrom, which improved Method is applicable to the Making of Tubes or Pipes from Certain other Metals and Combination of Metals."—17th December; 6 months.

James Lees, of Salem, near Oldham, in the County of Lancaster, Cotton Spinner, for "An Improvement in the Machinery for Spinning, Twisting, and Doubling Cotton, Silk, Wool, Hemp, Flax, and other fibrous Materials."—17th December; 6 months.

John Hawkshaw, of Manchester, Civil Engineer, for "Certain Improvements in Mechanism or Apparatus applicable to Railways, and also to Carriages to be used thereon."—17th December; 6 months.

Benjamin Goodfellow, of Hyde, in the County of Chester, Mechanic, for "Certain Improvements in Machinery or Apparatus for Planing or Cutting Metals."—18th December; 6 months.

John Roberts, of Manchester, Machine Maker, for "Certain Improvements in Machinery or Apparatus for Planing or Cutting Metals."—18th December; 6 months.

John Radcliffe, of Stockport, Machine Agent, for "The Application of an improved Covering for the Rollers used in the several Processes of Preparing Drawing, Slubbing, Roving, Spinning, Twisting, and Doubling of Wool, Cotton Wool, Flax, Silk, Mohair, or any other fibrous Material or Substance, or so many, of such Rollers as require, or are deemed to require covering for such several Processes, or any of them."—19th December; 6 months.

Joseph Zambeau, of St. Paul's Churchyard, Chemist, for "Improvements in Rotatory Engines." Communicated by a Foreigner residing abroad.—19th December; 6 months.

Andrew Smith, of Princes Street, Leicester Square, Engineer, for "Certain Improvements in Apparatus for Heating Fluids and Generating Steam."—20th December; 6 months.

Samuel Parker, of Argyle Place, Lamp Maker, for "Improvements on Stoves."—20th December; 6 months.

Carl Augustus Holm, of Mincing Lane, Engineer, and John Barrett, of Vauxhall, Printer, for "Certain Improvements in Printing."—20th December; 6 months.

Daniel Stafford, of 25, St. Martin's-le-Grand, in the City of London, Gentleman, for "Certain Improvements on Carriages, being an extension for the term of seven years, from the 24th day of December."—21st December.

ERRATA.

In the last number, page 403, in the description of Roe's patent water closet basin there is an error in lines 10 and 11; it states that "this chamber is *always kept* charged with water;" it should read, "the chamber is *only* charged with water when the handle is lifted, the water *at the same time being* discharged all round the basin."

Page 405, in the rule for converting French measure, line 9, describing the method of reducing francs into pounds, instead of "*add* two figures," read "*cut off* two figures."

TO CORRESPONDENTS.

Our correspondent respecting Dover Harbour, will hear from us by post.

Our correspondent at Carmarthen is informed that there is no defined dimension for slating called "*Queen's*"—both Queen's and Rag's vary in size from two to four feet in length, and from 18 inches to three feet in width; the average size is 36 inches by 24 inches; they are sold by weight, and not by the thousand.

"One of the Public" will be noticed next month.

We cannot notice Prospectuses of Companies at length, unless paid for as advertisements.

Subscribers are particularly requested to complete their sets of numbers for the first volume immediately.

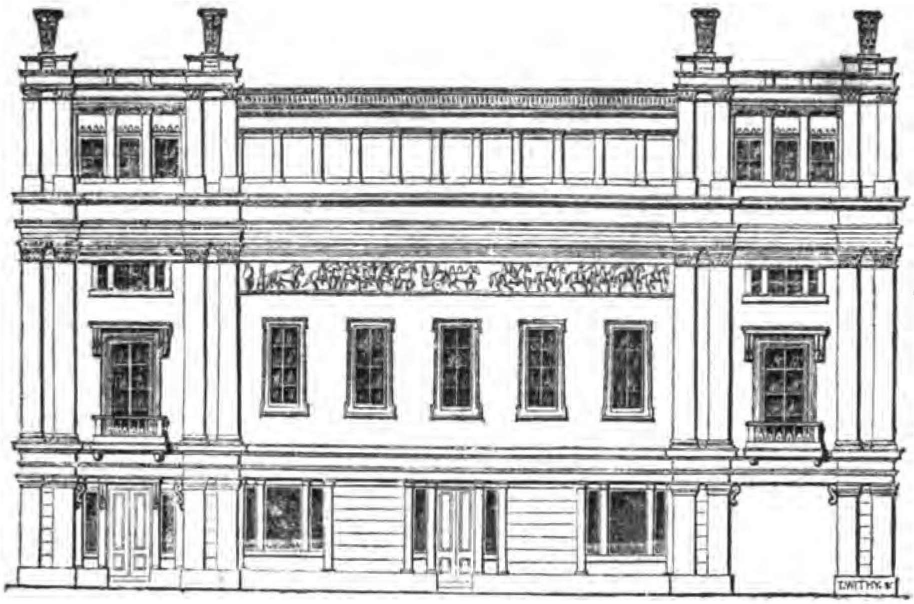
We shall feel obliged to the profession if they will forward us accounts of works in progress, new inventions and discoveries; and particularly if our country subscribers will send us any newspaper containing any matter relative to the objects of our Journal.

Books for review must be sent early in the month; communications prior to the 20th; and advertisements before the 26th instant.

*** The first volume may be had bound in cloth, and lettered in gold, price 17s.

THE ATHENÆUM, AT DERBY.

ARCHITECT, R. WALLACE, ESQ.



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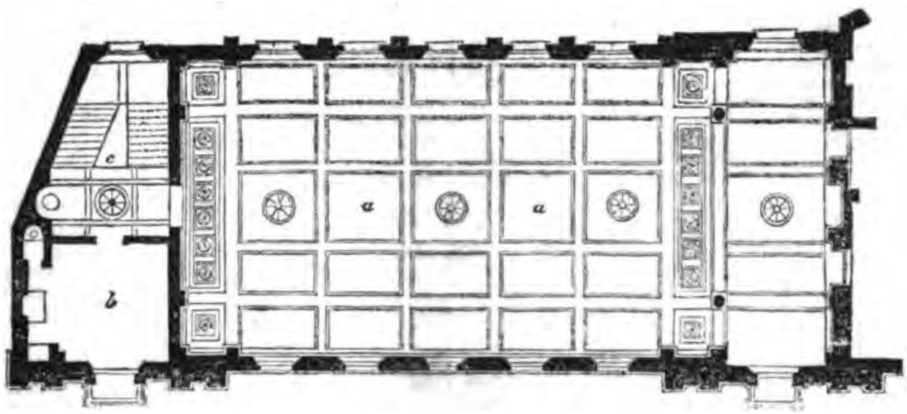
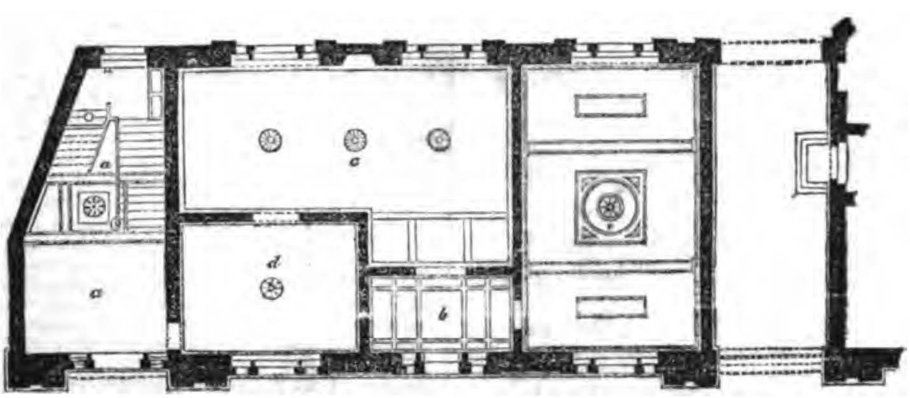


PLAN OF THE UPPER OR PRINCIPAL FLOOR.



PLAN OF THE GROUND FLOOR.

Scale of Drawings, 20 Feet to the Inch.

THE ATHENÆUM, &c., AT DERBY.

The "Companion to the Almanac" has already given a general view of the four buildings of which the Athenæum forms one, and a tolerably full description of them; yet although we have so far been anticipated by that publication, what is there said rather invites us to give further particulars respecting those spirited improvements than not, more especially as we are enabled, through the kindness of the architect, Mr. R. Wallace, to exhibit an elevation and plans of that portion of the design which has most architectural pretension and character, namely, the Athenæum.

As our wood-cut renders verbal description unnecessary, all that we need explain in regard to it is, that the blank space or opening in the lower part of the right-hand pavilion or wing is the covered gateway leading to the inn-yard at the rear of the building (as is shown in the ground plan), where is seen one of the entrances into the Hotel. Hardly, therefore, need we observe that the latter building immediately adjoins the Athenæum on that side, being divided from it below only by the covered passage or gateway between the two; but we should explain that both entablatures of the separate façade here shown are continued through the two fronts of the Hotel, so as to keep up a certain general uniformity of appearance, although the Athenæum forms a distinct composition. Indeed, further than the regularity thus produced by the continuation of the principal horizontal lines and mouldings, and that of the style adopted, there is little similarity; the elevations of the hotel presenting two ranges of windows above, the lowermost of which, or those of the first floor, rest upon a socle immediately above the cornice to the basement. Besides which, there is a series of smaller windows in the attic, which is somewhat lower than that in centre of the elevation here given. Consequently that portion of the entire line, or the south side facing Brook-street, has more of the dwelling-house appearance, while the Athenæum distinguishes itself by presenting what our French neighbours term a *monumental* character; to which both the disposition of the windows and the great proportion of solid wall contribute in no small degree. In this respect alone the design exhibits some novelty and piquancy, particularly in the centre compartment, where the three openings below and the five above them produce a good architectural contrast; though the effect would have been better still could the width of the two lower windows have been limited to that of their middle openings, because at present they extend too closely to the angles, where the adjoining antæ at the breaks indicate an inner wall, although, in regard to the rooms within, the windows are unexceptionably placed, as is apparent from the ground plan. The upper part of this centre compartment is well imagined—solid and unbroken, yet without either blankness or heaviness. The chief objection to be made to it is, that the cornice of the upper order is too poor and scanty—in fact, is only a repetition of that to the basement floor, whereas greater richness was here demanded, if only to bring it into keeping with the architrave beneath it, more especially as the depth of this latter is considerably increased by the mouldings of the antæ being continued immediately beneath it. We are bound to observe, however, that the projection of the upper facia and cymatium of this architrave have been greatly exaggerated by our wood engraver. The two pavilions or extreme compartments are pleasingly treated, and these features bear some general resemblance to the similar ones of the new Corn Exchange, Mark-lane, but by no means to such degree as to incur the charge of plagiarism. The tripods at their angles, through which the chimney-flues are brought, produce an excellent effect.

In the plan of the ground floor, *a a*, are the separate entrance vestibule and staircase leading to the Athenæum Hall above; *b*, the vestibule, to the library *c*, and news-room *e*. The former of these, which measures 36 feet by 16, or 21 at the widest end, opens into a smaller room *d*, appropriated as a reading room. The news-room *e* is 30 feet by 19.

The upper floor is, with the exception of the room *b*, which serves both as a committee-room and a cloak-room for ladies, entirely occupied by the Athenæum Hall, which extends over the gateway, whereby its total length becomes 69 feet by a width of 30 feet 6 inches and 23 feet in height.

While the general symmetry is well preserved, the apartment acquires not only much pleasing architectural variety in its plan, but apparent, as well as real, extension, by the addition of the division over the gateway. At the same time we are of opinion that it would have been an improvement had there been four columns at that end instead of two, so as to form four lesser intercolumns (of the width of those between the columns and antæ on each side) and a wider one in the centre. Such a screen of pillars would have made the two divisions more distinct to the eye, yet would by no means have separated them too much, or occasioned a crowded appearance, or obstructed the view of the fireplace at that end; for the centre intercolumn would have been 7 feet 6 inches wide, and the others nearly 5; whereas the distance from column to column is now 19 feet, which must be equal to the height of the columns themselves, if not more. Another thing that would have been an improvement would have been to remove the doors at that end of the hall further from the fireplace, putting them into the extreme inter-pilasters, so that one would have opened immediately into the card-room, the other (as at present) into the supper-room.

Judging from the plan, the back front of the Athenæum, appears to be of architectural design, although it only faces the inn-yard of the Hotel: at least the pilasters between the windows seem to indicate that such is the case; and, if it really be so, we think the cost so bestowed might have been better applied; more especially as that side of the building appears to be quite shut out from view by other buildings abutting on that angle of the Athenæum, where the staircase is placed, and in consequence of which the architect has been compelled to adopt a very irregular and inconvenient form for the staircase; whereas only four or five feet more at that angle would have greatly improved that approach to the Athenæum Hall. Above the hall is another room of the same dimensions, although considerably lower, which is lighted from above, and intended to be fitted up as a museum.

REVIEWS.

Observations on Limes, Calcareous Cements, Mortars, Stuccos, and Concrete; and on Puzzolanas, Natural and Artificial; together with Rules deduced from numerous experiments for making an Artificial Water Cement, &c. By C. W. Pasley, C.B., Colonel in the Corps of Royal Engineers, F.R.S., &c. London: John Weale, 1838.

We are indebted to Col. Pasley for this practical work, and for an admirable example of how theory may be applied as the assistant of practice. Cement has long since attracted a greater attention than stone itself, and many have longed for that power which enabled the Romans to make such durable works from materials so fragile. Col. Pasley has devoted himself to his task with an energy and application which have secured equal honour to himself and value to his admirable work. Few men immersed in professional labour have the time to follow up such subjects in a proper manner, for it is only from a connected series of experiments that success can be obtained.

The work now before us is the result of many years' labour and study, and enters elaborately into the examination of materials employed in building, and the cements used to unite them. He gives at great length his experiments on their strength and durability, and also on the quality of substances for forming limes and cements. He thus throws great light on the principles of construction, and enables us to ascertain the properties of the materials, the components of the mortars and cements, and the proportions in which they should be amalgamated. This is an important service rendered to the Architect and the Engineer, and gives the work a character of interest which we doubt not will be appreciated by our readers.

We make our first selection from the dissertation on limes, which conveys some judicious remarks on mortars:—

> We found by repeated experiments at Chatham, that one cubic foot of Halling lime weighed nearly the same when fresh from the kiln, and by the gradual addition of water that it dilated to the same increased bulk, in the state of quick-lime powder, but when worked up into mortar not too short for use, that it would not bear quite so large a proportion of sand as the common chalk lime had done. This experiment leading to a result in opposition to a common opinion amongst the builders of the metropolis, which is that the Dorking and Halling limes, as being stronger limes, will, when made into mortar, bear more sand than common chalk lime, I was induced to examine the principle upon which they found this opinion, which on consideration appears to me to be erroneous; because these two limes and all the other hydraulic limes are undoubtedly in an intermediate state between pure lime which is the weakest, and the water cements which are the strongest, of all calcareous cements: and every one will acknowledge that the proportion of sand, which will make good mortar with chalk lime, would entirely ruin cement, which if scarcely capable of bearing one third of that quantity. Hence it follows that the hydraulic limes ought not to admit of so much sand as chalk, but that they will bear more than cement, without being injured.
>
> Accordingly I conceive that three cubic feet of sand to one of Dorking or Halling lime, will be a good proportion for making mortar with those limes, which approach very nearly to pure lime. The water required will be nearly one cubic foot, and the quantity of mortar produced will be about two cubic feet and nine-tenths, being rather less than the original space occupied by the sand alone.

But the blue Lias lime will not make good mortar if mixed with more than two cubic feet of sand to one of lime. This opinion first formed by me from analogy, and in consideration of the blue lias approaching very nearly to a water cement, proved on due enquiry to be borne out by, and exactly conformable to, the practice of the masons of Lyme Regis. But Captain Savage of the Royal Engineers, who was employed professionally some years ago in improving the Cobb or Pier of that little seaport, which was done by tide work, and in which no other kind of lime was used, assured me that he found that a smaller proportion of sand than 2 to 1 made still better mortar. We have since ascertained by repeated experiments at Chatham, that 1 cubic foot of blue lias lime from the kiln weighing 47lbs., mixed with 2 cubic feet of sand, and about 3 quarters of a cubic foot of water, made mortar fit for use, but which could not have borne more sand without becoming too short. The average quantity produced was two cubic feet and one fifth, which contrary to the result obtained with the purer limes, occupied more space than the sand alone originally did. We found also that blue lias lime from the kiln, like all the other limes that we experimented upon, filled only about two thirds of its original measure, when reduced by pounding to the state of quick lime powder; but one cubic foot of blue lias lime when slaked, only dilated into one cubic foot and a third of slaked lime powder, not including about one eighteenth part of a cubic foot of core, which we threw away. Hence it expands less by slaking than either chalk lime or Halling lime.

The Colonel very justly attributes the *modern* introduction of concrete for foundations to Sir Robert Smirke, who first used it at the Penitentiary, Milbank, London. The Colonel remarks that :—

Neither gravel without sand, nor sand without gravel can form good concrete. The large pebbles composing the former, if mixed with quicklime powder and water would only be cemented together by lime paste, or as it is technically termed *lime putty*, filling up the large interstices between them, which is known to be the weakest form of lime. On the other hand, fine sand alone would produce nothing better than a mass of common mortar, which has very little strength in itself, but is excellent for cementing larger materials. The proportions of the gravel and sand used are of little importance, provided that the former be rather large, and the sand sufficient to fill up the interstices in it, for which purpose a mixture of coarse and of fine sand is better than one sort only. But no such mixtures are necessary, in using the sandy gravel of many parts of the Thames, where it is found in the state most suitable for making good concrete, and is employed both for this purpose, and as ballast for shipping.

It being known that clean gravel and sand when put dry into any measure, will almost immediately settle to a lower level on the addition of a certain quantity of water, and it being a matter easily proved that no ramming can possibly compress them afterwards, it appears to me, that the proportion of lime used in concrete should be just sufficient to combine with the gravel and sand in this compact state; that is after the violent action of slaking shall have subsided, which causes a temporary expansion, that is counteracted whilst in operation, but the usual process of treading down or ramming concrete.

Examples are given of several buildings in which concrete has been applied in the formation of the external walls, and the Colonel shews by their failure the impolicy of this mode of construction, however strongly he recommends its adoption for foundations.

The composition, commonly called Roman cement, has within the last few years been employed pretty extensively in the metropolis for building purposes, and has certainly greatly contributed to the extension of external decoration. A prejudice, however, still exists against its application for ornament in our churches and public buildings, which may have arisen from an improper use of it, and from the frauds of some of the manufactures, but the general result has been to convince us strongly of its applicability for these purposes. In our opinion, if of good quality and properly worked in the mixture with sand, it is of equal durability with Bath stone, and capable of employment for the same objects. An unfortunate prepossession against its application to ecclesiastical structures seems to prevail, even as if a mandate of interdiction were issued against it, although it would most certainly materially assist the architect in giving some character and decoration to these edifices. Neither would its expense be such as to call for a great increase of the penurious allowances of the church commissioners, who show as niggardly a spirit in these respects as if they wished to imitate the union workhouses. It would be well if the architects generally could prevail upon the proper authorities to allow its introduction, which we are sure could not fail to afford gratification to the public. It is only necessary to guard against the application of inferior preparations, and this could be fully secured by providing in the specification that the cement should be procured from competent manufacturers, which the architect may appoint.

We found by experiment at Chatham, that two thirds of a cubic foot of calcined Sheppy cement powder, which is equivalent to one cubic foot of cement from the kiln, would not bear much more than one cubic foot and one third part of a foot of sand, without evidently becoming too short for building purposes. This is equivalent to a mixture of two measures of sand to one of cement powder. But experience has shown that even this proportion of sand is too great in practice, for the builders of the metropolis, who have used immense quantities of the Sheppy and Harwich cements for many years, agree that more than 5 parts of sand to 4 of cement powder, or 1¼ measure of the former to one measure of the latter, injures the cement, by retarding its setting and rendering it too friable, whether used as mortar for walls, or as stucco for the fronts of houses; but they consider that equal parts of sand and of cement powder, involving a smaller proportion of the former ingredient, are still better.

But not to lose sight of the just comparison between cement and lime, these proportions, when stated in the same manner as we did in treating of lime, imply that whilst one measure of cement from the kiln will not bear more than two thirds or at the utmost five sixths of a measure of sand without injury, one measure of the various sorts of lime from the kiln, according to its quality, will bear two or three measures of sand or even more.

There are two properties of cement, which ought to be thoroughly understood.

First. It only sets rapidly when made up into small balls or in very thin joints. In large masses or in thick joints, the rapid induration takes place near the surface only, from whence it extends towards the centre so very slowly, that the cement there may remain in an imperfect state for a very long time. This property it has in common with lime mortars and concrete, which when in mass set more slowly at the centre than at the surface, in the like proportion (33).

Secondly. As was before remarked in article 42, cement is always weakened by sand, no matter how small the proportion of that ingredient may be, so that if both materials were equally cheap, it would be best to dispense with sand altogether in using cement as mortar for building walls, but not in using it as stucco for plastering the fronts of houses.

Numerous experiments have convinced me of the truth of these maxims, which any of my readers may easily verify. In respect to the latter in particular, take a small quantity of the best cement powder, mix it with three or four times its bulk of fine sand and make it up into a ball with water, and you will find that instead of setting, it will either remain quite friable or crumble to pieces, both under water and in air.

Upon the whole cement sets most quickly, and unites itself most powerfully to bricks or stones, when it is perfectly pure or unmixed with sand, provided only, that the joints be thin, I should say not exceeding half an inch in thickness. For this reason, in forming cement into chimney pots, copings, &c., where the general thickness much exceeds the above dimension, and consequently where pure cement alone would not make sound work, instead of frittering away its strength with sand, I would recommend fragments of broken tiles or gravel, to be mixed with it, the interstices of which are such as to allow the pure cement which fills them, sufficient body to attain a due degree of strength, without being quite so large as to retard its setting, and thereby cause weakness in the central parts of those spaces.

Among other interesting illustrations of the powers of cement, the Colonel has fully proved its great strength when applied as a joint for stone-work. One of these experiments was made upon two blocks of Bramley-fall stone, each 39 inches long, 29 inches broad, and 26 inches deep, weighing about 2662 lbs. The beds or contact surfaces of the stones at the joints were roughed over by picking down the surface; they were then united with some of Messrs. Francis & Son's best Roman (*English*) cement, composed of a mixture of Sheppey and Harwich cement stone. Six weeks after, the experiment was continued by suspending the upper stone, and loading the under one with weights, to the enormous extent of 36,544 lbs. without breaking the joint. This was then split by means of a mallet and chisel, when, to the Colonel's astonishment, it was found that with the exception of the outer part of the cement, which had been exposed to the air, and was extremely hard, the whole interior of the cement joint was softish, and neither resisted the action of the thumb-nail nor of a sixpenny piece on edge, which scored the surface to the depth of nearly a sixteenth of an inch. From this and other experiments, the Colonel deduces the importance of the "*application of cement in masonry, even in the union of the largest stones.*"

The author gives some experiments on the strength of stone, which we think will be found serviceable to the architect and engineer in the choice of this material :—

As the value and importance of artificial stone used for the walls of buildings, or for those of wharfs or docks, must depend upon its strength in opposition to a breaking weight, it now appeared desirable to ascertain its resistance in competition with that of the common building stones of this country, as well as with that of bricks and of pure chalk from the quarry, for which purpose I caused a number of similar small prisms, each four inches long and two inches square, to be cut out of all those substances, which being subjected to the proper breaking apparatus, yielded the results contained in another Table, No. VIII., and, in order to render this more complete, the cohesiveness of the same stones has been repeated from Table III., whilst that of well-burned bricks and of inferior bricks has been estimated, from the average of the strongest and some of the weakest results, recorded in Tables I. and II.

Table VIII.—Comparative Resistance of various Natural Stones, Bricks, and Chalk, reduced to Square Prisms of the same dimensions as the small Artificial Stones before Experimented upon, with their comparative Cohesiveness also.

Description of Stones, &c.	Weight of Prism, in Troy Grains.	Weight per cubic foot, in lbs.	Breaking weight in lbs. in several successive Experiments.			Average resistance, in lbs.	Average cohesiveness, in lbs.
1. Kentish Rag	10739	165·69	4286	3817	5099	4581	3773
2. Yorkshire Landing	9571	147·67	2976	2500	3185	2887	3642
3. Cornish Granite	11164	172·24	3179	2801	2445	2808	3841
4. Portland	9598	148·08	2105	2892	2958	2682	4004
5. Craig Leith	9383	144·77	1040	1786	1961	1806	2439
6. Bath	7945	122·58	708	694	596	666	1408
7. Well burned Bricks....	5944	91·71	704	795	717	752	3007
			955	622	640		
			722	706	823		
8. Inferior Bricks	......	......	204	262	522	329	1106
9. Pure Chalk (dry)	6157	94·99	414	265	314	334	473

In our next Journal we intend to continue our remarks upon this excellent work, and to give some farther extracts; and in the meanwhile we cannot too strongly recommend to the profession the utility of examining this work for themselves. We do not pretend to offer a substitute for the works which come under our notice, but rather to enable our readers to form such opinions as may guide them in their use and selection. It is as much as we can do in some cases of such extensive scientific works, to afford even a specimen; but in case of works like Colonel Pasley's, it would be indeed the old Greek story of offering a brick as the pattern of a house, to attempt to condense such important materials.

Westminster Improvements: A Brief Account of Westminster, with Observations on Plans of Improvement. By One of the Architects. London, 1839.

This small volume is designed to call attention to the plans of the author, as adopted by the Westminster Improvement Company, and is therefore necessarily subservient to that object. It contains, however, some interesting matter as to the site of Westminster, its levels, and its drainage, and some agreeably-written antiquarian matter.

The basis of Mr. Bardwell's plan is, that it shall be conducted on a large scale, so as to insure the thorough drainage of the district, which certainly cannot be effected by the piecemeal operations which are now adopted. Any change either in the population or the salubrity of the district in question, cannot fail to do some good, and the proposition is extremely opportune in the present state of the Houses of Parliament. We think, that in this consideration care should be taken not to mar the splendid mass of gothic which we shall soon possess, and this induces us to demur a little to Mr. Bardwell's admiration of the Italian styles. This comes strangely indeed from one who, in the early part of his book, evinces such a love for Edward the Confessor, and such a yearning for the preservation of St. Margaret's.

Considering the object of the work, we are not entitled to expect perfection, and we are therefore not very much astonished at an infusion of egotism, which prevails towards the conclusion of the book. We dissent, however, from Mr. Bardwell in some few of his opinions, and to some of these we beg to call his attention. We cannot see how the insalubrity of London can increase the fogs, for indeed if they arose from land miasma, they ought rather to have diminished from the draining and clearing of the metropolitan districts. He obliges us with a lengthened enumeration of the many causes of London unhealthiness, but he totally omits to state that London is one of the healthiest cities in the world, and that the average of human life has rapidly increased in value. We rather doubt also that our Saxon ancestors were the founders of the civilization of modern Europe, however much we might wish it, and we should recommend our readers to peruse this statement "cum grano salis." Mr. Bardwell may remember in what state Alfred found England after the time of Bede, and how France sank subsequently to the labours of Charlemagne and Alcuin. We dissent also from him as to St. Margaret's being a vestige of Edward the Confessor, and we cannot see any claim of antiquity which can be urged against its removal. The epithets applied to Westminster strike us also as rather incongruous, for we cannot see what resemblance it has to the Isle de la Cité, the Palatine Hill, or the Acropolis, nor what it has to do with the *στοά βασιλική*. "Lucus à non lucendo."

Public Buildings erected in the West of England; as designed by John Foulston, F.R.S., B.A. Quarto, 117 Plates. J. Williams. London, 1838.

This is almost the only work of the kind which has appeared in this country for several years, for, with the exception of Laing's, containing the Custom House, and some other buildings erected by him, we are not aware that any architect has published his own executed designs, although it used formerly to be by no means an uncommon practice among professional men. Gibbs, Adam, Paine, &c., for instance, published the plans and other drawings of all their principal edifices, and that at a time when architecture was comparatively little studied. It is all the more singular, therefore, that such custom should have been laid aside precisely at the time when architecture itself has become more prolific than it was during the last century, and when structures of very varied design are rising up yearly, if not daily, not in the metropolis alone, but in almost every provincial town of any note, and, in fact, almost all over the country. Whether it be that, notwithstanding the very increased scope and demand for architectural embellishment, there exists less demand than formerly for studies in design, both on the part of the profession and of private individuals, we undertake not to decide; but it certainly does look like a very anomalous fact, that such should be the case, let the cause be what it may. We could, indeed, make two or three guesses at the latter, one of which is, that those who have done most and best are not particularly anxious to bring out their designs as studies for the benefit of others; while those who have been less favoured by opportunity have not done enough to enable them to come before the public with a collection of the kind. Another reason, perhaps, is that, although greatly more has been done within the last twenty or thirty years than in the course of the whole of the preceding century, out of that number of buildings there are comparatively few that rise above a certain average standard of merit; consequently few that the public would care to have geometrical drawings of. Or, it may be that we are now so accustomed to behold decorated fronts, porticos, and other architectural embellishments, as to regard them as mere matters of course, and deserving no more than cursory inspection. Or else—but we will put an end to further conjecture; for even could we hit upon the real cause, it would be idle to expect that any thing we could say would tend to remove it. What may be taken for granted is, that there is no demand—we mean no adequate demand—for works of this description, else, doubtless, as is the case with all other produce, whether manual or mental, it would be followed by supply.

At all events, we bid welcome to the solitary "stranger" now before us, and not the less heartily because he comes from the provinces—from Devonshire and Cornwall, where, at Plymouth, Devonport, and other places, Mr. Foulston has erected not a few public and private buildings. Nor can we do better than give, before we proceed further, a list of those which form the subjects contained in the volume:—

Plymouth—The Hotel, Assembly Rooms, and Theatre, 47 plates; the Athenæum, 6 do.; Public Library, 5 do.; St. Andrew's Chapel, 8 do.; Do. Church, 8 do.; Exchange, 4 do. *Devonport*—Town Hall, 4 plates; Commemorative Column, 5 do.; Civil and Military Library, 5 do.; Mount Zion Chapel, 4 do. *Stonehouse*—St. Paul's Chapel, 1 plate. *Torquay*—Interior of Ball-room, 1 plate. *Tavistock*—Library, Ball-room, &c., 3 plates. *Cornwall*—County Lunatic Asylum, 8 plates. *Bristol*—Gaol, 5 plates.

Conceiving that every work ought in some measure to be judged by what it aims at, and by what is the author's professed aim, we shall here let Mr. Foulston explain himself, in order that more may not be exacted of him than he promises:—

> The author, in publishing this work, illustrating the buildings erected from his designs, makes no claim to originality, except as regards construction and adaptation. * *
>
> In exhibiting his designs, the author is aware they must be considered merely as models calculated for the atmosphere of a town remote from the metropolis, and, though spirited, proverbially poor. * *
>
> Many volumes of general plans and elevations have been published from time to time, giving some notion of *arrangement* and *proportion*, but affording none of that *practical information* which chiefly, of a professional student, constitutes the value of an architectural book. While, therefore, it has been the author's aim to obtain the attention of the amateur by his general elevations and perspective views, he has been still more desirous of attracting the notice of the young architect by his "details at large," as they are architecturally termed; and by thoroughly developing the internal mechanism of his more important buildings.

With these extracts from the plain and sensibly-written "Address" prefixed to the work, an address so different from the pompous, lumbering prefaces which a certain other party puts to his publications, we dismiss the work for the present, reserving our further remarks on it for our next number.

Hints to Mechanics on Self-education and Mutual Instruction. By TIMOTHY CLAXTON. London: Taylor and Walton. 1839.

Just in the same manner as in physical subjects we value the experience of practical men, so in moral and social questions we derive pleasure from seeing them treated by those who are "to the manner born." This is the gratification which must be communicated to every reader of the amusing book before us, which has all the ease and simplicity of De Foe, and the exemplary utility of Franklin. To the mechanic it offers at once an example and a pleasant companion in the pursuit of knowledge, and to the general reader it affords a deep insight into those labouring classes which are the sinews of the nation. This bearing of the work we must, however, leave to our literary brethren, and content ourselves with such practical extracts as may be of interest to our utilitarian readers.

The author, in his plain and easy style, while giving an account of his labours in Russia, thus mentions the columns of the church of St. Isaac, the greatest cathedral work of the present century:—

Some of their columns made of granite are very large and highly polished. I took the pains to measure one of the columns intended for a new church, and found it fifty-six feet long, and near seven feet diameter at the base. They were brought from Finland, and two of them were a load for a ship, one on each side of the masts, to balance each other. They were rolled from the deck to the vicinity of the intended building on timbers nine inches square, (placed but little distance apart,) which were completely crushed to splinters. The rolling was performed by two ropes; one end of each being made fast, some distance a-head, to stakes driven into the ground. They were passed under the column, up the back side, and over the top. The other end of each rope was wound round a separate capstan. Each capstan had four long levers, with from ten to twenty men at each lever. These columns were placed in a temporary building for polishing.

I also visited the foundry where the bases and capitals were made. They were of brass, of the Corinthian order, and highly polished and gilt. The square *plinth* for the bottom measured about nine feet on each side, and one foot thick. Several women and children were polishing these with pumice-stone. The *torus*, a round bead belonging to the base, was turning in the lathe, and the workman had a very strong tool for this purpose. A steam-engine, with a man to attend it, was employed entirely on the work. The capitals, with their leaves and volutes, had a very splendid appearance.

The following is but one feature of the great scale on which they do things in Russia. The whole empire, indeed, is a great poor-law union, which beats our Somerset House commissioners by a long way: the whole is carried on with such system, that it almost realizes the satirist's suggestion of boarded, lodged, clothed, and flogged by steam:—

The building in which I was engaged in putting up the gas-works, was for transacting the business of the Russian army. In this building were several departments, with a "general" at the head of each, some of whom employed above two hundred clerks. In this building I saw lithographic printing for the first time; copper-plate and letter-press printing were carried on here, and a very extensive establishment for the manufacture of mathematical instruments, all belonging to the government; also a drawing-school, consisting of about two hundred young officers.

The next extract exhibits another of their arrangements for removing great weights:—

In another building I noticed a model of the machine on which a large block of granite, weighing upwards of nine hundred tons, was removed several miles. Peter the Great is said to have stood on this rock, giving commands to his army, when he subdued the Fins. The Empress Catherine ordered it to be removed to the city for a foundation on which to place a bronze statue of that monarch on horseback. Many ineffectual attempts were made for its removal; but it was easily performed afterwards by introducing cannon-balls for rollers between bars of iron.

The three wood-cuts exhibit some ingenuity, and although there is little that is new about them, we thought that they might be of interest to some of our readers:—

Fig. 1.

Fig. 2.

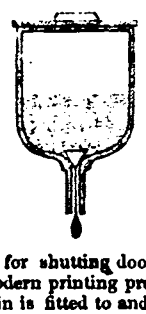


Fig. 3.

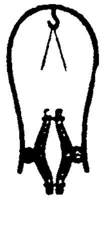


Figure 1 represents a contrivance for shutting doors. The power is applied in the same manner as in our modern printing presses. There is a pin at each end of the apparatus: one pin is fitted to and turns in a socket attached to the frame, and the other is fitted to a similar one on the door. In opening the door the pins are brought nearer together, and the weight in the centre is raised. The door is shut by this weight straightening the bars, and spreading the pins further apart. Some of these articles are made of iron, and are black; others are of brass, and kept bright; both kinds are extensively used. Figure 2 is a cistern for water, with a valve in the bottom, which is much used for washing the face and hands. By raising the valve the water is let down in small quantities, and, as it is used, passes off by means of a sink placed underneath. The advantages of this method are that persons do not wash in the same water with others, nor use it more than once themselves, which is not only more conducive to health, but makes less water necessary than washing in a common basin. These cisterns are made of various forms and sizes. Some of them have a dozen or more pipes, each furnished with a valve, so that many persons may wash at the same time; the large ones are made in a circular form, and placed in the middle of a room, but the small ones are hung against the wall. In figure 3 is represented a spring bow or arch. This is used with the horse-collar, for the horse that is placed in the shafts, as other horses do not have them. It was a long time before I could see any other use for this contrivance than to cause the horse to hold up his head, and to keep him from stumbling, by the bridle being hooked to the top of this arch. I was informed afterwards by an intelligent man, that the spring being connected with the collar prevented the shoulder of the animal from chafing, by continually easing the collar off, and suffering the air to pass between that and the shoulder of the horse.

This work will doubtless prove of considerable interest to our American readers; but the strict boundaries which limit the sphere of our labours, prevent us from entering into the work generally. It may, however, be read with gratification, for, as a piece of autobiography, it is as amusing as it is valuable, and fully reflects the character of its author, who is known and esteemed for his endeavours for the improvement of his working brethren.

Journal of the American Institute for Promoting Agriculture, Commerce, Manufactures, and the Arts. Vol. 3. New York. WAKEMAN, 1838.

THIS is a publication belonging to the New York Society of Arts and Manufactures, and is an excellent compilation of valuable materials from European and native sources. We find that our own work, among others, has been laid under contribution.

It contains, among other interesting subjects, the account of the last mechanics' fair at New York. Mechanics' fair is the term for an exhibition like that of the Conservatoire des Arts et Metiers at Paris, or rather like those of some of the continental provincial towns, and it is an omnium-gatherum of new inventions, old manufactures, confectionary, pictures, baby-linen, penmanship, perfumery, hobby-horses, and the fine arts. At the last fair there were above 1,500 contributors, and 160,000 persons paid down their admission shillings to the tune of about £2,000. The greater part of this money is re-issued in the shape of medals and premiums, and the institution, no doubt, stimulates enterprize equivalent to its popularity.

These fairs both at Boston and New York are strongly supported from political motives, being mainly upheld by the home manufacturing party. It is astonishing to see the strength with which protective duties and anti-free trade notions are maintained in the annual addresses; and it is very truly observed that partial free trade, without universal concurrence, is something like Governor Penn's peaceable constitution, laid at the mercy of neighbouring nations. Free trade is no favourite in the northern states, so that if our political economists are in the right, the progressing nation must be behind-hand for once.

We feel very happy to see ourselves in the far-west, for it is an additional proof to our readers, that we have been successful in endeavouring to fulfil our duties to them, while it imposes on ourselves the task of seeing that our labours may be such as to merit the extended circulation which our work has obtained both in the old world and the new.

Map and Sections of the Railways of Great Britain, with Tables of the Gradients. By GEORGE BRADSHAW. Manchester: Bradshaw, 1839.

This is a very careful compilation, on a large scale, from the best authorities, executed in a good style, and surpassing any publications of the same kind yet attempted. The railways for which acts of Parliament have been obtained are accurately delineated, and the accessories are executed with equal attention. The canals and roads are given in such a manner as to render it equally valuable for a general map as for its special object. By the side of the map are sections of all the railways, enabling the spectator to form an estimate of the gradients at a glance. The canals in the map have their levels marked upon them, and it would have been a considerable benefit if the same plan had been pursued as to the railways.

On the whole, it is a work which does credit to its compiler, and seems to be attended with few faults either of omission or commission. By some error of the colourist, the Oxford and Dudcot branch is represented as if it had obtained parliamentary sanction, and we observe that this and some other minor proposed lines, as the Harwich are inserted, while others in agitation, as the St. George's Harbour, Morecambe Bay, &c., are omitted. We suppose that the London Grand Junction is left out on account of the expiration of the act. We are glad to perceive that an announcement in the prospectus as to all the levels being reduced to that of low water at Liverpool is incorrect, although it would be advantageous if the datum were taken from the Trinity standard, as that of the longitude is from Greenwich.

In conclusion, we may award the meed of approbation to this work, as being one of great practical utility, and conferring high honour on its compiler. It is most appropriately dedicated, by permission, to James Walker, the President of the Institution of Civil Engineers; and thus, while it acquires a higher value with the public, pays an honourable tribute to the exertions of that gentleman.

LITERARY NOTICES.

The Monthly Chronicle, with an article on the Great Western Railway question, has been sent to us, but we have not thought it necessary to extract from it, as the matter seems only a dilatation of Mr. Wood's report, published by us in our present number. As to the argument pursued by the well-known author, relative to atmospheric resistance, he shows too much doubt himself of its feasibility by the intercalation of the phrase "in the present state of science," to render it necessary for us to refute it. Perhaps the author may do so himself; at any rate the present experiments are evidently incomplete, and it does not follow that a ratio of resistance existing at a certain period should continue uniform throughout. This resistance, as well as others, may be subject to the cyclar law of variation, and like the velocity of boats on canals become more favourable at a higher speed.

That valuable and cheap compilation, *Wyld's Monthly Index to the Times Newspaper*, has with the new year increased the sphere of its labours, and is enlarged to an *Index to the Metropolitan Morning Papers, Times, Chronicle, Herald, Post, and Advertiser*. It gives for the same price as before, 10,000 distinct references to 3,000 heads, and presents such a mass of figures, that were it not for the clearness of the arrangement, it would be sufficient to repulse the reader. The address contains some most interesting remarks, and the work itself is of that utility that no man of business should be without it.

Our attention has been called to a pamphlet entitled, *Hints on the adoption of the Broad Gauge on the Great Western Railway*, by Traffic; but as it is only a puff of a proposed line, repeating oft-refuted assertions, we do not think it necessary "to burnish the refined gold."

We have examined the last three parts of *Dr. Ure's Dictionary*, and we feel pleased to see that it still maintains its high character for utility. In the last number, which is the fifth, is an interesting table of chemical formulæ, and an excellent account of the manufacture of gas, which we should be tempted to extract, were we not assured that most of our readers have provided themselves with the original work, so that it would be like carrying coals to Newcastle. We see that the Doctor promises a new work on chemistry, which we have little doubt will be, like his other compilations, a valuable addition to the stock of science.

We shall refer to *Davy on Foundations* in our next Journal.

ORIGINAL PAPERS, COMMUNICATIONS, &c.

RALPH REDIVIVUS.—No. 18.

THE EXCISE OFFICE.

Most persons, I am inclined to suspect, employ certain current epithets and phrases, either without attaching any meaning at all to them, or else a very false one. One of the cant terms thus bandied about is *simplicity;* but when you ask what is meant by simplicity, you are stared at as being a most dunce-brained ignoramus, or an exceedingly disagreeable and impertinent bore. The result of all your inquiries and cross-questioning will be, that simplicity is simplicity, nothing more nor less, and that you must be a prodigious simpleton not to understand it. Perhaps, the better definition would be that it is a quality which everybody admires, or pretends to admire, which most people fancy they can see where it does exist, and which very few can perceive when it is actually before their eyes.

That it exists, for the most part, only in the imagination, or, perhaps, only upon the tongue, can hardly be denied, when we consider the sort of things which are praised for their simplicity, although more frequently than not, they are mongrel compounds most clumsily put together: for instance, a dull school-boy copy of a portico, (that is, of a few columns with an entablature and pediment—tied to a building where it is not only superfluous as far as utility is concerned, but worse than superfluous, a positive absurdity as regards consistency of style, or even mere artistical effect), shall be admired for its simplicity, although it ought rather to be reprobated as a vulgar affectation and absurdity, manifesting nothing so much as sheer obtuseness of taste, and utter sterility of ideas. On the other hand, that it cannot be perceived or estimated when actually placed before people's eyes can hardly be denied, when we consider how ill we appreciate an edifice that, for its dignified simplicity and unaffected nobleness of expression, has not its equal in the metropolis. I mean the EXCISE OFFICE. Let any one, after looking at the tawdry insignificance of the columned façades in the Regent's-park, go and contemplate the unpretending grandeur of the edifice in Broad-street, and he cannot fail to be struck with the vast superiority of the latter, and with the imposing presence it makes. If such really be the case, it will be said, how happens it that its merits have been overlooked, and that no one ever refers to it as a piece of architecture? Is not that extraordinary? *Tout au contraire;* that it should be neglected is quite in the ordinary course of things. It is marked by no striking features, much less does it recommend itself to the vulgar eye, by any of those *prettinesses* which are almost sure to command vulgar applause. Its value lies in character and expression, and in its totality of effect, qualities which, it would seem, are altogether caviare to the million. Besides which it is not, like St. Bride's steeple, one of those things for which the good citizens are taught from their infancy to entertain traditional admiration. While it is too old to be stared at as a modern improvement it is not old enough to be gaped at as being of long standing and universal note. Above all, it has never, like some productions greatly inferior to it, had the good luck to have a current reputation given it, by any generally recognized critical authority.

Nevertheless, all honour be to James Gandon, for in what he has here achieved, he has shown the true feeling of a master. It is, indeed, almost the only thing in all London that really looks like a palace, or that is worthy to pass for one. That erected, in evil hour, by Nash, admits of no comparison with this edifice, for greatness of manner, and stateliness of appearance. There, every part has a squeezed-up, little, and finical look; and, notwithstanding that there is a good deal of embellishment, or what is intended as such, the building has not the slightest air of richness; neither does it offer anything that can properly be termed variety; but, contradictory as it may sound, is stamped by insufferable monotony, although it exhibits nothing whatever of unity.

It is absolutely refreshing to turn from Nash's architectural *Micromegas* to this work of Gandon's, where the eye reposes with prolonged satisfaction on the breadth and *grandiose* physiognomy of the *ensemble;* to which all the proportions very happily contribute. Considerable as is the extent of front, it is not so great as in any degree to counteract the expression of unusual loftiness, which may be said to be the predominating one; and what conduces not a little to it is that there are no horizontal members dividing the height, and cutting it up into a succession of distinct compartments from the ground to the summit. If we compare it in this respect with Inigo Jones's building at Whitehall, we can hardly help feeling the great superiority of Gandon's. There, we behold a diminutive basement, and two small orders without any crowning member to give importance to the summit of the edifice; here, a basement of unusual loftiness comprising two series of windows, and above it a principal and secondary floor surmounted by the cornice that crowns the entire mass. Without thereby losing any of the consequence it derives from height, the first-mentioned portion of the structure acquires more importance in the design from the variety thrown into it, owing to the modes of rusticating employed, that below being of a more masculine character than the other. Nor is variety the only merit arising from this combination, because, to my eye at least, the upper part of the basement thus forms an agreeable transition from the more massive substructure to the more finished superstructure. This duplication of the basement is, besides, excellently well-motived by the lofty arch, which is so effective a feature in the whole composition. Substitute an ordinary sized doorway for it—either in idea or upon paper, and it will instantly be evident how greatly all the rest would suffer by such alteration alone. Another circumstance that mainly contributes to the air of external grandeur and internal spaciousness which distinguishes this piece of architecture consists in the proportions between the solids and apertures. Even in some parts of Somerset-house, a certain *petitesse* prevails, owing to the windows being too numerous for the surface they occupy; besides which the intermixture of windows with dressings and others without them, upon the same floor produces a patchy and parsimonious appearance. Here, on the contrary, the apertures are admirably proportioned to the whole façade, are effective but not obtrusive features—and although far from petty in themselves—subservient to the larger spaces; whereas in the building by Jones before alluded to, the windows predominate too much, and cause the columns and pilasters to appear diminutive in comparison with them.

Honour be to James Gandon, an architect to whom Dublin, I should observe, is indebted for its finest structures, and the author of what is undoubtedly by far the finest specimen of simple unadorned grandeur in our own metropolis.

CANDIDUS' NOTE-BOOK.

(Second Series.)

[The First Series of these papers appeared in the "Architectural Magazine," which work being now terminated, the writer has consented to continue them in this journal, under the same title, as that will identify him at once—perhaps recommend him better than a fresh one, to those of his present readers who here meet with an old acquaintance.]

FASCICULUS I.

I. Within about the same time that was employed on the single church of St. Peter's at Rome, the northern metropolis, named after the same saint, has arisen from its foundation to its present magnitude and grandeur. Yes, not quite a century and half have elapsed since the site of St. Petersburg was a dreary morass, and ere that century and half will have been completed, will the St. Isaac's church, one of the most stupendous achievements of modern architecture, be finished. The works are now proceeding with great rapidity, and it is confidently anticipated that the whole will be completed by the year 1842; and whenever it is, it may perhaps challenge the world to produce its equal for external grandeur and for sumptuousness of material. The whole of the exterior will be of marble, granite, and bronze, and the dome will be gilt with ducat gold. The height of this dome is 340 Russian feet, or very nearly 400 English ones, consequently greatly exceeds that of St. Paul's, which difference, though inconsiderable in proportion to their actual size, gives prodigious increase of magnitude, just as every additional inch above six feet does to the stature of a man. The number of columns, each consisting of a single piece of highly-polished granite, is 104, of which those forming the porticos are nearly sixty feet high, and the remaining thirty-two, around the tower or tambour of the cupola, of somewhat less dimensions. Neither is it in the magnitude alone of some of these structures that the Russians surpass us, but also in the celerity with which they execute them. The Winter Palace at St. Petersburg was burnt down about the same time as our Royal Exchange; but while the ruins of the latter are but just cleared away, the former is by this time rebuilt!—at least, in the middle of last August the works had advanced so far that it was expected the Emperor would be able to hold his new-year's levee there, for no fewer than five thousand men (a great number of them soldiers) were employed on the edifice. Very possibly this energy may in some respects be censurable, inasmuch as hardly any time can have been allowed for duly maturing the plans; but it certainly offers a very striking contrast to the drowsy mode in which we proceed here at home. The British Museum creeps on at a most tedious snail-like pace; indeed, if it does not soon begin to mend its pace, it is hardly likely to be finished before they end of the present century.

II. To me it appears almost inexplicable, that among the swarms of tourists and travellers who return every season from abroad with the materials for a volume or couple of volumes in their note-books, there should never be an architectural one. Most assuredly it cannot be because an architect can now meet with nothing that has not been described again and again, since to go no farther than Paris and Versailles, they alone would furnish matter both of description and criticism hitherto quite untouched. Even the hackneyed route to Rome affords many ungleaned patches, there being scarcely an Italian building of the present century which has obtained any notice from travellers. It is true, Italy has produced comparatively little in the way of architecture of late years; nevertheless, much has been accomplished that is exceedingly well worthy of note. There is, for instance, Canova's Tempie di Passagno, or Church at Passagno; to say nothing of several beautiful edifices at Milan and elsewhere, by Cagnola, and others by Dordoni, Bianchi, Durelli, Di Secco, Peverelli, &c. But if Italy holds out little that is new, there are Munich, Berlin, St. Petersburg, and various other capitals, which are as yet quite untrodden ground to English architects—places where they might at any rate pick up some fresh ideas. Non-architectural writers and tourists, on the contrary, are apt to make exceedingly bad work of it, whenever they attempt to describe buildings or discuss their merits. It is, therefore, quite a god-send when we meet with such clever descriptive sketches as the "Critical View of the Architecture of New York," and the "Fragments of a Provincial Tour," in the concluding number of the "Architectural Magazine." The only fault in them is, that, although not short articles in themselves, they create a longing for very much more from the same pens. Mr. Humphries ought to extend his tour much further; and, as he is quite *au fait* with his pencil as well as with his pen, should give it to the public in an illustrated octavo volume. His intelligent descriptions and remarks would be most acceptable, particularly were the former to be somewhat more expanded.

III. Among much other information to be obtained from Mr. Humphries' "Provincial Tour," the following is not the least worth notice:—"Beyond the church (at Manchester) I found the old college, an interesting building, unrestored and unadulterated by modernization of any sort. It was founded by one Cheatam, a high-minded merchant like Gresham, who has thus conferred a lasting benefit upon his native town. It contains a good library, which is *public* in the true sense of the word; that is, any person may go at any time, and call for any book he requires, unannoyed by any irksome restriction whatever." Prodigious! What a simple, plain-dealing creature must that same Cheatam have been to have given a library to the public upon such easy terms, without so much as imposing *any irksome restriction whatever!* What grovelling, childish notions of munificence and public spirit the man must have had!—certainly widely different from those entertained by old Soane, who would far more worthily than the other have become the name of *Cheat'em.*

IV. The two great stumbling-blocks of art, or the Scylla and Charybdis on which it is generally wrecked, are pedantical, spiritless precision and exactness on the one hand, dull licentiousness and disregard not only of all authorities, but of all conditions of art, on the other. The great point is to know how to emancipate ourselves from the trammels of slavish imitation, without—I will not say running into wild, chimerical extravagances, but without destroying those qualities of the style aimed at, which confer upon it its chief charm and value.

V. It does not often happen that the "Gentleman's Magazine" ventures upon anything like honest critical remark in regard to any of the buildings it notices. The following strictures, therefore, in the volume for 1826, deserve to be here brought forward again, and to many will be entirely new. "Expensive and numerous," says E. J. C., "as are the public buildings in progress, though the names of Soane and Smirke may be quoted as the architects, and the thousands expended in their construction be adduced in their favour, are, I would ask, any one of them *grand?* On the contrary, do not the new buildings present one uniform air of meanness? The spacious wing added to the British Museum, with its unbroken brick wall, seems to have been built to compete in beauty with the King's Bench, or the Fleet. The new Post-office, like the new Mint, and the generality of Mr. Smirke's buildings, is as tame and spiritless as plain stone walls with dwelling-house windows, and a few columns stuck about them as apologies for porticos, can be. If the *ephemeral praise of periodicals* was sufficient to exalt the character of a building, it is but a few years since that all the newspapers and periodicals, from one end of the kingdom to the other, were filled with applauses on that huge and senseless pile the Custom-house." As to the new Mint, that has certainly not conduced at all to Smirke's fame. Indeed, it lies in a territory criticism never travels into; which, however, may be a rather fortunate circumstance for it than not, because the less it is known and spoken of, the less likely is it to be condemned.

CONSTRUCTION OF LIGHTHOUSES ON SANDS.

We now lay before our readers one of the most important experiments of the present day, which promises to give to the engineer a foundation as secure in the sea as he has hitherto enjoyed on the surface of the earth. The success of this attempt will give us resources to battle with an antagonist, before which all our mechanical strength has too often proved defective, while, to the maritime interests of the country it will afford new and further protection. We can appreciate the difficulty which Smeaton encountered in planting the Edystone on the firm rock; but we have now the means offered to us of security even upon the shifting sand.

At page 22 of our last volume, we were, through the kindness of Mr. Elmes, enabled to give a description of "Mitchell's Patent Screw Moorings," but we did not then anticipate the application which they have since received. It having been brought under the notice of the Corporation of the Trinity House that this instrument might be advantageously applied in establishing lighthouses on sands, their attention was immediately given to the subject, and accordingly directed an experiment to be made to ascertain its practicability, under the superintendance of their engineer, Mr. James Walker.

The spot selected is on the verge of the Maplin sand, lying at the mouth of the Thames, about twenty miles below the Nore, forming the northern side of the Swin, or King's Channel, which, on account of its depth, is much frequented by large ships, as also by colliers and other vessels from the North Sea, and where a floating light is now maintained. This spot is a shifting sand, and is dry at low water spring-tides. The plan is to erect a fixed lighthouse of timber framing, with a lantern, and residence for the attendants. For this purpose, in August last, operations were commenced to form the base of an octagon, 40 feet diameter, with Mitchell's mooring screws, one of which was fixed at each angle, and another in the centre; each of these are 4 feet 6 inches diameter, attached to a shaft of wrought iron about 25 feet long, and 5 inches diameter, and, consequently, presenting an immense horizontal resisting surface. For the purpose, a stage for fixing the screws, a raft of timber, 30 feet square, was floated over the spot, with a capstan in the centre, which was made to fit on the top of the iron shaft, and firmly keyed to it; a power of about 30 men was employed for driving the screws; their united labours were continued until the whole force of the 30 men could scarcely turn the capstan: the shafts were left standing about 5 feet above the surface of the sands. The fixing of the nine screws, including the setting out the foundation and adjusting the raft, which had to be replaced every tide, did not occupy more than nine or ten days.

This is the portion of the work hitherto effected, and its continuation will be proceeded in when the proper season comes in the ensuing spring. Upon this foundation the superstructure of timber is to be constructed, consisting of a principal post, strongly braced and secured, with angle-posts made to converge until they form a diameter of about 16 feet at the top, giving the superstructure the appearance of the frustrum of an octangular pyramid, the feet of the angular posts and braces are well secured and keyed down to the tops of the iron shafts, and the whole is connected at top and bottom with strong horizontal ties of wood and iron. The entire height of the superstructure will be 30 feet above the top of the iron shafts; up to a point about 12 feet above high-water mark spring tides the work will be open; the part above will be enclosed as a residence for the attendants; in the centre and above this will be erected a room or lantern of about 10 feet diameter, from which the lights are to be exhibited.

The interval that has elapsed since the screws were fixed has fully proved the security of them, which, although driven into sand, seem as if fixed into clay, and in this state they have remained since the summer. The whole process confers the greatest credit both on the engineers and Mr. Mitchell, the patentee of the screws who superintended the work, (assisted by his son) and we feel happy to hear that his ingenious invention daily obtains a greater extension.

The importance of this experiment certainly called for a trial, and it was with due liberality that the Trinity Board sanctioned the expense. To them it involves the question of a better security of the light, and a less expense in its maintenance, both objects justifying the experiment, and counter-balancing the expense of prime cost in such construction. The insecurity of floating lights has been too manifestly productive of disastrous consequences not to call for a remedy, and it will be fortunate if by this means it be obtained. Within the last month the Nore light was blown from her mooring; and the breaking away of the North-west Light of the Mersey is supposed to have led to the lamentable shipwrecks at Liverpool.

We can perceive only one objection which can be started, and that is rather to be determined by experience than conjecture, that is how far the edifice is liable to be washed away by storms as one of the Edystone buildings was; but this, in our opinion, will be mainly provided against by the unity of construction and the breadth of base well secured to the shafts by the screws.

The progress of this work will naturally be watched with interest, for it is one which in its influence is not limited to this individual case. It is of much more importance than chain piers, as it will enable us to obtain a foundation in positions where they cannot at present be used. It must be remembered that the screw can be employed where the pile is of no avail, and that it possesses a much stronger hold, and has greater durability.

We shall thus, therefore, be able to construct piers and breakwaters in localities inaccessible, and be enabled to render important service to the interests or commerce. We think, too, that the screw itself would be of great utility in securing the end chains of suspension-bridges, as its powers of resistance can be extended to any necessary degree by an increase in size. The greater employment of the screws, which would arise from their successful application, will have a further beneficial effect in enabling the patentee to supply them at a diminished expense, which, under their present limited sale, is necessarily high.

The carpenters' work of the superstructure is about to be contracted for, which is intended to be erected and put together at the Wharf at Blackwall to save time of fitting, &c., at the spot.

In order for the better understanding of our description of the mooring screws at page 22 in our last volume, we have obtained of Mr. Weale the use of the wood engravings illustrating his valuable publication, the "Public Works of Great Britain." They will exhibit, in a much clearer light, the construction of the moorings. The screws described above for the foundation of the lighthouse, differ in some respects from these engravings; instead of being furnished with a chain and shackle, they have a wrought iron shaft connected to the screw as before described.

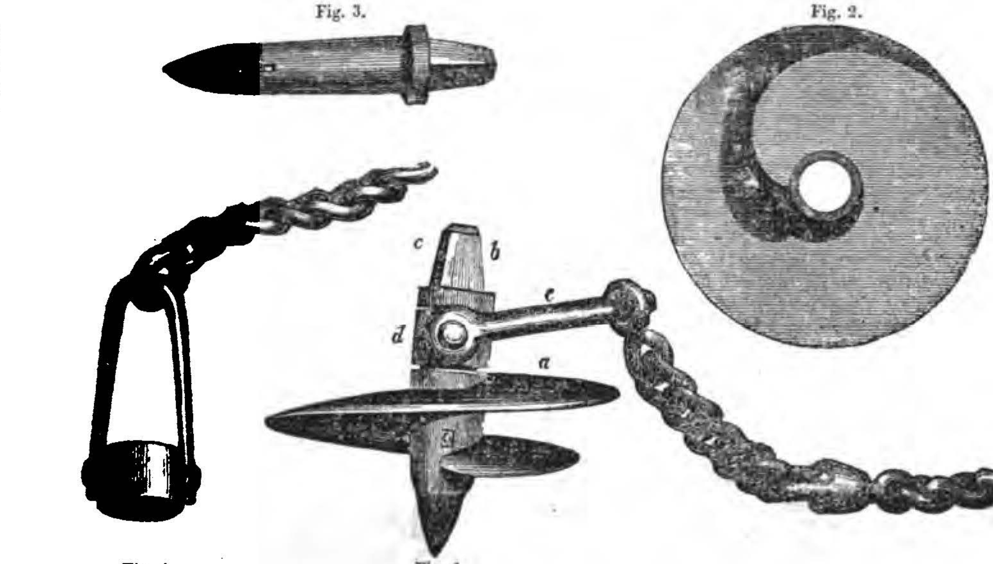


Fig. 3. Fig. 2. Fig. 4. Fig. 1.

Figure 1 shows the screw mooring as prepared for use. *a* is a spiral or screw flange of about one turn and a half, having a hollow cylindrical centre, as shown in *figure* 2, and of cast-iron in one piece; *b* is a wrought-iron spindle, which passes through the cylindrical socket of the screw flange, somewhat tapering in form, as shown in *figure* 3, and when driven up tight, is fixed thereto by a forelock, which passes through both; it is formed with a square head, *c*, to receive the key for screwing it into the ground; *d* is a collar of wrought iron, the front of which is shown in *figure* 4, fitted so as to turn freely on the upper part of the shaft of the spindle below the collar. *Figure* 2 shows the upper surface of the spiral flange; *figure* 3, the spindle; and *figure* 4, the collar and shackle. The shackle is fixed to the spindle by means of the loose collar, in order to prevent the dragging round, and the consequent fouling of the chain, whilst the spindle is being turned in or out of the ground.

HARLAXTON.

When we stated, in our review of "Dr. Dibdin's Tour," that Mr. Gregory's splendid new mansion at Harlaxton, near Grantham, was begun by Mr. Blore, we had fallen into a mistake, which we now correct. The architect originally employed, when the building was commenced in 1832, was Mr. Salvin; and although the execution of the work has since been committed to other hands, his designs have been adhered to. Mr. Blore was called in, but only to be consulted; and Mr. Burn, who was afterwards engaged to complete the edifice, had only to erect what remained to be done, in strict conformity with that half or portion which had been built by Mr. Salvin; consequently, to the last-mentioned gentleman belongs whatever reputation this mansion may acquire as a piece of architecture; and, notwithstanding that it is in a style to which, as a style, we are by no means partial, we are free to confess that it is infinitely more to our taste than almost any other specimen of it we are acquainted with.

The principal or entrance front—that facing the north—is, indeed, a most picturesque and masterly composition, presenting a refined ideal of the style, where all its best qualities are brought out and blended together, and where features, which, taken by themselves, have no pretensions to grandeur or elegance, are made to contribute towards the richness and stateliness of the *ensemble*. The true feeling of an artist manifests itself throughout every part of this façade. It is so perfect a picture that all our prejudices against the style itself not only are silenced before it, but serve to enhance our admiration, when, contrary to all our preconceived ideas, we behold what may be produced out of it when treated with geniality of taste. We shrink, however, from the task of attempting to convey, by mere words, any intelligible idea of so complete and varied a composition as this front. In description, the whole would appear little better than profusion and confusion; whereas, in the design itself, notwithstanding the great number and diversity of its features, the whole is perspicuous and harmonious. The centre compartment, flanked by two turrets, and crowned by a larger one of highly decorative character, presents itself as almost one entire mass of ornament, yet without seeming in any degree crowded; there is nothing superfluous, because there is nothing that does not evidently conduce to the character here aimed at. The other principal front, which is not quite so lofty, being raised on a terrace occupying the depth of the ground-floor on the entrance side, is that facing the west; and here the lower part, or that on the level of the terrace, is occupied through the whole extent from north to south by the gallery, that is, by what Dr. Dibdin describes as the drawing-room. This gallery measures 97 feet by 25, exclusive of the northern oriel, besides which there are two bays and a lobby communicating with the terrace on the west side. On the other side of the gallery are two fire-places, one facing each of the bays just mentioned, and between them a door leading into an ante-room, (25 feet square,) beyond which is the dining-room, 40 feet by 25, exclusive of an additional space 37 feet by 10, and further extended by oriels, and recesses with windows, which latter are in the turrets at the angles of the centre compartment of the north front. Behind this dining-room is a spacious hall or reception-room (78 feet by 27, and two stories in height), whose lofty oriel and other windows form such conspicuous and characteristic features in the elevation of the south front. The principal drawing-room (36.6 × 25) is at the west angle of this front, where it forms a projecting wing, between the great hall and the gallery, with the principal staircase at the rear of it. This latter communicates with the ante-room between the gallery and dining-room; thus affording a line of upwards of a hundred feet, from the fire-place in the ante-room to the south bay of the drawing-room.

IRISH RAILWAY COMMISSION.

(*Continued from page* 15.)

The Irish Railway Commissioners speak of the port of Havre, in France, at page 66, thus:—

"We know that it is a question of doubt still pending whether Havre, or some other place in France, or a port of the British Empire, shall henceforth become one of general resort for the business to America for a great part of the continent of Europe, and a favourable result for our own country can only be obtained by the establishment of facilities manifestly superior to those of Havre or other French ports."

In looking over the very few pages which the Railway Commissioners' Report contains regarding the best harbour on the western shores of Ireland, which should be selected as the port to communicate with America, and the very few and limited observations they have given as to the success of an intercourse by steam with the new continent. The total want of any kind of exposition on the very extended range that steam navigation across the Atlantic will naturally assume with all the large commercial sea ports situated on the western shores of Europe, with those on the eastern coast of America. The extremely objectionable system of railways, which the Royal Commissioners have laid down, to connect the three largest cities in Ireland, viz., Dublin, Limerick, and Cork, shows that the Commissioners have not been able to elucidate in a full, clear, and satisfactory manner, even any one of those very interesting subjects, although "My Lords have full evidence from the character of the gentlemen appointed to form the commission, that their labours will be conducted in a satisfactory manner."

The position assumed by the Commissioners as to a general port or ports, either on the south or west coast of Ireland, to communicate with America by steam, and to be a general port for a considerable part of Europe, is not shown to be based upon any reasonable grounds for such an assumption; and in merely assuming that this will be so it has been recommended by them not only to connect Dublin, Limerick, and Cork, by railways, amounting to 316 miles, but also to make a new railway through Wales, not less than 140 miles long, and which will cost more than ten million sterling.

The Commissioners' report strongly recommends that the Government should make no less than 456 miles of railway, or nearly double the length from London to Liverpool* for the principal object of endeavouring to make Cork, as they state, the general point or port in Europe for communicating by steam with America. I am thoroughly convinced that when the British parliament examines those magnificent projects of the Royal Irish Commissioners that it ought not to advance one single penny towards the execution of a line of railway through Wales of 140 miles in length, or to the making of 316 miles of railway through the southern part of Ireland for the mere hazardous chance that one of the southern ports of Ireland might become the port of general communication by steam between Europe and America. Does not reason announce that such has been the success of steaming from America into Bristol and Liverpool, that no western or southern harbour in Ireland is ever likely to become, in the present condition of commerce, the general port to communicate with America by steam, or for any portion of the continent, Great Britain, or even Ireland herself.

From the triumphant success which has attended the voyages of the Great Western and other steamers in navigating across the Atlantic between Europe and America, it must be quite clear to every person at all acquainted with the progress of steam navigation, that all the large British ports which may have business with the states of America, to any extent, such as Bristol, Liverpool, Glasgow, London, &c., will all have their own American steamers in the course of a short period. This is fully established by the present condition of steam navigation between London, Cork, Belfast, Dundee, Inverness, Hamburgh, St. Petersburgh, Portugal, Malta, Egypt, &c., &c.

Let any one acquainted with the rapid progress of maritime steam navigation during the last 25 years, read the extract at the head of this article and say if it does not lead to conclusions and speculations of the most absurd and ridiculous kind. To state that people in America returning to England, France, Belgium, Germany, &c., would be desirous to arrive at an Irish port in preference to an English or a French one carries its own refutation. I can venture to tell the Government of this country, the Royal Irish Commission, as well as those who are concocting this very extraordinary job, that France will have her own steam vessels for American intercourse as well as Britain. France is too powerful, too great, too maritime, too commercial, and too ambitious, not to avail herself of all those advantages which steam intercourse with America will confer and offers to other nations. The noble harbour of Brest lies nearly under the same longitude as Falmouth, and is much more westerly than Bristol, Liverpool, or indeed any port in England except the first, and a steamer sailing from Brest only requires 12 tons of additional coal for a voyage to America to reach the longitude of the most westerly harbour in Ireland, while on the other hand the parallel of Brest is a much better climate than that of Ireland to navigate from for America; besides the port of Brest would be the best for Central Europe to communicate by steam with America, and possess many advantages in this respect over any of the southern or western ports or harbours in Ireland. Even the ports of Havre and Bordeaux will yet have steamers plying regularly to America.

Looking at the immense revolution which the application of the steam engine to navigation has so successfully achieved in all the seas of Europe and North America, looking again at St. George's Channel and the Irish Sea leading from the Atlantic to the port of Liverpool; to the Bristol Channel running from the main ocean to the port of Bristol; to the English Channel reaching up to near the port of London

* The expense of making the Liverpool, Birmingham, and London Railway (about 210 miles long), has been stated at ten millions sterling.

on the shores of the German ocean; to the Northern Channel and the Estuary of the Clyde stretching up to Glasgow. Are not these communications extending from the Atlantic Ocean to the principal ports of Great Britain admirable channels, and quite sufficient for all kinds of steamers to navigate to these respective ports. Thus has nature laid open the whole of the harbours and commercial ports in the Empire to all the advantages of steam navigation with the states of the new world; and be it further observed that these magnificent sea channels have cost the nation nothing and never will require any kind of repair. On the other hand, looking to the land, is there not a railway already made and extending from Liverpool to London? and from which harbour or ports steamers are plying to all the principal ports of Holland, Belgium, and the north of France, Hamburgh, and even to St. Petersburgh. Again a railway communication exists between England and Hull, facing Hamburgh on the continent, and laying open the whole of the northern countries bordering the Baltic sea; and is there not a railway in full progress of execution which will connect Bristol and London called the Great Western? I ask are not these channels, harbours, and railways, quite sufficient to afford all reasonable facilities and accommodation to general intercourse with the American continent by steam, without embarking the government in the great expense of making 140 miles of railway through the mountains of Wales; and 316 miles of railway through the southern districts of Ireland, which would incur an expenditure of ten millions sterling, on a mere chance or probability that Cork might become the "*general resort for the business to America for a great part of the continent of Europe.*" The endeavour to make Cork a point of general resort for the business to America is made to appear the ostensible reason why government should make so many hundred miles of railway through Wales and the south of Ireland. It is under this mantle of a western port for the accommodation, as it were, to the intercourse of a great part of the continent of Europe is concealed one of the most extraordinary projects that has ever been attempted to be carried into execution within the realms of this empire, but it is to be hoped that the good sense of the British parliament will at once put a stop to any further proceedings as regards the recommendations of the Railway Commissioners.

W.

LONDON AND WESTMINSTER BANK.

ARCHITECTS.—CHARLES COCKERELL ESQ. R.A., F.S.A.; AND WILLIAM TITE, ESQ. F.R.S.

The new building for the city establishment of the London and Westminster Bank, which has just been completed, is situated on the north side of Lothbury, immediately opposite to the north-east angle of the Bank of England. The whole structure occupies a site of nearly 80 feet in frontage, and 90 in depth. The façade consists of one general plane or face, broken only by an advancing pier at each end. It has seven apertures in the length, and three tiers of them in the height; the two lower tiers, comprehending the openings on the ground and one-pair floors, are included in one architectural story, or order, if such it may be called, the upper tier, which consists of the windows of the two-pair floor, being contained in an attic story. The whole of the front is of Portland stone, with the exception of the plinth, which is from the Bramleyfall quarries. The entrance vestibule or avenue has, on each side, a line of four plain Doric columns, with appropriate accessories. From this vestibule access is gained on the right to the country bank, the principal staircase, and some official apartments; and directly in front, to the principal or town bank. The latter apartment is by far the most considerable in the building. Its general form is a square of about 37 feet, whose height is that of the entire building, and it is extended by lateral recesses, east and west, to a portion of this height. These additions or aisles are divided from the centre, on each side, by an arcade of three arches, springing from Doric columns, with cornices. The surrounding walls are channelled in rustic courses to the height of this order. The recesses are sufficiently lofty to allow of the introduction of a gallery on each side, finished in front by a balustrade, abutting against the columns at such a height that the capping of the balustrade ranges with the abaci of the columns. Above this, the arches of the arcades run across over the aisles, and are intersected by a contrary vaulting, producing a system of groins as ceilings to the galleries; they are also advanced over the main body of the building, and treated as a series of half groins, so as to afford support to an upper gallery, which passes quite round the principal square. The verge of this upper gallery is guarded by a barrier, consisting of a double horizontal rail, sustained at intervals by ornaments of a scroll foliage. Over this gallery the lines of the cubical form below are continued through, and gathered up by means of pendentives in a domed figure, exhibiting nearly a hemisphere cut off by planes raised upon thides of a square inscribed within its circumference. The top of this dome is pierced by a large circular opening for a skylight, the margin of which is covered, and additionally ornamented with mouldings and lions' masks. Light is also obtained by triple windows, occupying the flat semicircular spaces left by the pendentives of the dome, on the three sides which are exposed to the view of a person entering; these windows are filled with glass in geometrical compartments, alternately ground and polished. Smaller semicircular windows are introduced likewise in the three arches on the north side, which form a continuation to those of the lateral arcades. Of the remaining apartments, the principal is the boarding-room, occupying a frontage of four windows on the one-pair story. On the same story are various apartments for the business purposes of the establishment. The two-pair story, and another above it, the frontage of which last is concealed behind the balustrade of the attic, are appropriated to the use of the resident manager. Ample accommodation for cellarage, strong-rooms, porters' apartments, &c., is provided in the basement story, which is fire-proof. The time occupied in the completion of this building has been about 18 months.

ASPECTS AND PROSPECTS.

The following judicious remarks relative to the choice of aspect for a house, we have extracted from the valuable work, entitled "Fragments, by the late H. and J. A. Repton." They are given in the form of a report concerning the situation for Walwood House, Laytonstone, Essex:—

Nothing is more common, than for those who intend to build, to consult many advisers, and to collect different plans from which they suppose it possible to make one perfect whole; but they might as well expect to make an epic poem, by selecting detached verses from the works of different poets. Others take a plan, and fancy it may be adapted to any situation; but, in reality, the plan must be made not only to fit the spot, it ought actually to be made upon the spot, that every door and window may be adapted to the aspects and prospects of the situation.

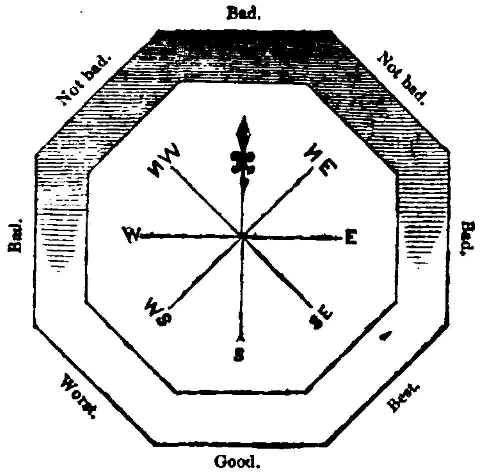
It was a remark of my venerable friend, Mr. Carr of York, after fourscore years' experience as an architect, that "to build a house we had only to provide all that was wanted, and no more, then to place the best rooms to the best aspects and the best views." Simple as this apothegm may appear, it contains more truth in theory, and more difficulty in practice, than all the rules which have ever been laid down in books by architects, or the remarks of all the admirers of rural scenery with whom I have conversed. The former never think of aspects, and the latter think of nothing but prospects. I will, therefore, beg leave to enlarge on these two subjects.

I consider the aspect of infinitely more consequence to the comfort and enjoyment of the inhabitant, than any prospect whatever; and every common observer must be convinced, that in this climate a southern aspect is most desirable; but few are aware of the total difference in the effect of turning the front of the house a few points to the east or to the west of the south; because, although the south-east is the best, yet the south-west is the worst of all possible aspects; for this reason—viz., all blustering winds and driving rains come from the south-west, and consequently the windows are so covered with wet, as to render the landscape hardly visible. My intention was originally drawn to this subject by travelling so much in post carriages, and often remarking the difference betwixt the window to the south-west and that to the south-east, during a shower of rain, or immediately after; when the sun shining on the drops causes an unpleasant glitter, obstructing the prospect, while the view towards the south-east remains perfectly visible.

At Organ Hall, in Hertfordshire, the living room was towards the south-west, and during a heavy storm of wind and rain we accidentally went into the butler's pantry, which looked towards the south-east, where we found the storm abated, and the view from the windows perfectly clear and free from wet; but on returning into the other room, the storm appeared as violent as ever, and the windows were entirely covered with drops, which obstructed all view.

On considering the prevalence of south-west winds, it was determined to reverse the aspects of the house by changing the uses of the room, making a very comfortable house of one which, from its aspect only, was before hardly habitable; since no window, nor hardly any brick walls, will keep out the wet, where a front is exposed to the south-west; for this reason, it has been found necessary in many places, as at Brighton, &c., to cover the walls with slates, or pendent tiles, and to use double sashes to the windows so situated.

If we had only one front, or one aspect to consider, our difficulty would soon vanish; but the prevailing partiality for variety of prospect seems to require that in every direction the views should be retained; and as the opposite walls of the house must be parallel, and the corners at right angles, we must consider the effect on each of the four sides thus:—



First, the aspect due north is apt to be gloomy, because no sun shine ever cheers a room so placed.

Secondly, the aspect due east is not much better, because there the sun only shines while we are in bed.

Thirdly, the aspect due west is intolerable, from the excess of sun dazzling the eye through the greatest part of the day.

From hence we may conclude that a square house, placed with its fronts duly opposite to the cardinal points, will have one good and three bad aspects.

Let us now consider the effect of turning the principal front towards the south-east, then the opposite front will be to the north-west; an aspect far better than either due north or due west; because some sunshine may be preserved, when its beams are less potent than in the west, and the scene will be illuminated by those catching lights so much studied by painters; especially where, as in the present instance, the landscape consists of large masses of forest trees, and thickets richly hanging down the side of an opposite hill. An aspect open to the north-east would be objectionable during the cold winds of spring; but in this instance it is effectually sheltered by an impervious screen of trees and large hollies, not drawn across the landscape, but perspectively receding in a deep bay, and forming an admirable defence against the north-east winds: while the richness and variety of this amphitheatre of evergreens will render the prospect as perfect as the aspect. This warmly sheltered corner will invite the cattle from every other part of the grounds, to enliven the home view near the windows.

It now remains only to mention the side towards the south-west; and having stated the objection to this aspect, we may consider it fortunate that the prospect in this direction is such as requires to be hid rather than displayed; and consequently the detached offices and plantations, to connect the gardens with the house, will defend the latter from the driving storms of the south-west, and give that sheltered and shady connexion betwixt the house, offices, and gardens, which constitute one of the most delightful *agrèmens* of a country residence.

While speaking of the three different aspects, I have slightly adverted to their respective views or landscapes, but I will speak further on that towards the south-east, to which all the others may be considered as subordinate, although not sacrificed.

It is very common for admirers of landscape or natural scenery to overlook the difference betwixt a tree and a pole, or betwixt a grove of old trees and a plantation of young ones. We fancy that time will reconcile the difference; but, alas! we grow old as fast as the trees, and while we dot and clump a few starving saplings on an open lawn, we indulge hopes of seeing trees, when in fact we only live to see the clumsy fences by which for many years they must be protected. Happy, therefore, is that proprietor of the soil who becomes possessed of large trees already growing on the land he purchases, since no price can buy the effect of years, or create a full-grown wood; and without that we may possess a garden, or a shrubbery, but not a landscape. This consideration alone is sufficient to attach us to the vicinity of that venerable avenue, which it would be a sort of sacrilege to desert, and whose age and beauty will give an immediate degree of importance to the house, which could never be expected in any more open part of the estate.

The view towards the south-east will consist of a glade into the forest, where distant woods of Wanstead are seen betwixt the stems of large trees in the foreground, producing a purple tone of colouring so much studied by painters and admirers of picturesque effect. To this may be added the cheerful moving scene of a public road, not too near to be offensive; for however some may affect to prize the solitude and seclusion of a forest, shut out from all the busy haunts of men, yet within six miles of the capital few places can boast such privacy as Wallwood House commands within its forty acres, surrounded by a forest. Who then would regret to see occasionally, and at a proper distance, the enlivening mixture of man with animal life, and vegetation in its most interesting forms?

From its situation within so few miles of the metropolis, this place ought to combine all the pleasures of the country with the conveniences of a town residence.

REMARKS ON THE REPORTS OF THE GREAT WESTERN RAILWAY.

BY AN OLD ENGINEER.

Sir,—The report of Mr. Wood to the directors of the Great Western Railway, upon the principle of construction adopted by Mr. Brunel, its advantages and disadvantages, &c., and the contrasted results obtained by experiment upon other lines, having largely engaged the attention of the public for some days past, and as I do not coincide in opinion with Mr. Wood and Dr. Lardner, as to the mode in which some of the experiments were conducted, and the inferences deduced from them, you will perhaps oblige me by laying my strictures upon the report in question before your readers.

Before entering upon the subject, I cannot refrain expressing my admiration of the honourable and conscientious feelings evinced by Mr. Wood at the very threshold of the enquiry, that he was determined to constitute himself the mere chronicler of experiment, and in the spirit of a real philosopher, to go no farther than justified by its evidence. This temper contrasts beautifully, with the reckless, empty, report of Mr. Hawkshaw; and I am happy to record my respect in favour of Mr. Wood here, in the hope that his distinguished conduct may have its due influence with my professional brethren, to induce them more frequently, in like cases, to do likewise.

The experiments made to ascertain the tractive power and performance of the engines, and the tabulated arrangement by which the results are exhibited, meet my fullest concurrence; but I object to the statement "that the average weight of coke required to convert a cubic foot of water into steam, is not greater than what is required by the best constructed stationary engines, and less than Mr. Watt's standard, viz., 8 lbs. of coal to each cubic foot of water." Mr. Watt found that, to produce equal heat, coke is to coals, as 0.375 to 1, so that 8 lbs. of coke is equal to 30 lbs. of coal; thus, the locomotive in question consumes, comparatively, nearly four times as much as a fixed condensing engine.

The experiments to which I would particularly direct your attention are those made upon the inclined planes, with the view of ascertaining the atmospheric resistance, and the experiment was only varied in two ways, viz., by impelling a train of empty carriages down the plane, and then the same carriages loaded, and noting at what point the speed became uniform. The manner of conducting the experiment I consider by no means the best, and the results deduced from it exceeding fallacious. The first thing I should have done, would have been, to ascertain the velocity which the plane, or angle of inclination, was capable of generating; and I should have done this, by a skeleton carriage, alternately empty and loaded, exposing the least possible frontage or surface to the wind; the result would then have shown a certain point at which the velocity would not increase, a point at which gravity was counteracted by friction, &c.; this ascertained, then, the carriages, loaded and unloaded, might have been subjected to a like experiment, and the difference of the two velocities would have been then justly due to the enlarged frontal area. But even this method, if the subject sought had been merely the determination of the resistance due to the atmosphere, is not that which is most conclusive, if the frontal area alone be considered; for, had a surface like a kite been exposed against the wind, and the string connected with a spring balance or weighing-machine, the resistance of the surface at varying velocities, could then have been read off by the weights indicated upon the limb of the instrument. This would have been the true way of determining the matter, and would have been best made upon a level, and in an open country; but in whatever way the experiment had been made, it ought to have been when the wind was still, because, driving against the wind and with it are very different matters, and in the experiments, this circumstance ought to have been noted.

A body freely descending an inclined plane of 1 in 96, will be 96 times as long descending, as a body falling through the vertical height of the plane, and making no deduction for friction, when it reaches the bottom of the plane, its velocity would be the same as that attained by the falling body; now a body falls freely through 96 feet in two seconds and a half, at the end of two seconds and a half it will have acquired a velocity of 80 feet; but this velocity along the inclined plane will have been acquired when the body has reached the foot of the plane; but in practice the resistance from friction will be such as to reduce the velocity uniformly to a point somewhere about the mean, or half, which is proved by the experiment, and the addition of weight can produce no effect further than to increase the momentum of the body by so much as the weight is increased, but the velocity itself will be scarcely affected by the change, for the same reason as a cannon shot or a bullet, if let fall from the top of the Monument at the same moment, will both reach the ground at the same time; that this view of the case is correct, is proved by the experiment down the Madeley plane, on the Grand Junction Railway; here, as in the former case, the carriages being propelled down the inclined plane at a velocity of 30 miles per hour, (it is only a fair experiment to presume the starting velocity in both cases the same) and the carriages attained an uniform velocity of 30 feet per second, or 21 miles per hour, so that they were retarded until they were brought to the velocity the inclination itself was capable of generating without friction.

Mr. Wood says, "The force exerted by 15·6 tons down an inclination of 1 in 96 is equivalent to 364 lbs., and as this was the weight of the train in the first experiments, it follows that such a coach train, moving at 31 miles an hour, suffers a resistance of that amount, which includes both friction and atmospheric resistance," or, what is the same thing, that 364 lbs. represents the tractive force necessary to propel such a train, at the rate of 31 miles an hour, upon a level, including both friction and atmospheric resistance;" 364 lbs. raised 45 ft. per second is equal to the power of a 30-horse engine, and to produce the same results on a level, as shown by the experiments, requires a locomotive, evaporating 197·7 cubic feet of water per hour, or, in other words, an engine of 197·7 horse-power. This fact proves, that the power of a locomotive to produce a high speed is destroyed, or is most disadvantageously applied, and shows most conclusively that the great loss of power is not to be accounted for by the atmospheric resistance, as proposed.

As regards the observations respecting deflection, no notice seems to have been taken of the comparative bearing surfaces of the stone blocks, sleepers, &c. A stone sleeper is usually 4 ft. surface; placed at 3 ft. asunder will be 8 ft. bearing surface for the two rails, or a yard in length. A transverse wooden sleeper is scarcely ever more than 10 inches wide; if 6 ft. long, and 3 ft. asunder, the bearing surface will be only 5 feet. A longitudinal timber is seldom wider than 13 inches, giving 6½ ft. surface; this view of the case at once accounts for the superior solidity of the stone sleepers, for in fact the question of solidity must always be brought down to a question of surface, and that railway will be the most solid, other things being equal, the rails of which have the widest base; the mode, as admitted by Mr. Wood, of fixing the rails to the timbers is beyond all comparison safer than fixing them in chairs. A chair is seldom wider than 4 inches, and an inch and a quarter thick at the point of least section; then supposing them placed 3 ft. asunder, 1¼ inch will be distributed over a space of 3 ft., or a section of little more than one-eighth thick of cast iron, is placed to bear all the concussion of the engines and train, whereas, as in the case of Mr. Brunel's rail, every section of it is held down by a section of half an inch thick of wrought iron, and the leverage of the rail reduced fully one-half less than upon the London and Birmingham Railway.

However additional smoothness of motion may be attained by the removal of the piles and transoms, unless additional bearing surface be supplied, or the line perpetually packed, the levels will be lost by the sinking of the timber, for it is quite absurd to expect that any degree of consolidation can take place in a yielding and inelastic soil. In my opinion, the only proper method to be adopted is, to place the cross transoms closer together, and form a sort of flooring under the longitudinal timbers, thus throwing the load upon a wider surface, and this would be equally desirable if the weight and stiffness of the rail is increased.

Mr. Wood, in his enumeration of the conditions to be taken into account to form a perfect carriage, has omitted to note the perfect parallelism of the axles, a condition of more importance than any other, for if this be correct, the carriage is certain to run well.

The machine described to have been used to note the various vibrations, in my judgment must have been very ill adapted for the purpose; it must have been too mercurial, too sensible; had a heavy pendulum been employed instead, it would have given far more satisfactory results.

There is no doubt that the proper mode to link carriages, so that there shall be no concussion, is by an inflexible link between each carriage. Mr. Booth's patent draw-screws produces a good effect, but the simple inflexible link as adopted by Mr. W. J. Curtis, on the Greenwich Railway, is much more simple and very much better.

The 7 feet guage, which has been so much reviled, is most unquestionably the only gauge to carry out the plan which has been recommended by every person who has studied safety in railway travelling, and by no one more so than Mr. Brunel himself, to place the carriage within the wheels. By doing this, and allowing only one inch clearance, a width of 6 ft. 6 in. is obtained, and lowering the carriage to within 6 inches of the rail, a vertical height of 7 feet is procured, giving an area 45 ft. 6 in.; so that the Great Western carriages will be to the London and Birmingham as 45 ft. 6 in. to 53 ft. and it is impossible, with the London and Birmingham carriages, to make a similar improvement, without making them 8 or 12 inches wider.

One great advantage results to the public from the investigation which has taken place into the merits of this railway, proving the very defective condition of the system of railways generally, rendering it the imperative duty of railway companies to avail themselves of the suggestions and improvements of others, besides their own people. If it has the effect, therefore, of breaking down the spirit of domination and exclusiveness at present existing, which forbids the introduction of other methods than the crude and original ideas of Stephenson and Co., such a conclusion is well obtained at the expense and noise this inquiry has created, and must be regarded with satisfaction by every well-wisher to the railway system, and by none more so than by

AN OLD ENGINEER.

LETTER FROM WM. TURNBULL, Major U.S. Topographical Engineers.

It is with considerable pleasure that we publish the following letter received from a highly respectable and valuable member of the profession residing in the United States. We are happy in enlisting him as a correspondent to the pages of our Journal, and it will be a gratification to us to receive the other engravings of the Potomac Aqueduct promised by the Major, in order that we may be able to lay before our readers the progress of that work.

Washington City, Aug. 31, 1838.

Sir,—Several months ago, when a specimen number of your valuable journal was exhibited in this city, I became a subscriber; but, owing to the remissness of our booksellers, or the want of a proper agent here, I did not receive it until within a few days, when I received three quarterly numbers at once.

I feel highly flattered that you should have thought a description of the work (Potomac Aqueduct) under my charge, worthy of a place in your journal, and avail myself of the opportunity of our Charge d'Affaires to Belgium, M. Virgil Maxey, who visits London on his return to Brussels, to send you a copy of the drawings and description, which have been added to since the first publication.

There are still three or four more drawings, showing the condition of the work at the end of the year 1837, and some changes, suggested by our experience, made in the construction of the coffer-dams, which have proved of great utility, and which should accompany the description, but, unfortunately, they are yet in the hands of the engraver. I shall have the pleasure to forward them by the next opportunity that offers.

The subject of coffer-dams is one of peculiar interest to me. I remarked in the third number of your journal, a drawing and description of the coffer-dam to be used in the construction of the terrace-wall, &c. of the new Parliament-house, and hope that it will be in your power to give some details of the operations of emptying, &c., as that work progresses.

On examining the plan, I observe a great many iron bolts, passing through the puddling at different heights. I was once forced, by the spreading of the outer row of piles, to use bolts in a similar way, at low-water mark; and, as the puddling settled, a cavity was left under each bolt, through which the water found its way, and was the cause of very great inconvenience: the dam was filled with water several times by means of them.

I should be much pleased to know their effect in the coffer-dam for the new Parliament-house.

With my best wishes for the success of your journal, which, I think, bids fair to be of extensive utility.

I have the honour to be, Sir, very respectfully, your obedient servant,

WILLIAM TURNBULL,
Major U. S. Topo. Engineers.

MOMENTUM OF FALLING BODIES, COLLISION, &c.

SIR,—In further elucidation of my letter of last month, I beg to offer the following remarks, which I request you will be so obliging as to insert.

"Momentum is *said to be* (vide Hutton's Course of Mathematics, Vol. II, page 252, &c.) the power or force in moving bodies with which they strike any obstacle which opposes their motion:" and (page 314, proposition 149) *it is said* that "B being a body moving with the velocity V, $BV=M$ is the momentum with which it strikes another body b:"—and an example is given of two bodies, $\acute{B}$ weighing 5, and $\acute{b}$ weighing 3, moving respectively with velocities $V=3$ and $v=2$, which, *it is said*, would, after collision, move with velocities $\frac{\acute{B}V+\acute{b}v}{\acute{B}+\acute{b}}=2\frac{5}{8}$ if previously moving in the same direction; $\frac{\acute{B}V-\acute{b}v}{\acute{B}+\acute{b}}=1\frac{1}{8}$ if in opposite directions, and $\frac{\acute{B}V}{\acute{B}+\acute{b}}=1\frac{7}{8}$ if $\acute{b}$ were at rest. Now I hold this to be incorrect. I conceive the momentum of a body moving with a given velocity, to be the *sum of two similar forces* ($m=\mu+M$), whereof μ is the force that acts to overcome the inertia of the body and is measured by its weight ($\mu=b$), and M is the force necessary to preserve the motion of the body at the given velocity; which force is in proportion to the product of the weight by the velocity (M is as bv).—From the experiment detailed in my last letter I conclude that $M=\varphi bv$, where φ is $>\frac{10}{7}$ and $<\frac{13}{8}$ nearly $=\frac{3}{2}$. Hence $m=b+\frac{3}{2}bv$; and v in feet per second $=\frac{2}{3}\left(\frac{m-b}{b}\right)$.—The following would be the working of the problem above quoted.

$$\left.\begin{array}{l}\acute{M}\text{ the momentum of }\acute{B}=5+\frac{3}{2}(5\times3)=27\frac{1}{2}.\\ \acute{m}\quad\text{ditto}\quad\text{of }\acute{b}=3+\frac{3}{2}(3\times2)=12.\end{array}\right\}\begin{array}{l}\text{where the formula}\\ \text{is } m=b+\frac{3}{2}bv.\end{array}$$

Making use of these values of the momenta and the formula $v=\frac{2}{3}\left(\frac{m-b}{b}\right)$ applied to the various cases, we have

(I) $\frac{27\frac{1}{2}+12-8}{8}\times\frac{2}{3}=2\frac{5}{8}$ velocity when $\acute{B}$ and $\acute{b}$ moved in the same direction.

(II) $\frac{27\frac{1}{2}-12-8}{8}\times\frac{2}{3}=\frac{5}{8}$ velocity when they meet.

(III) $\frac{27\frac{1}{2}-8}{8}\times\frac{2}{3}=1\frac{5}{8}$ velocity when $\acute{B}$ was moving and $\acute{b}$ at rest before the collision.

These resulting velocities are very different from those given in "Hutton's Course."—Experiment would decide which are correct. Were the experiment, detailed in page 18 of this Journal, repeated with good spring balances, and different weights let fall, a more exact value of φ would be obtained, and the formula $m=\mu+M=b+\varphi bv$ would be tested.

Yours obediently, B.

ERRATA.—Page 18, line 34, *for* $m=b+M^{bv}$, *read* $m=b+\varphi bv$.
" 49, *insert* between, *and read* equal to between 10-7ths and 13-8ths, &c.

WOODEN PAVEMENT.

SIR,—I was much gratified the other day, in passing along Oxford-street, to see that a comparative trial is about to be made of various kinds of pavement. It is only by laying down the different sorts in juxtaposition, on a much frequented thoroughfare, that any thing like a just estimate of their respective advantages can be made. I know not whether the works now going on are under one particular superintendance, or whether the laying down of each kind of pavement is confided to the particular persons whose interest it is to see that every precaution necessary to ensure success be attended to. This latter mode would seem not only the most natural, but the most desirable; for if each sort of pavement be not as perfect in its kind as it is possible to make it, the comparison will not be a fair one. Nevertheless, from what I have observed, it would appear really as if the persons directing the laying down of the wooden pavement were exerting themselves in behalf of their rivals, for never did I see work done in so slovenly and insufficient a manner. I must, however, premise what I have further to say by observing, that I am in no way whatever interested in the question of the relative merits of the different kinds of pavement; but I am acquainted, well acquainted, with the nature of wooden pavements, their advantages, and defects, and can affirm that no kind of pavement, perhaps, requires to be constructed with greater care.

1. The hexagonal blocks must be cut with mathematical exactness in all their dimensions.

2. The surface on which they rest must be not only perfectly even, but so solid and compact as not to be irregularly compressible into hollows. The latter circumstance, indeed, is necessary to all pavements.

3. The blocks must be dry when laid down, else, if they be much swollen by wet, they will contract considerably in drying, and the pavement be no longer solid, but ricketty. When laid down dry, the blocks will always be far enough from perfect contact to admit of such slight swelling as may result from rain falling on their upper surface.

4. The successive blocks of each successive range should be hard rammed down to a level, determined by a transverse rule laid on them from side to side, *before another row is placed*, so that if any block sinks lower than another by being rammed, it may immediately be lifted up, and fresh sand or fine gravel placed beneath it.

5. The cross-section of a wooden pavement should have but very little slope.

Now, Sir, every one of these essentials to a good wooden pavement is neglected in laying down the one in Oxford-street.

1. The hexagons are very different in size.

2. The surface on which they rest is one of a most irregularly-sized gravel, a mixture of large and small rounded stones; the very worst bottom that could be chosen for the purpose.

3. The blocks are quite wet when inserted.

4. The blocks are not rammed as laid down. I believe they will not be rammed till the space is all paved.

5. The cross section presents by far too great a convexity. The different size of the blocks is such, that in many places the faces are more than half an inch asunder, and the irregularity of the bottom on which they rest will make them very ricketty. If, while wet, such openings exist, what will there be in summer? The ramming will be done to make an even surface; but unless each block be driven down till it can go no further, the passage of carriages will soon make an uneven road of it; and if every block be rammed down to the utmost, the whole pavement, with much labour, must be beat down to a level, when any single block that may happen to go down lower than the rest.

If well made, the surface of a wooden pavement is so smooth that the slightest slope is sufficient to let the water run off. Too great a slope is very dangerous on a wooden pavement; for one of its inconveniences is its being exceedingly slippery in wet weather or in frosty weather; indeed, this I take to be the great disadvantage of wooden pavements for the *streets* of London (for *court-yards*, when well done, it is excellent); many a poor horse's knees will suffer from it, and the omnibus drivers, who already pull up their horses so suddenly that they slide a few feet on the roughest stone pavement, will find it impossible to stop suddenly, but by the wheels striking against the prostrate bodies of their cattle.

It is found that the mud of our streets is produced from the squeezing up of the subsoil. Now, this cannot possibly happen in a well-constructed wooden pavement, and such is, therefore, always free from mud in winter, and from dust in summer, both very great advantages. But the pavement, as laid down in Oxford-street, is so badly done, that it will soon be covered with our slimy mud, and no horses' feet, unless their shoes be made with iron spikes to them, will hold. Indeed the thing is done in so hurried a manner that it cannot be good. A clever workman cannot lay down more than two square fathoms of wooden pavement in a day, supposing the soil beneath all ready to his hand, and if the blocks are secured to each other by wooden pins, as is found advantageous in some cases, he will not do more than 49 square feet in a day.

The necessity of a good bottom is such, that in some places it has been found necessary first to lay down a good solid pavement, on which a perfect floor of two inch planking is laid down, this is smeared over with pitch, and finally, the hexagonal blocks are carefully placed and secured each to the other with wooden pegs. This is, of course, very expensive, and with us unnecessary, but a hard and perfectly even bottom should be made before laying down the blocks.

I could say a great deal more on the subject, having had opportunities of studying it, not from motives of interest, but from a love of information. I must, however, conclude this article, already, I fear, too long. Any information in my power to give I will be happy to communicate; my address may be learned of Mr. Weale, Architectural Library, Holborn. I am, Sir, your most obedient,

27th December, 1838. J. R. J.

[The above communication was intended for our last Journal, but was received too late for insertion. The wooden pavement in Oxford-street already indicates our correspondent's predictions; but the bad success of the experiment is not to be attributed to defects inherent in that kind of pavement, but to the unwarrantably careless manner in which it has been laid down; another cause of its failure may be attributed to the small space allotted for the experiment, the mud from the roadway at each end is brought on to it by the horses' feet and carriage-wheels, which keeps it constantly covered with mud or dust as the other pavement, whereas the great cleanliness of a wooden pavement is one of its prominent advantages, which can only be secured by having it for some distance.]

WHEELS OF LOCOMOTIVE ENGINES.

SIR,—I beg to submit to the consideration of the readers of your influential Journal, a suggestion on the construction of the wheels of locomotive engines, should you consider it of sufficient value to be admitted to your pages. It is simply to call attention to the feasibility and utility of employing brass as the material for those parts of the engine. We well know that in machinery generally, it is considered of great saving in wear and tear to prevent the contact of kindred metals, and perhaps it might be deserving of consideration how far the wear of the rails might be lessened by such an expedient.

Anything tending to promote this object I know will meet with attention; and it might perhaps be practicable by the use of brass wheels to save the expenditure of metal on the length of rails which are more difficult to repair, and therefore more expensive. I do not pretend to decide upon the utility of this suggestion or its actual economy in working, but perhaps some of your readers who are engaged in experiments on railways and have the means of trying it, might be induced to ascertain what would be the practical result.

In machinery, as you know, the contact of homogeneous metals is sometimes prevented by the application of leather, but it would be absurd to propose such an expedient for adoption on a railway on a large scale. It might, however, be well worth experiment on a small scale, as elucidatory the laws of friction, how far the application of leather or other substance to the wheels or rails, by producing a smoother surface, would be calculated to diminish the friction.

I am, sir, yours, &c.,
HYDE CLARKE, C.E.

STUART'S DICTIONARY.

SIR—In the last number of your useful Journal your correspondent, "A Constant Reader," while noticing Mr. Britton's Dictionary of Ancient Architecture, adverts to the deficiencies of preceding similar works; and, among others, he names "Stuart's Dictionary of Architecture." Having had the misfortune of projecting that compilation, I am desirous of your permission to say a few words in explanation of *some* of its manifold imperfections.

It was originally designed to contain a *general* collection of technical architectural terms, a popular history of the art in all countries, and biographical notices of architects; but the engagements of the publishers, urging a greater haste in publication than was consistent with a careful preparation of the manuscript, I found it impracticable, under the circumstances, to carry out the design to my own satisfaction. The labour of crude and undigested compilation became so irksome, that after hurrying a *few* of the first sheets through the press, and preparing about twenty-five of the engravings, I was glad to resign my share of the speculation. Feeling, however, the weight of my own faults, I was unwilling to run the risk of being loaded, in addition, with the editorial sins that might possibly be committed by my successor, and I therefore stipulated that the name of another Editor should be substituted for mine in the future parts of the compilation. Some time after this the publishers became bankrupt, and I thought the book had deservedly died, as it "made no sign." The letter of your correspondent first informed me that it had subsequently been revived, and continued, and that too under the original title. A peep, a few days ago, into the truly "finished" Dictionary of Architecture, by Robert Stuart, makes me anxious to assure the "Constant Reader" that I am utterly innocent of nineteen-twentieths of its nonsense and plagiarisms. Should any of his friends be simpletons enough to buy the volumes, in the hope of finding that kind of information which the title pages say they contain, and in the bitterness of disappointment, proceed from damning the book to perform the same duty towards its authors, I entreat the "Constant Reader" to interpose his friendly offices, and direct that one-*twentieth* part only, and no more, of the deserved maledictions shall rest on my devoted head in time coming. I am sure he will feel the reasonableness and justice of my request, when he reflects that for several years past I have, unknown to myself, borne *all the blame* of compiling that miserable production. I am, sir, your obedient servant,
ROBERT STUART.

London, 22d Jan. 1839.

ON ARCHES BUILT IN CEMENT.

The custom of turning arches in cement has now become very general with engineers, more particularly where great strength is required, as culverts under heavy embankments, and arches of a flat elliptical form. It appears questionable whether the additional strength acquired by turning arches in cement is real or imaginary; taking into account the great liability to fracture in all brick structures built in cement, the least settlement occasions a fracture, by which the adherence of the cement to the brick is totally destroyed, but which would not be the case did the cement possess any yielding properties, as common mortar.

In some cases I have observed arches turned in mortar, and a few feet at the crown only built in cement; and again elliptical arches built in mortar as high as the haunches, and the remainder in cement: this latter method will doubtless allow the arch to settle in a slight degree without detriment, in which case it would merely have the effect of forcing out some portion of the mortar joints; that part in cement remaining a compact mass, any rupture in which would occasion its destruction. A slight percussive force will often have the effect of rupturing a wall in cement, which would be comparatively harmless if built in mortar.

It has often occurred to me, and I now respectfully submit it to the notice of engineers, whether in the case of an arch being turned in cement, it would not be preferable to have mortar joints in each ring running quite through the arch, which I suppose would allow of some considerable settlement to take place without injury to the structure:—say in the case of a brick arch having three or more courses in the first half brick ring turned in cement, and as many courses in the remaining rings as necessary to allow of a continuous mortar joint from the soffit to the back of the arch. The part in cement assimilating to a string course in masonry. I imagine that this method of construction would possess many advantages over that in present use—especially where there would be reason to suspect a subsidence of the abutments.

PETER BRUFF.

Charlotte Street, Bloomsbury,
January 20th.

BENNETT'S NEW STEAM ENGINE,

FOR CAPTAIN COBB'S STEAMER.

We make the following extract from a pamphlet, forwarded to us from America, entitled "*Atlantic Steam Ships*":—

This vessel, built under the immediate superintendence of Captain Nathan Cobb, and intended for the Liverpool trade, is now completed, and will be ready for her first voyage across the Atlantic on the 10th of June (1838).*

This enterprise was planned and decided upon by Captain Cobb (then of the Liverpool packet Columbus) in 1834. He memorialized the legislature on the subject, without success; but, determined to test its practicability, he entered into a contract with Mr. Phineas Bennett, of Ithaca, to supply the machinery for his intended vessel before the 15th November, 1836. Various delays, however, occurred in performing the same—the engine being constructed on a principle entirely new, the sole invention of Mr. Bennett; but, had the contract been duly fulfilled, Captain Cobb's vessel, having been built upwards of two years, would doubtless have reached the English docks several months before the first voyage of the Sirius to this country.

Presuming the annexed description of her engine will interest many of our readers, we copy it entire:—

This engine has undergone the scrutiny of great numbers of scientific professors, ingenious and experienced mechanics and engineers, citizens and strangers; and the examinations have resulted in a general conviction that the world is about to realize a new improvement, not inferior to that of Watt and Bolton—an improvement that will effect a new era in ocean navigation, and bring all parts of the world in approximation to each other. A voyage to Liverpool, it is believed, may, by the power of this engine, be accomplished in ten days, and with only *one-tenth* of the fuel heretofore required, thereby allowing more room for passengers and freight.

The following description and drawing, it is hoped, will fully explain how the fire and the water can be brought and continued in actual contact with each other, and, rapidly generating the steam, still kept in controul, and its potency safely directed to propel the ship, or other object to which it may be applied.

The engine for Captain Cobb's Liverpool steam-packet, is a double horizontal high-pressure engine, thirty-five inch cylinder, and six feet stroke, with two blowing cylinders, of half the capacity, worked by the piston-rod of the steam cylinder passing through the lower or extreme head, and into the blowing cylinders; consequently, both will be of the same motion.

* We have not yet received any intelligence of this vessel having been completed or ready for her intended voyage.—ED. C. E. & A. JOUR.

References.—Pipes, C, with the necessary valves attached to the blowing cylinders, convey the air to the steam generator, whose outer case, *a*, *a*, is four feet diameter, and twelve feet high, and the inner case, or furnace, B, is three and a half feet diameter, and nine feet high. Smoke and feed-pipe, D, is constructed with two slides, *e*, *e*, which closes the pipe perfectly tight when thrust into it—their uses will hereafter be explained; *f* is a cap-valve in the steam chamber, placed over a short pipe or nozzle on the upper head of the furnace, and fitted to its seat perfectly tight, with a rod extending through the upper head of the outer case; *g* is the ash-pit below the grate; *h*, an opening into the ash-pit, with a slide to close it tight, when necessary.

In order to put the engine in operation, and successfully use all the advantages of this generator over any other, it will be necessary to set open the feed and smoke-pipe D, and the pipe *h*; introduce fuel down the feed-pipe, in sufficient quantity, and ignite it. Previously fill the space between the outer and inner case with water up to the dotted line, half way up the cap-valve *f*, which will completely immerse the furnace; and when steam is generated of sufficient elasticity to start the engine, say seventy-five pounds per square inch, close the pipes D and *h*, with their respective slides; then start the engine in the usual way, by opening a communication with steam-pipe *i*; then the blowing cylinders will force their charges of air through the pipe C into furnace B, partly taking its course through the mass of fuel on the grates, a sufficient quantity being introduced above the fuel to burn the smoke, which can be regulated by slides in the branch pipes, terminating the air-pipe C. You will discover that there is no escape for the air thus forced into the furnace, until its elasticity is, by the continued blast from the blowing cylinders, a little superior to the steam in the steam chamber, when the cap-valve *f* will rise from its seat, and the air, flame, and gases arising from combustion will be forced to pass under the edges of the said valve out into the water; and in this process all the heat generated will be imparted to the water, without the possibility of escaping otherwise.

By the repeated experiments I have heretofore made, I find that one foot of air blown into the furnace to promote combustion, by the expansion it undergoes, and by the addition of the gases and steam, is augmented in bulk at least five times its original size, or, to speak briefly, there is five times as much compound steam as air forced into the furnace; consequently, it will take one-fifth part of the power of the steam to operate the bellows, *plus* the friction, or this is nearly the power; but I forbear at present, nor is it necessary, to speak at large on that subject in this paper.

By a careful examination, it will be seen that the pressure of steam will wholly depend upon the proportion of the size of the blowing cylinder to the steam cylinder. In my engine now building, the blowing cylinders each contain twenty cubic feet, the steam cylinders each forty feet; but the steam being cut off when the piston has made but one-half its entire stroke, which reduces its size, as a measure to deal out the steam, to exactly the size of the blowing cylinder, the measure of the air forced in by the blowing cylinders being augmented, by passing through the generator, to five times its bulk, has to be forced into a space in the steam cylinder of just its original bulk; it will, therefore, exert a force equal to five atmospheres, which will be sixty pounds to the square inch above the atmospheric pressure.

This force, per inch, will not be exerted during the whole length of the stroke of the piston, but only half way, or to where the steam is cut off; and at the end, its elastic force is reduced to about twenty pounds, which will make the average pressure fifty pounds per square inch, and the piston contains 962 square inches, which multiplied by 50, will produce 48,100 pounds—the whole average force the piston moves with. It is calculated to have the engine make thirty-five double strokes per minute; hence, the piston will move 420 feet per same time, which multiplied by 48,100, produces 20,202,000 pounds: the weight that the piston would lift one foot high per minute, divided by 33,0001 being what a horse-power is estimated at, gives 612 horse-power for each steam-cylinder. But the power abstracted to operate the blowing cylinders and overcome the friction, I allow nearly equal to the power of one of the cylinders; therefore I estimate the power of the engine at 612 horse-power.

The amount of fuel consumed will depend upon the amount of air forced into the furnace by the blowing cylinders, and my two blowing cylinders, at every revolution, would force in 80 feet, if there were no leak either in piston or valves, and no space between said piston and valves for the air to compress in, and not be wholly forced out; therefore, probably not more than 75 feet will be expelled each revolution of the engine; and as it takes all the oxygen contained in 175 feet of atmospheric air to burn one pound of carbon, and 525 feet to burn one pound of hydrogen, I am of opinion, that to allow 225 feet to be necessary to burn one pound of fuel, will not be allowing too much; and, as before stated, 75 feet will be forced into the furnace at each revolution, it will therefore take three revolutions to burn one pound; and, as a cord of yellow pine weighs about 2,100 pounds, it will take 6,300 revolutions to burn one cord, which, divided by 35, the motion of the engine per minute, will give three hours for each cord—which, compared with the engine of the steamer Erie, on the Hudson, of little less or nearly the same power (600 horse-power), will consume forty cords in ten hours, or twelve cords in the same time my engine will one cord.

RESTORATION OF GOTHIC WORKS IN AUSTRIA.

We find that the attention of the Austrian government has been attracted from the research of classical ruins to the restoration of their own fine Gothic monuments, some of which threatened to be equally lost. When we remember the expense which was employed in the antiquities of Pola, Spalato, Aquileia, Trieste, Venice, Verona, &c., we are justified in entertaining great expectations from this zeal for their national architecture. We do not know whether this is one of the fruits of the French mania for the Renaissance, but at any rate it forms an accession to the extension of that taste for the Gothic, which already in France and Northern Germany seem to promise the revival of this glorious style. Few countries are more interesting than those of the Austrian empire to the student of medieval architecture, for they stand upon that debatable ground where the Moorish and the Byzantine influence both exercised control, and where the churches are not less interesting from proper Gothic monuments, than from the relics of those arts which Greece, even when expiring, poured forth on the western world.

SOUTH EASTERN RAILWAY

WORKS NEAR DOVER.

Communicated by an Engineer on a tour of inspection of the Public Works in Great Britain.

The works upon this line of railway, under the charge of Mr. Cubitt, are now proceeding with vigour, and present a thorough business-like appearance, indicating a decision on the part of the company to complete with as little delay as possible this line of railway, which, as the great continental outlet of the kingdom must, when completed, assume an important station among the principal lines of internal communication.

At Dover the works which are under the charge of Mr. John Wright as resident engineer, are very extensive and also of peculiar interest; they consist of the formation of double (or parallel) tunnels, together with open galleries along the face of the extensive and magnificent range of chalk cliffs which extend from the harbour at Dover to the Martello towers eastward of Folkstone. This very interesting portion of the line is being divided into six spaces of unequal extent, three portions appropriated to tunnels, two to the open galleries alternating with the tunnels, and the sixth to an open cutting along that remarkable place the Warren, which is an undercliff occasioned by a settlement of the chalk strata during one of those great convulsions of nature, which causing both subsidence and elevation of the crust of the earth, has put us in possession of her internal wealth, and given to the science of geology its high importance.

The eastern tunnel terminates at the Dover side of Shakspeare's cliff, where the cutting to form the face of the tunnel will be about 110 feet, the immense masses of chalk rock required to be removed from this spot, and from so great a height, has led to a very extensive use of gunpowder for this purpose, and masses containing upwards of one thousand cubic yards of chalk are at one blast precipitated from the summit to the beach below, there to be levelled for the formation of an embankment leading to the terminus on the quay. We were fortunate enough to witness two of these blasting operations on the 12th of January, the masses to be removed were nearly cubes containing about 700 yards each, and isolated from the great body of the cliff, by excavating from behind them a sufficient space for the workmen to pass and repass conveniently; at the foot of the mass to be overthrown, in the above-named excavation, two borings were made downwards, forming an angle of about thirty degrees with the perpendicular, each boring being fifteen feet deep; these were then filled, first with six inches of tow at the bottom, then 50lbs. of gunpowder was poured in, and lastly the holes were rammed to the top with rubble chalk around an iron rod, which, upon being withdrawn, left a hole from the surface to the charge to contain the priming, which consisted of fine gunpowder; in one of the holes of the second mass to be overthrown, the priming was conveyed to the centre of the charge by a pewter tube ¼-inch bore, similar to those used as gas pipes: this was done by way of experiment, and appeared to answer better than priming in the common way, which communicates with the top of the charge only instead of the centre. When all was ready and the order for firing the train given, a most animated scene presented itself along the extensive face of the cutting the workmen, amounting in number to about 170, were seen scrambling and climbing along the almost perpendicular face of the cliff, to attain a respectful distance from the scene of action. In a few seconds after the ignition of the train, a rumbling sound, like that of extremely distant thunder was heard, and the next instant the whole mass was lifted bodily from its base, and in falling again, it cleft asunder from top to bottom, and opening, crumbled to fragments, which poured like a torrent down to the beach. The charge being inserted obliquely (below the mass to be overthrown, as before described), at the same time that it lifted it up, forced out at least 300 yards from below its base, making a total of not less than one thousand cubic yards of chalk removed with one blast, and if both charges had gone off simultaneously, as was intended (there having been a perceptible interval between the explosions), a much greater effect would in all probability have been produced, as it was, however, estimating it at 1000 yards, and allowing the specific gravity of chalk to be 2·3, as stated by Dr. Mantell, we have for the weight of chalk thus removed with 100lbs. of powder, no less than 1,748 tons. In a few minutes after the first explosion, the signal for firing was again given, and the second mass similarly followed the first; thus this immense work, which if executed by manual labour only would be very costly, is now carried on at a comparatively trifling expense both of time and money.

The double or parallel tunnels are being formed by first drawing a heading six feet high and four feet wide, the top of each heading being within two feet of the intended roof of the tunnel, the headings are worked in opposite directions from shafts sunk from the surface above, and the excavated chalk is removed by side headings or driftways at right angles to the direction of the tunnel and leading to the face of the cliff, where it is thrown into the sea; a trainway is formed along these drifts having an inclination of 1 in 30; the waggons when loaded from the heading are easily pushed by one man down the trainway to the face of the cliff, he teems its contents into the sea, and upon such an inclination is easily able to push the waggon back again into the workings for another load; by such judicious arrangements the cost of the earthwork of the tunnels is reduced very considerably, compared with that of similar great undertakings. Upon an examination of these works we could not but notice the precision with which the direction of the various headings had been preserved during the excavation, for we could not discern the least deviation from the right line where the workings met from opposite directions.

REPORT OF THE ENGINEER TO THE DIRECTORS OF THE LONDON AND BRIGHTON RAILWAY.

Gentlemen,—The state and condition of the Works up to the present time are as follows:—

On Contract, No. 1.—The contractor has completed the bridge at Combe Lane, and has cut through the high ground in the late Mr. Chollett's land, and formed the embankment across Birdhurst Lodge, and cut through the hill beyond, and built a bridge over the lane on the south of the hill, and the embankment is carried some way over this bridge.

An occupation bridge is also built, and the road formed under it. The Works here are so well put together, that the temporary rails will be immediately laid down for half a mile, and then the long embankments will be more rapidly proceeded with.

The works are also commenced at the junction with the Croydon railway up to the cross-roads at Croydon common, and the contractor has laid in a large supply of materials for the remainder of the bridges, which will be commenced as soon as the weather is sufficiently settled. There are at present employed on this contract 170 men and 13 horses.

Contracts, Nos. 2 and 3, are let to one contractor. All the cuttings but one on No. 2 contract are in active execution: the Coulsdon-road bridge, and the occupation bridge No. 5, are nearly complete; the approaches will be finished in a few days: the culverts and brickwork are all in progress, and the temporary rails will in a short time be laid upon a great portion of the work.

Considerable progress has been made in the excavations of No. 3 contract, and although the contractor ought to have done more work in the time, yet the want of lodging and accommodation for the workmen has been a great drawback to him, but as buildings are now erected for the extra accommodation of above eight hundred men. I shall compel him to use his utmost exertions.

There are at present, however, employed on these two contracts seven hundred and fifty-four men, and thirty-two horses.

Contract, No. 4.—Merstham Tunnel.—The contractor has got all the shafts but one sunk to the bottom of the Tunnel, and that one is sunk to the level of the top of the Tunnel.

The driftway between the shafts is in progress, that between the trial shaft at the north end of the Tunnel and the first working shaft is completed, as well as the driftway between the trial shaft at the south end of the Tunnel and the last working shaft. This Tunnel is perfectly free from water, and the chalk is exceedingly hard and compact.

There are at work on this contract 162 men and 9 horses.

The extra contract at Merstham for the diversions of the turnpike road is proceeding in a satisfactory manner, although the contractor was at first delayed by not having possession of the Merstham tram-road.

There are 120 men and 36 horses at work on these roads.

Contract, No. 5.—The contractors have been at work little more than one month, and they have commenced upon cuttings Nos. 1 and 2, and on the side cutting for the large embankment on Earl's Wood common. The bridge over the mill-stream at Merstham is nearly completed, and they are proceeding in a very satisfactory manner. I am informed they will have possession of some land they require for temporary purposes in about a week, when they will be enabled to make greater progress.

There are 337 men and 28 horses at work upon this contract.

Contract, No. 6.—The contractors have been at work on this contract about one month, and as they have only possession of part of the land, are obliged to confine their operations to the side cutting on the Low Lands at Horley. They have fenced off most of the land they are in possession of.

There are at work on this contract 158 men and 10 horses.

Contract, No. 7.—The contractor is at work upon the cuttings that will require the longest time to execute, and is going on in a very satisfactory manner. About three miles of this contract, is of so light a description of work, that it is not necessary at present to enter upon it.

There are at work 220 men and 10 horses.

Contract, No. 8.—Balcombe Tunnel.—There are five working shafts at this Tunnel, besides two trial shafts which are sunk down to the bottom of the Tunnel, as well as two air shafts: one working shaft is finished. Two others are sunk down within five yards of the top of the Tunnel, another within 14 yards, and the third within 20 yards, and they are all proceeding night and day.

The water here has been found in greater quantities than I anticipated, I have therefore caused an adit to be driven up from the Brook Course, about 350 yards long, which is finished, and has tapped the water at the level of the bottom of the Tunnel, which it carries clear off the workings as fast as we get them opened out.

The driftway at the south end of the Tunnel has been completed to within a few yards of the first working shaft, and lays the work dry as it proceeds. The driftway is also going on between the north trial shaft and the northern working shaft. The total length of driftway at present complete is 280 yards in length. When the driftway is finished the whole of the water will run off of itself, and the Tunnel for ever afterwards be perfectly dry.

The contractor has at present 225 men and 15 horses at work upon this contract.

Contracts, Nos. 9, 10, 11, and 12.—These contracts are all let, and the contractors are actively engaged in casting up brick earth, preparing materials and getting them to the ground, to commence the work immediately the weather will permit.

Contract, No. 13.—This contract was entered upon last September, and the contractor has pushed on the work with spirit, and has made a considerable advance with the cuttings and embankments. He has completed and ballasted half-a-mile of road, ready to receive the permanent rails, which are in course of delivery. He has also a very large quantity of temporary rails.

The contractor has 300 men, 30 horses, and 60 waggons at work on this contract.

No. 14 Contract—Clayton Tunnel.—There are 10 working shafts at this tunnel, besides a trial shaft at each end; five of the working shafts are complete, four are sunk to the top of the tunnel, and the remaining one is within about 18 yards.

In sinking the trial-shaft at the north end of the tunnel, an impervious strata was found cropping up to the north, which prevented the water running off. I therefore ordered an adit to be driven up from the low ground to the trial shaft, which when cut through the impervious strata on a level with the bottom of the tunnel, will let off the whole of the water, and no more can in future accumulate.

The driftway between the shafts is being driven, and has been opened out between two of them. The chalk is firm and hard.

The contractors have at present 143 men and two horses at work on this contract.

The Company have obtained possession of lands for making bricks for the Tunnels and other works at convenient situations, and brick earth has been cast up, and early in the spring there will be a large supply ready for use.

Contracts, Nos. 15, 16, and 18.—These contracts extend from the south end of the Clayton Tunnel to the station at Brighton, as well as the station itself, and are all now advertised, and will be let on the 14th of March next.

Contract, No. 17.—The Shoreham Branch.—The contractor has proceeded much to my satisfaction. He has got most of the bridges built, several cuttings are opened, and the embankments formed, $2\frac{1}{2}$ miles of road are formed; the ballast is being put upon it, and the permanent rails will be laid down immediately.

A locomotive engine has arrived at Shoreham, which will be at work upon the line as soon as the rails are laid. This will materially expedite the forming of the embankments, and I expect this contract will be completed in September next, when the Shoreham branch will be opened to the public, which will be of great advantage in conveying materials for the main line. The contractor has at present 280 men and 40 horses at work.

A large supply of rails, blocks, sleepers and chairs have arrived, and more are daily expected.

The following is a summary of the number of men and horses employed on the whole of the works:—

	No.	Men.	Horses.
On Contract	1	170	13
	2	468	23
	3	286	9
	4	162	9
Turnpike-road diversions at Merstham		120	36
On Contract	5	337	28
	6	158	10
	7	220	10
	8	225	15
	13	300	30
	14	143	2
	17	280	40
Total		2869	225

This amount is exclusive of men casting and preparing brick earth.

The works now let and in operation extend over a distance of $41\frac{1}{2}$ miles, and are to be finished by the middle of August, 1840; and I cannot conclude this Report without expressing my satisfaction at the rapid progress of the works.

I am, Gentlemen, your most obedient servant,

London, Jan. 16, 1839. JOHN U. RASTRICK.

GREAT WESTERN RAILWAY.

[We trust that the importance of the following reports will be a sufficient justification for having occupied so many pages of the Journal. We had intended to have made some remarks thereon, but in consequence of our correspondent, "An Old Engineer," having so ably commented upon them, we have refrained, for the present, saying any thing further on the subject.]

EXTRACTS FROM MR. WOOD'S FIRST REPORT.

The increase of gauge has been from 4 feet 8½ inches to 7 feet, and the prominent reasons assigned for such a departure from the common width, is the attainment of a higher rate of speed—increased lateral steadiness to the carriages and engines—a diminution of the friction by the use of wheels of a larger diameter—and a greater space afforded for the works of the locomotive engines.

The deviation from the ordinary mode of constructing the railway, has been the substitution of continuous longitudinal timbers, with piling at certain intervals, and cross transomes; with iron rails of a particular form screwed down upon the longitudinal timbers.

The additional width of gauge has increased the breadth of the entire track of the railway between the outside of the rails of the two lines (including the breadth of the rails) from 16 feet 3 inches to 20 feet 10 inches; consequently all the works connected with the formation of the road will be increased to a certain extent, but not in proportion to the above figures. The plan of continuous wooden timbers and piling also involves an additional cost beyond that of forming railways according to the ordinary method.

The questions submitted to me for consideration, therefore, appear to me to be shortly these; are the advantages professed to be obtained by this departure from the ordinary plan of construction of railways and increased width of gauge, realized? to what extent—at what additional cost—and are the advantages an equivalent for the increased cost of forming the railway according to this plan, viewing the whole subject in connection with the present state of the works?

Acting upon the principles hereinbefore explained as to the mode of conducting the inquiry, it was my object, as much as possible, to subject all, or as many as could be, of the properties of this railway as contrasted with others, to direct experiment; certain advantages are stated to be derived from this departure from the ordinary width and plan of constructing railways, and the circumstance of 23 miles of this railway having been opened, and having been in operation since the 4th June, appeared to me to afford an opportunity of subjecting to the test of experience, and of obtaining correct and indisputable results by carefully conducted experiments, *that which rested on conjecture, or casual observation.*

It is perfectly true that a daily opportunity has for some time existed of observing the rate of travelling with the passenger trains on your railway, by which some result of the rate of speed accomplished, or likely to be realized when a greater length of line was opened might be obtained, but the engines on the Great Western differ in many respects from those employed on other railways, and also from each other; if, therefore, extended observations had been made on the rate of travelling, it was necessary to distinguish what was due to the road, and what to the engines, and if any increased speed or greater performance was accomplished, whether such was applicable to the railway itself, or to the particular construction of engine only, and whether, by the application of similar engines to other railways (if practicable), the same results would not accrue.

If this had been done, no doubt important and valuable information would have been obtained, but that would have been, in fact, the very sort of inquiry by your own people, which you have determined to entrust to others; and it may be remarked, that if the inquiry had been conducted by yourselves, it could not have been at all conclusive or satisfactory in the comparison with other railways, and without such comparisons it would have been useless.

At the first outset of the inquiry, it therefore appeared to me necessary to institute a set of experiments, to ascertain the actual performances of the locomotive engines upon your own railway; with this information carefully obtained we then had the real working powers of the railway; by employing heavy loads, we obtained correct data for determining the maximum weight which the engines, then upon the railway, could drag, at determinate rates of speed; and by subjecting the engines to very light weights, we likewise determined the maximum rate of speed with certain known loads; and by recording the quantity of coke consumed and water evaporated in each trip, we also ascertained, with considerable accuracy, the comparative cost of motive power in dragging different loads at different velocities.

These experiments appeared to me to be highly necessary and valuable, inasmuch as whatever difference of opinion might exist (in the absence of correct experiments to ascertain the fact) as to the friction of the carriages, or resistance of the road as compared with others, these experiments, by determining the real practicable expense of working the railway, would at once ascertain what increased rate of speed could be accomplished, and at what additional cost of motive power such higher rates of speed was attained. These experiments would, in fact, anticipate, so far as the powers of the engines reached, the experience of some years of regular work upon the railway, and with more correct results. On my arrival upon the line on the 17th instant, I therefore commenced a series of experiments on the working powers of the engines, which were continued under my own observation during the ten days I remained there, and are now in operation, and will shortly be completed by persons in whom I have perfect confidence.

It would be premature, to say the least, at this stage of the inquiry, to give any results derived from experiments not yet complete; but it may be some gratification to the proprietors of this great work to state, that one of the engines, the North Star, accomplished an average performance from London to Maidenhead and back, of dragging 180 tons, including engine and tender, at the rate of nearly 30 miles an hour, and that on some occasions, for short distances, a rate of 45 miles an hour was attained.

When the powers of the locomotive engines and capabilities of the Great Western Railway are thus obtained, in order to comply with your instructions, and contrast this information with the capabilities of other railways, it will be necessary, in order to arrive at correct and conclusive results, that we should have the result of a similar set of experiments made upon railways of the ordinary construction. Although isolated experiments have been made by different individuals on several railways, and although I have made several myself, it does not appear to me that a set of experiments have yet been made sufficiently extensive and varied to fully develope the capabilities and powers of other railways, so as to form indisputable data for contrasting with the experiments made upon the Great Western. The directors of the London and Birmingham Railway, in the most liberal manner, granted me full permission to make any experiments on their railway, consistently with the noninterruption of their traffic; and Mr. Robert Stephenson, the engineer in chief, kindly assisted me all in his power, and furnished me with some experiments he had made on that railway, on a former occasion. I deem it, however, my duty to state to you that I do not think the information I am in possession of is sufficiently extensive or conclusive as regards other railways to enable me to make a comparison with the performances of the engines on the Great Western, so as to arrive at an incontestible conclusion, nor do I think it right that I should go into a comparative statement at all, unless the data be equally conclusive or carefully deduced on both sides. The information I at present possess does not enable me to go further than report to you the performances of your engines on the Great Western Railway; and if it be your wish that I should comply fully with your request, and contrast their powers with the performances on other railways, it will be necessary that some experiments, similar to those performed on your railway, should be instituted on some of the ordinary railways of a different width of gauge. It will not be necessary that the experiments on those railways should be equally numerous, as the engines on the other railways are generally of one description, and consequently one or two sets carefully conducted will be sufficient. It may be asked what practical advantage will result from all these experiments to the interest of the proprietors of the Great Western Railway? The answer is shortly this: it is admitted that the construction of that railway involves an increased capital; it is, therefore, quite necessary to determine what are the additional advantages, in a practical point of view, resulting from this mode of construction, and whether the advantages are greater or less than are equivalent to the increased cost of construction.

These observations apply more particularly to the plan of construction of the Great Western Railway generally, and to the capabilities of the entire system, or to the increased gauge, and the mode of construction combined; but it is not necessary to the adoption of an increased gauge, that the railway should be constructed on the plan adopted by Mr. Brunel; it may be constructed on some modified plan of that system, or it might even be constructed on the plan of the London and Birmingham, or Grand Junction railways. Neither is it absolutely necessary, if an increased gauge be deemed advisable, that such increased gauge should be precisely seven feet; all these are separate and distinct questions, requiring different and distinct investigation, and, therefore, the simple acquirement of correct information of the comparative capabilities of the Great Western Railway in its present state, with the other existing railways does not appear to me to comprise the whole question; it appears to me to admit of inquiry whether the width of gauge adopted by Mr. Brunel is or is not that which conduces most to accomplish all the objects for which a departure from the more established width was deemed advisable, and also whether the mode of construction of the railway is the best that can be devised, or in what way it can be improved, consistently with the objects required to be attained, and with due regard to economy.

The plan adopted by Mr. Brunel, as previously stated, consists of longitudinal timber bearings secured by piles at proper distances, with cross transomes, double at the joinings of the longitudinal timbers, and single at the intermediate piles; and upon these continuous bearings iron rails of a particular form are fastened by screw bolts.

It has been alleged that one of the objects of the increased gauge was a greater stability to the carriages, and consequently less vibratory, or greater smoothness of motion to the passengers; it appears to be, therefore, one of the subjects of inquiry how far this is realized,—whether such a desideratum is accomplished,—and to what extent. Keeping in view the principle set out with in this inquiry, of, if possible, subjecting to experiment mechanically every minutia, rather than to rely on opinion, or the more fallacious evidence of our senses, I had constructed an instrument for measuring and recording upon paper all the oscillations or vibrations of the carriages, from one end of the line to the other; and by transferring this instrument to the carriages of the ordinary railways, incontrovertible evidence is obtained, and such as can be appreciated by any one, of the relative vibratory motion of the carriages on the Great Western Railway, compared with the motion on other railways.

We have thus produced a diagram upon paper showing the number and extent of the vibrations of the carriages, and hence it can not only be ascertained if there does exist less motion on this railway than on others of a less width of gauge, but to what extent: and this is thus made capable of being a subject of arithmetical determination.

It was soon found, however, and this shews the importance of this mode of investigation, that the motion of the carriages on railways was a compound one; that besides a vertical motion, it was composed of an horizontal oscillatory motion and of a transverse undulatory motion combined; and it appeared, so far as we could depend upon observation, that less of one description of motion existed on the Great Western Railway, and more of the other, than upon the ordinary railways; it therefore became necessary, and of some importance, to measure and determine each of these motions distinct from the other, not merely for idle curiosity, but for the purpose of ascertaining the causes of each, and having done so, to attain the first step towards accomplishing a remedy. All this applies to the compound action of the rails and the carriages; and it will be seen that such a complication of motions required not only time but extreme labour and attention to investigate.

We now come to, perhaps, the most important consideration, that of the construction of the railway; this is the substitution of longitudinal continuous bearings of timber, with piling, instead of isolated stone blocks, or transverse timber sleepers, or, indeed, continuous timber bearings without piling.

The investigation of this part of the subject, according to the principles laid down in this inquiry, was attended with extreme difficulty.

The first subject for investigation was, the relative firmness or solidity of base exhibited by the continuous bearings of timber with piling, and compared with stone blocks, or continuous bearings without piling; to determine this, I had an instrument, or deflectometer, made, which being placed underneath the rail, measured the amount of deflection when the trains or known weights passed over, and the more accurately to determine the precise action of the load in passing over the rails, I employed three deflectometers at the same time. The motion of one with the other was effected by a rod between each instrument, one was placed underneath each of the supports or transomes opposite the piles, and one in the middle of the rail; and by a similar contrivance to that employed in the instrument for measuring the oscillation of the carriages, I got a tracing of the deflection of the rails recorded upon paper, and thus obtained correct diagrams of the deflection at each of the places at the same moment of time.

By subjecting the rails with piling in all their varieties, and also continuous bearings of the same scantling of timber without piling, to the deflectometer, I obtained a measure of the relative firmness or solidity of base of these two varieties of construction; and by likewise employing the same instruments to measure the deflection of the rails and depression of the blocks, or cross sleepers, on other railways, I thus obtained the relative firmness of base of all these different modes of construction, and these diagrams being capable of being transferred to, and embodied in a report, and measured with undoubted accuracy, will enable any one to pass their own judgment upon the relative firmness of base of those different plans. It will at once, however, be seen, that admitting we have obtained the relative firmness of base of the existing plan of construction of the Great Western Railway compared with that of known plans of construction of other railways, the degree of stiffness developed by the former, comprehends both the section of the timbers, and that of the rails; and that such a plan of continuous bearings, either with or without piling, does not necessarily imply the use of that particular form of iron rail; it was therefore necessary to determine what part of the deflection was due to the timbers and what to the particular form of rail. To accomplish this, I purpose having these rails removed, and the same rails which were subjected to experiment on other railways, where stone blocks or cross sleepers were used, substituted; when the deflection will be again measured. By a combination of these experiments in all their varieties, I expect to arrive at results which, not being matter of opinion, but facts, deduced from carefully-conducted and self-recording experiments, cannot fail of producing the most important if not conclusive results.

Independently of those experiments, to elucidate all the minutiæ of action of the different parts of the system of railway mechanism, and others, which it is not necessary at this time to enumerate, I subjected to experiment, so far as the means and circumstances afforded me, the resistance and friction presented by the Great Western Rails to the passage of the carriages and engines along them; and by pursuing a similar course of experiments on other railways, we shall thus have valuable corroborative evidence to that of the experiments made with the engines, of the relative resistance of the Great Western Railway, compared with that of railways of the ordinary width.

With the exception of some experiments on the London and Birmingham Railway, made on my survey, and which were not sufficiently varied or sufficiently numerous to afford conclusive results, we still require further evidence of the resistance of the carriages and engines on other railways, to compare with those made on the Great Western Railway, in order to arrive at conclusive results, or indeed to enable me fully to comply with my instructions for this inquiry.

REPORT OF JOHN HAWKSHAW, ESQ.

To the Directors of the Great Western Railway.

GENTLEMEN,—Your instructions of the 5th September are to the following effect:—That you are desirous of obtaining my assistance in coming to a sound and practical conclusion as as to your future proceedings, directing my attention to those points which may be said to constitute the peculiar features of your railway, as contrasted with others, including the construction and efficiency of your engines, as well as every matter connected with the locomotive department.

My attention is also called to the bridge at Maidenhead, as to its construction generally, and as to the means proposed to remedy an existing defect in one of the arches. To arrive at an opinion, I am desired to undertake an examination of that portion of the line now completed, and investigate the result of the whole system which has been adopted.

To come to a proper conclusion, it appeared to me to be necessary that I should make myself acquainted with the general character of the whole line, and consequently I have been over its whole length to Bristol. It seemed also desirable that I should inform myself, as accurately as possible, as to the traffic to be expected upon it generally, and in the aggregate, for this certainly forms one of the most essential features of all lines.

The question seems also to require a still more extended view than this; the district into which it goes has to be glanced at; the area and extent of population, which may be looked to for collateral traffic, has to be seen; and these have to be compared with districts through which other lines have been made, and where other lines are at work.

The necessity of such a view of the question became apparent to me, because, on coming first upon your road, that which immediately strikes is, the enlarged capacity of all things, engines, carriages, and road. And the existence of such an arrangement pre-supposes, in my view, an equally enlarged traffic; trains of much greater weight, and of a greater number of passengers than elsewhere. In short, though not to an equal degree, the difference between your arrangements and those of other railway companies, is something like the difference between a canal for barges and a canal for ships; and this comparison will not be extraordinary, should it appear that, taking your gradients into the question, your locomotives have twice the power of those on other lines; and the contrast will not have been useless, should it be shown that it would be a parallel case to build a ship of 200 tons burthen, when there was no probability of ever obtaining a cargo of half the weight.

Further, I may extend these preliminary remarks by observing, that the object which I presume you to have in view is, (after paying a due regard to to the accommodation and convenience of the public,) to carry out your measure in such a manner as shall be most conducive to the interests of those who have invested their property in it. That this should be your object there can be no doubt, and I wish to place it here as *the desideratum*, because it is one thing to design that which shall be pleasing in outline, and grand in dimensions, and it is altogether another thing to design that which, under all the circumstances, shall best answer the end in view; one of those ends being to obtain a return for the capital invested.

I am desirous that it should not be thought that I am here pre-judging the question. To all questions there are conditions, and I only wish it to be clearly understood what are the conditions of the question, which, as I understand it, this report professes to consider. And they may be repeated, that in carrying out the measure, there is to be *the fullest regard to the wants and conveniences of the public*; but also a constant regard to the prospects and expectations of the shareholders.

Now, it will not be difficult to show, that the legitimate interests of these two parties are one.

The profits of a railway are determined by the ratio of the proceeds to the cost; if the latter be greatly increased, it becomes almost imperative on the proprietary to increase the former, either by curtailing the accommodation, or by increasing the charge to the public. The public, therefore, is interested as much in the economy of railroads, as in the economy of manufactures; in the one case, if it be in fabrics, it will cause a reduction of the price per yard; in the other case it will cause a reduction in the rate per mile. And if the public, in the extended sense of the word, is to be benefited by economy being exercised in the construction of a railway, the public, in a more limited sense of the word, or the more immediate district through which the line passes, will derive still greater advantage.

Suppose, for instance, that the problem to be solved was, to give the greatest impetus to the trade, and the greatest advantage to the town of Bristol. The way to solve this problem, I think, would be, to connect it with the metropolis by a road on which parties could be carried for the smallest sum, and at a velocity not inferior to that at which they can be carried in any other direction. Now the cost at which a party can be carried will be as the interest on the *capital expended* added to the cost of working the road.

For instance, call the gross revenue of a road paying 10 per cent., 100; and call the cost of working 50 per cent.; 50 will then be left to pay 10 per cent. on a capital of 500; double the capital, and it reduces the profit to 5 per cent.

The capital ought not to be doubled, advisedly, therefore, unless one of these two things is to be accomplished by it; either that the cost of working be reduced to nothing, or that the gross proceeds to be doubled. Should the capital be increased without effecting any material reduction in the cost of working, the consequence will be, that, to increase the proceeds, the rates must be raised; and this may or may not be effectual; for an increase of charge beyond a certain limit will not increase the proceeds. If it should not be effectual, the shareholders will suffer. If it should be effectual, the public will suffer, by having to pay the higher rates.

If, supposing in the case of a railway only partially constructed, it should turn out that the traffic had been as much under-rated as the cost of the line had been increased, and that still a profit of ten per cent. would accrue, yet it proves only this, that though in the one case, by good fortune, a profit of 10 per cent. will be obtained, in the other case a profit of 20 per cent. would have been secured.

I would not apply this species of illustration to cases where the cost is increased of *necessity*; I would only apply it to cases where the increased expenditure is for some *specific object*; such as the attainment of much flatter gradients, or of very high velocities, or of much greater dimensions; which may or may not be desirable, according to the result when tried by this rule.

Now supposing this species of test be applied to one great object which you appear to have in view—the reduction of a great portion of your line to a practical level, for the ostensible purpose of obtaining higher velocities, or diminished resistance.

Between your maximum parliamentary gradient, which was 1 in 528, or 10 feet per mile, and your present proposed gradient, which is 1 in 1320, or only 4 feet in a mile, the question stands thus.

Calling friction, resistance from the atmosphere, &c., 10lbs. per ton, and adding gravity, the resistance on 1 in 528 will be 14. 2lbs. per ton, on 1 in 1320 it will be 11 7lbs. per ton, making a diminution of resistance, when ascending, of 17 per cent. Now, supposing your railway was one inclination throughout between the extreme termini A and B; in rising from A to B the increased resistance of 17 per cent. would be felt, and a corresponding increase of steam would have to be expended; but in descending from B to A there would be a diminished resistance in the same proportion, and a smaller quantity of steam would be required; and in such a case, as it regards *cost* of working, there would be very little advantage in one gradient over the other. The maximum load that an engine could draw on an incline of 1 in 528, would be less than on 1 in 1320; but on an incline of 1 in 528 all average loads could be taken.

On an incline of 1 in 528 also, to carry *the same load*, an engine would have to be a trifle heavier than on 1 in 1320; but on 1 in 528, to carry full average loads, an engine could be made of as light weight as they ever are, or perhaps can be made, consistent with the requisite strength.

If, instead of having one inclination, the line consisted of a series of inclinations greatly undulating, the advantages of the flatter line would approach nearer to the 17 per cent.; not but that it would still follow, that in going up the steeper gradients there would be increased resistance, and in going down there would be diminished resistance in equal proportion; yet in practice it has been found, that unless the inclines be of very great length, advantage cannot be taken of the diminished resistance in going down, as regards *steam*; for though it is not wanted to an equal extent, yet a great portion is wasted by blowing off at the safety valve.

But your line corresponds to neither the latter nor the former of these cases; it is neither composed entirely of one plane, nor of a series of planes *greatly undulating*; but in result it will approach nearer to the former case than the latter; for it may be said to be composed of two great planes, one rising up to the summit, the other descending from it—one upwards of 70 miles in length, the other upwards of 40, and dividing your line at the summit into two parts; it would then be analogous to the former case, in which it appears that practically, and as regards cost of working, there would be no very material difference between the inclination of 1 in 528, and of 1 in 1320, *when so circumstanced*. If in your line, therefore, the advantage of one gradient over the other be put at 8.5 per cent., it will, in my opinion, be the *full* equivalent.

Now, if the whole cost of working a railway was expended on locomotive power, by reducing the gradient from 1 in 528, to 1 in 1320, a saving of 8.5 per cent. would be effected, and therefore an increase of 8. 5 per cent. to the capital to obtain it would not be expended uselessly.

But the expense of working railways does not consist entirely of the cost of locomotive power. There are other expences that remain constant, whatever saving be effected in the locomotive department; and this fact should be kept constantly in view during the remainder of this report.

Taking the Liverpool and Manchester Railway as a standard, it will there be seen that the cost of power does not form one-third of their half-yearly expenses. It is upon this item only, therefore, that an alteration of the gradients of the nature I have been describing would effect a saving of 8.5 per cent.; and 8.5 per cent. upon one-third of the annual expenses will be only 2.8 per cent. on the whole of the annual expenses, and therefore a company would do wrong in increasing their capital more than 2.8 per cent. to effect such an alteration.

But the small saving to be obtained in many cases by reducing gradients below a certain inclination may be proved by an appeal to actual practice; not experiment only, but the every-day results of lines in operation, which is far better, for it is upon the every-day business that the saving must be effected, if it is to be.

Contrasting your line with one which opened about the same time, which also has continuous bearings, upon which an equal velocity has been maintained, and which, as will appear from the statement below, has very different gradients, it will be seen that in a case like yours I have put the advantage of a gradient of 1 in 1320 over 1 in 528, high enough.

GRADIENTS ON GREAT WESTERN RAILWAY,

Miles.	Chains.				
„	16		level		
2	1	rises	1	in	1760
7	48	„	1	„	1320
„	40		level		
3	48	falls	1	„	1760
7	40	„	1	„	1320
1	72		level		
„	30	falls	1	„	1980
1	40	„	1	„	1820
2	20	„	1	„	2640
1	40	rises	1	„	2640
1	„	„	1	„	2112
„	20	„	1	„	1320
„	30	„	1	„	1980
2	„	„	1	„	1320

GRADIENTS ON MANCHESTER AND BOLTON RAILWAY.

Miles.	Chains.				
„	10		level		
„	26	falls	1	in	1312
„	28	rises	1	„	160
„	16		level		1034
„	35	rises	1	„	1634
1	60	„	1	„	544
4	61	„	1	„	200
1	32	„	1	„	274½
„	62		level		

The following are the results of Four Weeks' Traffic on each of these Lines, ending the 13th of September.

GREAT WESTERN RAILWAY.

Average number of trains per day	14
On Sundays	12
Times of running	8, 9, 10, 12, 4, 5, 6, 7
Average number of carriages per train	6. 5
Average number of passengers per train	111
	Tons. Cwt.
Average weight per train	40 5
	lbs.
Average consumption of coke per mile	51. 00
Average consumption of coke per ton per mile	1. 26
Average consumption of coke per passenger per mile	0. 45
Length of trip	22½ miles.
Average time, 55 minutes, with two stoppages.	

MANCHESTER AND BOLTON RAILWAY.

Average number of trains per day	20
On Sundays	4
Times of running	7, 8, 9, 10, 12, 2½, 4, 5, 6, 7
Average number of carriages per train	6
Average number of passengers per train	72
	Tons. Cwt.
Average weight per train	24 1
	lbs.
Average consumption of coke per mile	27. 00
Average consumption of coke per ton per mile	1. 16
Average consumption of coke per passenger per mile	0. 36
Length of trip	10 miles.
Average time of making it, without stoppages	27 minutes.
Average time, 35 minutes, with 5 stoppages.	

From the foregoing statement it would appear that the consumption of coke is considerably less on the line with steep gradients. But the average weight per train is in each case exclusive of the engine and tender.

The average weight of engine and tender, in working order, on the Great Western Railway, will be 27 tons.

On the Manchester and Bolton Railway the engine and tender, in working order, weigh 16 tons 4 cwt.

Adding these to the respective trains, *the average weight* of the Great Western train, including engine and tender, will be *67 tons 5 cwt.*

The average weight of the Manchester and Bolton train, including engine and tender, is *40 tons 5 cwt.* And

Consumption of coke per ton per mile on the Great Western, including weight of engine and tender, is 0.75lbs.	Consumption of coke per ton per mile on Manchester and Bolton, including weight of engine and tender, is 0.67lbs.

And on the Leeds and Selby Railway, with the following gradients, the results of a month's working, ending the 13th of September, are as under:—

GRADIENTS.

1½	miles	rises	1	in	210
1	„	„	1	„	176
2	„	„	1	„	152
3	„		level		
3	„	falls	1	„	135
3	„	„	1	„	152
6½	„		level		

Average number of trains per day, 7. 2 on Sundays.

One train extra on two market days per week.

Average number of passengers per train	57
Average weight per train, exclusive of engine and tender	32 tons 5 cwt.
	lbs.
Average consumption of coke per mile	36.00
Average consumption of coke per ton per mile	1.1
Average consumption of coke per passenger per mile	0.63
Length of trip	20 miles.

Average time 1 hour 7 minutes, with 4 stoppages.

The next subject for consideration is the increase of gauge. In examining this question, it will be necessary to put aside useless and erroneous objections; for the enquiry is one on which I am not only anxious to arrive at a proper conclusion myself, but I am desirous of enabling others to do so also; and throughout this report I shall rather aim at developing the process by which the opinions it contains are arrived at, even at the risk of being tedious, and aware though I am, that this will be laying it more peculiarly open to any who should be disposed to cavil at it; yet, on such a subject, it is better that it should partake more of the nature of demonstration than of mere assertion.

It may be observed here, that much that is absurd has been applied to the question of gauge: some have looked for advantages so great as would have left them little less than magical; they seem almost to have expected that on *such a gauge* the carriages would run of themselves. Others, on the contrary, seem almost to have expected that on such a gauge carriages could never be made to run at all. It has been applauded to the skies as being wonderful; it has been decried, and cried down, as being little less than nonsensical. Now, it is neither the one nor the other of these; it is simply a railroad of greater dimensions than those hitherto constructed, and the only question is, is such an increase of dimensions judicious or not? And the next question will be, if injudicious, considering the amount in money to which you are committed to it, is it better for you to proceed or to make the alteration?

In the first place it may be stated, for there can be no doubt about it, that just as good a road can be made 7 feet wide as 5 feet wide: it is simply a question of cost. There are some, no doubt, who have connected the effect of the malformation of your road in the first instance, with the width of ways, but of course erroneously so.

In the next place, in determining on the question of gauge, it should be considered quite independently of anything that may have been done upon your railway, which is not absolutely consequent on the increase of gauge; and I shall class among the non-essentials the peculiar mode of laying with piles, engines of 16 tons weight, and tunnels of 30 feet diameter.

It may be premised that determining the question of gauge in this country, is a very different question from determining it with regard to countries where the railway system is scarcely introduced. In England, what may be termed the great trunk, connecting the north with the south, has already been formed, or is in progress. Under the superintendence of men who were earliest connected with the Liverpool and Manchester Railway, and with railways even prior to that, it has been constructed on a gauge of 4 feet 8½ inches. They had more experience than others in railway matters; and their continuing the same dimensions as to width of way proves that they had found no occasion for altering it. Moreover, it is indisputably true, that they who have had the most experience, and who have been brought most into contact with the working of railways, see the least occasion for an alteration as to width, and are the most satisfied with the present gauge.

In addition to this main trunk, another line crossing it right angles, and of which the Liverpool and Manchester, and the Leeds and Selby Railways form a part, and which will connect the eastern with the western seas, is already constructed, or in progress, to a similar gauge: and other lines of great extent, some of them surrounding and piercing into the district into which your Railway goes, are also formed, or are rapidly forming to the 4 feet 8½ inch gauge.

And it will not be too much perhaps to say, that three-fourths of England is already being traversed by railways to the narrower gauge.

It follows, then, that any company deviating from this gauge will be isolating themselves to a certain extent; if not as regards their main line, yet as regards their branches; if not as regards their direct traffic, yet certainly as regards their collateral traffic.

But in the present early stage of railway traffic, it yet remains to be seen whether or not it may not become a great evil, for a main line to be thus isolated and rendered impossible of connection with the great lines in its neighbourhood; that it will be an evil in this sense as it regards the branch lines, there can be little doubt; for they or some of them, in course of time, will of necessity run into the neighbourhood of other lines of different gauge; but with these, however vital the connection may be, all connection will be impossible.

In this point of view only, it has become a serious matter for any company in this country to make their line to differ as to dimensions from the majority of lines around them. It is to a certain extent as if a canal company in a country of canals should construct a new navigation so, and with locks of such a character, as would totally shut out the boats of all the canals that surrounded it.

Still it is possible that there might be, coupled with the deviation, improvements of such a nature as would counterbalance the inconvenience, as would even compensate the loss. They might consist of arrangements that would effect a *great and important saving in time and money*, and in a better conservation of the property to be conveyed. and it will be necessary to enquire if such will be the result of the deviation in your case as to the width of way.

If the 7 feet gauge is to effect a saving in money, it must be in one of two ways; either by calling for less capital in the first instance, or by reducing the cost of working afterwards. The first of these it cannot do. On the contrary, the capital will be increasd certainly: to how great an extent it would be impossible for me without more time for calculation to say. But contracting the dimensions to the smallest limit; two ways of 7 feet must of necessity require a greater width than two ways of 4 feet 8½ Inches. I should say, to make a line equally as convenient, this increase of width would amount to 4 feet; for the width between the ways is not to be governed entirely by the maximum width assigned to the load. A certain width is found convenient for repairs and other purposes; and too great a proximity of the ways is dangerous; as by it an accident occrring on one line may be productive of disastrous consequences on the other, as I have seen. And the width outside the ways will also be nearly a fixed quantity whatever be the gauge; for a certain width is requisite for safety, and for allowing proper consolidation to the outer rail on the embankments, and to give room for drainage in the cuttings; and, therefore, the width of the road generally, to make as convenient a road, would have to be increased by the extra width given to the ways. And besides this increase of general dimensions as to earth work and land, the locomotives would of necessity have to be heavier (I do not say to an equal extent to those you now have), and they would therefore be more costly to some extent. The permanent road will also cost more of the larger dimensions than if of the smaller; for it avails nothing to compare a light rail on the large gauge, with a heavier rail on the smaller gauge; such comparisons must be made when other things are the same, or they amount to nothing.

If then the capital will of necessity be increased, the next enquiry is, will the cost of working be diminished? The cost of working will depend on the first cost of the engines; for though, in the first instance, they may be charged to capital, afterwards they will have to be charged to current expences. It will also depend on the repairs of the engines, the consumption of coke, and the maintenance of way; and on other matters which are in nowise connected with the gauge.

As it regards the cost of the engines, it will be greater on the wide gauge; as it respects the repairs of the engines, should it prove in favour of the wide gauge, it can only be in a small degree. For the repairs of locomotives on lines where passengers are carried at great velocities, have been found to be incurred chiefly on the wheels and axles, tubes, and fire boxes, which cannot be affected by the gauge, excepting that if the wheels and axles be made larger, the repairs will be increased. And, at all events, the common repairs of a larger machine, necessarily so in consequence of the larger way, but not necessarily so in consequence of any greater traffic, it is probable, will counterbalance any saving that might be effected in the repairs of the smaller gearing, in consequence of having more room to arrange it. Besides, a great portion of the repairs of locomotives is not for common wear and tear, but is on account of accidents. And in proportion as the machine is made larger and more expensive, so will the cost of repairs consequent on accidents be increased.

The maintenance of way will of course be *fully* as great on a wider way, and with heavier engines, as on a narrower way, with lighter engines; for perhaps it would not be advancing too much to say, that the engines and tenders do more harm to the superstructure of railways than all the rest of the traffic put together; excepting perhaps loads of long timber.

And lastly, if the consumption of coke is to be reduced on the wider gauge, it can only be by the friction being diminished, or by what has been called the mechanical advantage of large wheels.

It would have been highly desirable, if before using this as an argument, the Irish commissioners had clearly determined that there was an advantage in larger wheels. For there are some experiments and several reasons for doubting that any such advantage will be derived from increasing the size of wheel. As it regards the friction of attrition, or that caused by the rubbing of the axles, it may be supposed to remain constant, however the wheel be enlarged; if it be allowed that with an enlarged diameter of wheel, and especially when attached to a longer axle, there must be a corresponding enlargement of journal; and in practice I think this would be the case. And as regards the friction of rolling, it is not likely to be diminished by increasing the size of the wheel, for the rolling friction on rails is very different from the rolling friction on common roads, where obstacles are met with that have to be surmounted by raising the vehicle over them. Small wheels on turnpike roads have been found to create much more resistance. But on a railway, unless the wheels be very small, the obstacles to motion from causes of this nature must be nearly imperceptible. And there is another species of rolling friction, caused by the grinding of the flanges of the wheels against the rails, which will be more felt in large wheels than in small wheels, and especially round curves.

But to arrive at something more definite on this subject, I will give the result of some experiments made on your line on the 20th September.

A large train, consisting of nine carriages, one six-wheeled waggon, and eleven trucks, laden with iron and stone, was got into motion up and down a long and perfectly straight inclination of 4 feet per mile. The experiment was first made upon the whole train, which gave a result of 6.22lbs. per ton friction.

The experiment was made so as to ascertain the friction of the trucks and the carriages separately, one truck only being left attached to the carriages, and the result obtained was a friction of 6.5lbs. per ton for the trucks and waggons, which weighed together 79 tons 8 cwt.; and a friction of 8.15lbs. per ton on the carriages and one truck alone, which weighed in the aggregate 74 tons 12 cwt.

On the 26th September I took six wagons on the Manchester and Bolton Railway, each laden with 3½ tons of iron, and experimented in the same way upon them, by getting them into motion, and noting the velocity and the distance run, from which the friction was determined to be 6.3lbs. per ton. The plane on which this experiment was made was terminated at each end by curves, one of 111 chains radius, the other of 67 chains radius. In the experiment up the plane the distance run was 2950 feet, the wagons having run 330 feet into the curve of 111 chains radius before they stopped. In the experiment down the plane the distance run was 3825 feet, 1980 feet of which was in the curve of 72 chains radius in which the wagons stopped. The same train of six wagons was then brought to an inclination where gravity alone was sufficient to get it into motion. This portion of the line had previously been divided by stakes into lengths of 100 feet, and the rails opposite each stake accurately levelled.

From the starting point to the ninth stake the line was straight, but at this point a curve of 42 chains radius commenced, and extended beyond the point where the wagons came to rest.

The result of this experiment, repeated twice, gave a friction of 7.32lbs. per ton; but it should also be observed that besides passing for 1300 feet along a curve of about half a mile radius, the whole distance run being about

2200 feet, the train had to pass through three shunts before coming to rest, which will probably account for the friction being higher than in the previous experiments.

This line, as well as the Great Western, has continuous bearings of wood. Though for a short distance in the curves in all the experiments on the Manchester and Bolton Railway, the motion was continued on continuous bearings of stone. The Manchester and Bolton line has a heavier rail of (53lbs. per yard). And in the Great Western experiments, three of the carriages and one wagon had six wheels each, which have rather more friction than those of four wheels; but in such a large and heavy train, no great difference could be caused by this.

The whole of the wheels in the Great Western experiments were four feet in diameter, the journals 2 11-16 inches in diameter. In the experiments on the Manchester and Bolton Railway the wheels were of three feet diameter, and the journals of two inches diameter; and four feet : three feet : : 2 11-16 inches : 1 1-16 or two inches nearly. But supposing that neither the foregoing experiments nor reasonings are to be decisive as to the mechanical advantage of increasing the size of the wheels, and I do not mean to say that they are, for to determine the question clearly the experiments should perhaps be made on the same road; yet still as a general question there will be several drawbacks on the theoretical advantage of the larger wheel, such as the greater resistance on curves with the wider way; more rubbing of the flanges against the rails, not only in consequence of the larger wheel, but of the greater breadth of way; for I think it is probable that friction would be reduced to a minimum by concentrating the whole momentum of a train on one rail, and that friction will be increased in some degree, as the distance between the wheels, or as the width of way is enlarged.

The next enquiry respecting the gauge is as to the matter of safety. If the gauge is to be altered on this account, it should only be because of a want of safety in the present gauge. If A be safe, there cannot be the smallest advantage in making B safer.

Now the question is, is the narrower gauge safe? It might have been reasoned *a priori* that the width between the railway wheels being equal to those of turnpike-road carriages; and from the very great weight of railway wheels and the under carriages, the centre of gravity being in all cases much lower on a railway coach than on a stage coach; and the railway itself being infinitely more smooth and perfect than the common road; that though the velocities are much greater, yet still there is no danger of overturning. And the fact is, I have never heard of a case of overturning, or of any accident that I should attribute to the narrowness of base, occurring. And from what experience I have had on Railways, I believe it would be a most difficult matter to overturn the carriages upon them, with the present gauge, even if the object was purposely to do so, and an experiment should be made for the purpose. But having heard it urged that there was greater safety on the wider base, which may be granted, but which amounts to little if there is quite enough of safety on the narrower base; and being unable to call to mind a single instance of an accident or of an overturning in consequence of a narrower base, I addressed a letter to Mr. Booth, the treasurer of the Liverpool and Manchester Railway, on the subject, to know if he had ever known an accident that could be attributed to the narrowness of base; I also wrote a similar letter to Mr. Smith, engineer on the Leeds and Selby Railway, and I received the following replies:—

"Liverpool and Manchester Railway,
"Lime Street Station, 21st Sept., 1838.

"SIR,—I have to acknowledge the favour of your communication of the 19th, enquiring whether or not, in my experience, there is any want of safety in the present gauge, 4 feet 8½ inches as to the chance of overturning; and also if I have known any case of overturning in consequence of narrowness of base, or are aware of any accidents having occurred, which I would ascribe to the narrowness of the 4 feet 8½ inches, base.

"In reply, I beg leave to inform you that in my opinion there is not any want of safety in the 4 feet 8½ inch gauge, and I am not aware of any accidents having occurred, which I should ascribe to the 4 feet 8½ inch gauge. The only case of overturning which I recollect occurred some years ago, when, owing to the breaking of an axle, the engine (which had only four wheels) quitted the rails, and drew several of the carriages over the embankment, near Bury-lane.

"Whether in such a case a broader base would have prevented the carriages overturning, I will not pretend to say; it might depend on the relative height of the carriages and other circumstances. "I am, Sir, &c.,
(Signed) "HENRY BOOTH."
"John Hawkshaw, Esq."

"Leeds, 21st Sept., 1838.

"DEAR SIR,—In reply to yours of the 19th inst., we have had but one accident (during the experience of four years) that was not occasioned either by tongues being wrong or some obstacle in the way. The one excepted, was caused by the repairers raising some wood sleepers too much at once on a new made embankment. I do not consider there is any want of safety in the gauge, (4 feet 8½ inches) nor do I know of any accident or overturning which can be attributed to that guage.
"I am, dear Sir, yours, &c.,
(Signed) "GEO. SMITH, R.E.,
"John Hawkshaw, Esq." "Leeds and Selby Railway."

Besides, there is no difficulty in lowering the centre of gravity on the present gauge very considerably, were such a thing desirable or called for. For by making the coaches omnibus fashion, the passengers in each coach could be made to sit a foot lower than at present. That this is not done goes a great way to prove that it is unnecessary. Or by keeping the centre of gravity as it is, it is quite easy and practicable with the present gauge to increase the size of the wheels from three feet to three feet six inches, or larger, if any thing was to be gained by it.

Having gone into the question of gauge abstractedly from what has been done upon your line in connection with it, and debiting the system of a 7 feet rail with such an increase of cost only as appears to me to be absolutely consequent on its adoption, I feel compelled to come to the conclusion, that there are no advantages to be obtained by adopting it, at all commensurate with the evils that will be consequent on the deviation; and for the reasons which follow, it is not desirable, in my opinion, to proceed with it, unless you were already committed to it in a pecuniary sense, to an amount that will outweigh all the objections to it, but which will be seen hereafter.

The additional reasons for not proceeding with it are these;—first, considering the great cost, and the comparatively small profits of railway lines generally on the smallest dimensions, and the great difficulty there is, and the corresponding increase of outlay that is incurred, in obtaining curves of sufficiently large radius to be workable at the present narrower gauge; I cannot conceive that there is a single practical man in England who could recommend the 7 feet gauge, as general system for this country.

If unfit as a general system for the whole country, it will be unfit as a partial system for a portion of it; unless that system is of necessity to be very much confined; its ramifications into other districts impossible from natural barriers, such as seas, or lakes; and the nature of the country, such as to undulations, that the cost of obtaining curves of larger radius will be trifling.

Even admitting that the latter condition is true of your line, and that from its general flatness curves can easily be obtained of large radius, yet this cannot be predicated of the whole of the branches and extensions to which you will have to look for collateral and extended traffic. And even if it could, still the system is unquestionably more expensive to some degree, and though you with your large traffic might not be totally crushed by it, it has yet to be seen what the effect will be on the smaller and less favourable lines; which, to get into yours, will be compelled to adopt similar dimensions, and involving of course similar expenses. At the same time, the prosperity of your line will be affected in no small degree by the prosperity of the tributaries to it; and in fact, a probable result of doing things on such a great scale will be, to drive traffic which otherwise would come upon you, in some other direction. For in railway lines generally, in the same country, there will come to be a mutual dependance one upon another. And surely it must be rather an untenable doctrine to hold, that the gauge of each line is to be determined only by reference to its curves and gradients, for by such a rule it would follow that no two lines could be alike.

Finally, it may be said of railway lines, that they will not bear any additional expense. It may perhaps be said of every railway formed in this kingdom, that if the company had to begin again, their object would be to economise, and to diminish their first outlay, not to increase it; or if there be a railway company, and such are rare cases, that has already devoted its attention to the utmost in keeping down the expenditure in the first instance—that railway company would not do otherwise if it had to begin again; and that railway company will feel that for the course that has been pursued, there is every cause for congratulation.

I could not advise you to take the London and Birmingham as your model, and feel satisfied if you exceed them as to cost in only a few particulars; their line was necessarily through a country very different, and far more expensive than yours; and their line is in a position in which, if a great expenditure is to be repaid anywhere in this country, it will be to them. For I cannot conceive that your line, or indeed any other line that I am acquainted with, can expect an equal amount of thorough traffic; for into their line a great portion of the north of England, and a still larger portion of Scotland, besides the great manufacturing and commercial districts of Birmingham, Manchester, and Liverpool, must of necessity converge before arriving at the Metropolis.

Still, though I do not see that the aggregate of your traffic can ever be expected to equal that of the London and Birmingham; yet, considering the much more favourable country through which your railway passes, and that the traffic upon it will be unquestionably very large, I think your line presented equally as good features for investment, and perhaps may do so still; it will depend, in my view, upon the course you pursue.

That course, as far as my opinion goes, is not to go forward on your present system. Knowing that railways hitherto, and on the smaller scale, have been found greatly expensive, so much so as scarcely in any case to leave an ample dividend, when the great risk of such investments is considered, I cannot advise you to proceed on a plan which, in all human probability, will materially diminish that dividend.

It cannot be necessary for the attainment of safety, when in the present gauge there is no danger.

It cannot be required for the attainment of high velocities, because on the narower gauge velocities can be attained with perfect safety, greater than could be maintained by any railway company in England perhaps, without absolute ruin to themselves in a pecuniary sense.

The Liverpool and Manchester Railway, by increasing their speed from 20 to 26 miles per hour, have increased their locomotive expenses about 15 per cent. Much higher velocities than this are attained, and with perfect safety, on the narrower gauge; but there is no company that could bear the increased expense of maintaining such velocities constantly, or if there be, it will be found to be that company which has expended the least in the first instance. For example: the Grand Junction would feel the effects of increased expenditure to maintain a very high velocity, less than would the London and Birmingham; not that their gradients are better, they are worse; but simply because their first outlay is much less, and therefore their annual expenses might be much increased, and still leave as large a revenue: in short, for very much the same reason that 20s. for carrying a passenger 97½ miles on their line, will probably pay them quite as well as 30s. will pay the London and Birmingham Company for carrying a passenger 111 miles on their line.

But in advising you not to proceed in constructing your line on the larger scale, it is necessary to take a review of the consequences.

You are, to a certain extent, committed to it in a pecuniary sense. This amount can be ascertained and contrasted with the saving to be effected by contracting the dimensions, if there be a saving; if there be no saving as to first cost, in making the alteration, yet as I believe there would be a material saving in the expenses afterwards, and other advantages of greater magnitude still, such as the avoiding the introduction of an expensive system into districts which can ill afford it, the consequent re-action from which would be felt by our own line, I feel bound to recommend you to make the alteration.

That which will go to the *debit* of making the alteration will be as follows:—

22 Miles of road to be taken up and re-laid, the same materials being used, £1,500 per mile....		£33,000 0 0
14 Locomotives and tenders received (adapted for wide gauge) £1,980 each,	£27,720 0 0	
7 Engines and tenders, constructing, say same price	13,860 0 0	
42 First-class carriages at £544............	22,848 0 0	
40 Second-class carriages at £351	14,040 0 0	
118 Trucks and wagons at £106	12,508 0 0	
		90,976 0 0
		£123,976 0 0

On the rails I do not consider there would be any loss, for though I think them too light, yet they will be much less objectionable in this respect on the narrower way.

That which will go to *the credit* of making the alteration will be as follows:—

£1,000 per mile to be saved on 100 miles of permanent way yet to be laid..	£100,000 0 0
£400 each less upon 60 engines and tenders yet to be obtained to make full stock	24,000 0 0
£200 per mile less on earthwork, &c. yet to be completed, say 60 miles..	12,000 0 0
Say 20 per cent. on tunnelling yet to be done, by the narrower gauge, requiring 4 feet less width, say 2,000 yards, at £10	20,000 0 0
	£156,000 0 0

It is useless to push this enquiry further. It is clear that even considering the question as if your present stock of engines, carriages, &c. would be valueless if you alter the gauge; and contrasting this loss with the saving that would be effected by adopting the narrower gauge, supposing that in prosecuting the 7 feet gauge you were only in future to do that which is barely necessary, still, taking such a view of it, the advantage in a pecuniary sense is decidedly in favour of an alteration of the gauge.

But if the comparison were made on the supposition that in carrying out your system as to gauge, you were to continue the large dimensions you have begun with, the pecuniary advantages in favour of reducing the gauge would be very much greater.

Further, there is no necessity for considering all your present-stock of engines and carriages as valueless; for supposing you should decide upon altering the gauge, it could be done as follows.

It would be necessary in the first place to curtail the dimensions of all the works yet remaining to be done, and to proceed with taking up one of the lines between London and Maidenhead and to relay it to the narrower gauge. In the mean time your present traffic in passengers could be carried on very well on one line. On the railway between Antwerp and Brussels, greater numbers are carried on a single line of way. This would of course afford employment for your present stock of engines and carriages for probably a year and a half, and would therefore go to diminish the sacrifice that ultimately would have to be made; that sacrifice would be still further diminished, by the value of such part of the carriages, trucks, and engines, as could be applied in the construction of others for the narrower gauge.

Of course the traffic would have to be transferred to the line of narrower gauge before the second seven feet way between London and Maidenhead could be taken up; it might then be relaid to the narrower gauge, and could be got ready by the time that an extended portion of your line should be prepared for opening.

Having come to a conclusion that so great an increase of guage as to 7 feet is to be avoided; the question will arise, is 4 feet 8½ inch exactly the thing? No one, perhaps, will pretend to say that it is so precisely, or that an inch or two in addition could make much difference as to cost. Of course the objections to increasing the width of way, on the score of expense, become less as the increase to be made is diminished; the *main reason* in my view for abiding by the 4 feet 8½ inch guage in this country is, that it has been greatly adopted, and that there are no very substantial grounds for altering it. I have never heard any one, whose opinion I should esteem of great value from their experience of the working of locomotives on railways, wish for more than a few inches of additional width, five or six inches at the utmost; and even as to this increase, just in proportion as the parties had had much to do with the working of the locomotives on railways, so in the same proportion did they esteem even it to be of minor importance.

Perhaps, if railways were just commencing in this country, an addition of a few inches, five or six inches at the most, might be made; but the advantage to be gained by making it now, in my opinion, would in no manner compensate the evil that will arise from a variety of gauges in the same country.

Impressed with the importance of having other opinions on this subject than my own, I addressed a letter to two of the largest manufacturers of locomotives in this country, requesting from them to know what in their opinion were the practical disadvantages of the 4 feet 8½ inches guage as affecting the manufacturer.

The opinions of both these parties in my view are peculiarly valuable, for they were not only amongst the earliest locomotive manufacturers, but have also had much more experience as to the working of their engines on railways than any other manufacturers I know; and without this latter kind of experience, manufacturers are, to a certain extent, only theorists, as to the question in hand.

Their answers are below.

"Liverpool, Sept. 29th, 1838.

"Dear Sir,—In reply to your letter of the 27th inst. referring to the question of the right guage, which at this time is so much agitated,

"I beg to state that though we do not labour absolutely under great difficulties, in consequence of the want of breadth, yet there is no doubt an addition to the present width (4 feet 8½in) of a few inches would enable us to make a more perfect engine. The addition of 6 inches would be ample, and I consider any thing beyond that would tend to increase the difficulties beyond what we now experience, rather than otherwise.

"Yours truly,

(Signed) "EDWARD BURY.

"John Hawkshaw, Esq."

"London, Oct. 1, 1838.

"Mr. John Hawkshaw.

"Sir,—The extent of inconvenience we experience in the construction of locomotive engines of moderate power (say 14 inch cylinders) for a gauge of 4 feet 8½ inches, is very small indeed. In our early engines an additional width of 3 or 4 inches would have facilitated the arrangement of the working gear and eccentrics; but this has since been simplified, and our latest arrangement of those parts leaves scarcely this small increase of width to be wished for.

"The construction of engines for Russia for a six feet gauge, leads us to believe that a considerable increase of expense is attendant upon increased width; more especially if the power of the engine is considered to bear any relation to the width of the gauge. If the power or dimensions of the engine be kept the same, the additional expense consequent upon an increase of gauge will not be very considerable.

"We are, Sir, &c.,

(Signed) "ROBERT STEPHENSON & Co."

With respect to Mr. Bury, it may be observed, that if any manufacturer in England has felt inconvenience from the 4 ft. 8½ in. guage, he must have done so; for, from the peculiar construction of his engines, it is a principle with him to use inside bearings only, which necessarily leave less room for the working gear than when outside bearings are used.

BRIDGE AT MAIDENHEAD.

I have carefully inspected this bridge, and find that at the crown of the eastern arch, and for 12 or 14 feet on each side of it, there is a separation between the 1st, 2nd, and 3rd rings of whole bricks, counting from the soffit of the arch; these separations generally are about half an inch wide; and extend three or four yards each way from the crown of the arch; the dislocation appears to be less towards the interior, for on making a hole quite through the brickwork in the centre of the arch, it was found that there was a separation only between the 2nd and 3rd ring of whole bricks, but this separation was about an inch in width.

There is nothing anywhere that I could perceive like crushing of the bricks, or dislocation in direction of the thrust.

I think it probable, therefore, that if a few iron bolts were put through the arch, so as to prevent any further separation, and the crown of the arch loaded with additional weight, that the bridge might stand, and perhaps be quite strong enough for anything that ever may be required of it. But I cannot say that I should advise such an experiment to be made on such a structure, especially as putting its stability beyond all question will not be a very serious matter.

I should recommend, therefore, that from 25 to 30 feet of the crown of the eastern arch be taken out, (the precise quantity will be seen as the arch is opened), and replaced with stone, the facing of the elevation may still be of brick, so as not to destroy the appearance of the bridge. The stone will give greater weight to the crown of the arch, which I think is wanted; and I should also recommend an additional weight to be placed on the crown of the western arch; a couple of courses of 8 or 9 inch landings would do; for I find difficulty in accounting for the appearances presented, otherwise than on the supposition that the haunches of the arches have had more than their full share of load; and at all events, I am of opinion that some additional weight on the crown of both arches will be of service, and will add to the general stability of the structure.

PERMANENT WAY.

The mode adopted in laying the rails, is, I think, attempting to do that in a difficult and expensive manner, which may be done at least as well in a simpler and more economical manner.

LOCOMOTIVE POWER.

Beyond what may have been said on this subject generally in the preceding parts of this report, the length to which it has already extended forbids my saying much more. Generally, I should say, that the power of your engines should be proportioned to your loads.

Employing engines capable of drawing 200 tons to drag loads averaging 50 tons, will be very much like fastening eight horses to a post-chaise.

The great weight of locomotives is a positive evil. It is so, because they have to be carried about for nothing. It is so, because they do more harm to the road than anything else, and a railway is to be made stronger and more costly on account of them. But, to a certain extent, it is a necessary evil; but only to a certain extent. And if the weight be increased beyond this limit, it will be so much thrown away.

The weight of the engine should be determined by the average load be taken, and the nature of the gradients.

Moreover, the engines will work economically, or otherwise, in proportion as their power approximates to their loads.

The average of your passenger trains cannot be expected to be greater or heavier than on the Grand Junction Railway. Supposing them to be the same, as to weight; from your flatter gradients, engines of little more than two-thirds the power of those on the Grand Junction, and therefore of considerably less weight, would be sufficient for you to travel at equal velocities. If you wish to travel at double the velocity, of course you must have more powerful engines; but it should not be forgotten, that you can only travel at double the velocity, by pretty nearly doubling the cost.

Finally, I should say of your line, that the country is favourable, and the gradients good; naturally so, or in so far as they are dependent on the undulations of the country.

Further, with such a traffic as you may expect, and such a country, your line holds out great inducements for the investment of capital.

But the advantages of country will be lost sight of and nullified, if for the sake of a system, the cost of the road be greatly increased; and even the good gradients will be rendered of non-effect as to economy, if the speed be greatly increased; for greater speed will entail greater cost and will be tantamount to steep gradients.

And though the same results may perhaps be obtained on railways of better gradients, with more dead weight than on railways of bad gradients, yet this seems to be merely bringing down the good line to the standard of the bad.

I am, Gentlemen, your very obedient servant,

(Signed) JOHN HAWKSHAW.

Manchester, 4th October, 1838.

REPORT OF I. K. BRUNEL, Esq.

TO THE DIRECTORS OF THE GREAT WESTERN RAILWAY COMPANY.

Gentlemen,—In compliance with your request, I beg to submit to you the following observations upon the only report which you have laid before me; that expected from Mr. Nicholas Wood not having yet arrived.

Knowing that I should be called upon to express an opinion upon the subject of these two reports, and that the time allowed me would necessarily be very short, I had proposed to class, as far as possible, their contents under two heads,—viz., first, *facts*, including under this head the statement of actual results ascertained upon the Great Western or other lines, and general principles, or rules, laid down and assumed as axioms, whether of mechanics, mathematics, or of the practical working or economy of railways; and, secondly, of the *arguments* founded upon these facts or axioms, including the inferences drawn from them and the opinions expressed.

I proposed, in the next place, to consider how far the former were applicable to the case, and, what is of great importance, how far they constituted *all* the facts that it was necessary to state for the purpose of arriving at a fair conclusion. I intended then to have discussed the correctness of the latter, and thus to have arrived, by a clear and satisfactory process, at the object I had in view, which was, to give my opinions and my views on the same subject as that of the reports; to compare them with those of the writers; to show wherein I agreed with them and where I differed, together with the reasons and grounds for the differences between us.

This would, I think, have laid before you a business-like view of the case, and such as I should have wished to have submitted to you. I regret that the peculiar nature of the only report yet received puts it out of my power to pursue this course; for having carefully read it, I found, that by confining myself to the division or classification which I had proposed, I should have passed over in silence a very great portion of its contents, unless I formed a third division, including neither such facts or arguments as I have described, but consisting of general remarks and hypothetical cases, and even the opinions of others founded upon hypothetical cases. It is true, there are many remarks and comparisons made which are not applied directly to the Great Western railway, nor are they in terms stated to be strictly relevant; neither are the cases hypothetically put afterwards proved to have any practical existence, or made to throw light upon any of the existing circumstances of the railway; but being interwoven with a report specially made, upon the Great Western railway, they are calculated, however inadvertently, to mislead, unless their irrelevancy is pointed out.

I regret very much the necessity of considering these portions of the report, as it involves the tedious process of referring almost to each page, and of frequently entering into long explanations to remove a misapprehension, produced, perhaps, only by a single word; but no alternative is left to me. The utmost extent to which I can venture to depart from the line pursued by the report which I have before me, will be to consider the subject, in the first place, in what appears to me the engineering and business-like view, and then, subsequently and separately, to consider the particular manner in which the writer has treated the question.

The report, after a few preliminary remarks, is divided under the the following heads, and they are considered in the order stated,—namely, the objects to be attained in the construction of a railway, or what are very properly called, "the conditions of the question;" the comparative advantages of good gradients; the width of gauge; Maidenhead bridge; the construction of the permanent way; and the locomotive power. I shall now consider the subjects in the same order, and, for the sake of perfect accuracy, refer to the pages and paragraphs of the printed copy before me. As the opinions expressed, and the conclusion arrived at, in this report, are generally, if not wholly, diametrically opposed to those which I am known to entertain, and which I am now quite prepared to support, it is but just to state, at the outset, that I differ altogether from the general principles laid down, which appear to me to be unsound, and, indeed, to be incorrectly and insufficiently expressed; and I must say, that I consider the reasoning fallacious and defective, and that many of the calculations are incorrect or erroneous from the omission of quantities or conditions which must affect the results.

In the report (p. 48), the conditions of the question are stated to be, that, "there is to be the fullest regard to the wants and conveniences of the public, but also a constant regard to the prospects and expectations of the shareholders," in which I concur. But the observations which follow I entirely dissent from, for which I will shortly state my reasons. It is said that the "profits of a railway are determined by the ratio of the proceeds to the cost; if the latter be greatly increased, it becomes almost imperative on the propietary to increase the former, either by curtailing the accommodation or by increasing the charge to the public."

In noticing this paragraph, I wish to premise that I deprecate, as much as any one, all *useless* expenditure, every increase of the capital of any company not justified by a fair probability of return, either by economy in the management or in the maintenance of the work, or by increase in the income to be derived from traffic:—and I must distinctly say, that no departure from a sound and wise economy would ever receive my sanction. Having said this, I now, in answer to the observation I have quoted, would beg to remark, that at whatever cost a railway may have been constructed, the only way to increase its proceeds is the same in all cases: you can only induce the public to travil upon a railway, by holding out better accommodation or lower charges, or both, than they can find elsewhere,—by, in fact, *reversing* the means recommended—by increasing the accommodation or curtailing the charges. Expedition, comfort, and cheapness, are the temptations to railroad travelling, and, according to the degree in which they exist are made manifest, will the public use the railway. The object is, to get the largest income by these means,—the income must depend upon the facilities afforded. Let the railroad cost what it may, it is by no such process as that recommended that "proceeds" can be increased, but by one just the reverse, which is and must be the common object of all companies,—viz., to obtain the maximum of traffic and income: and no curtailing of the accommodation, no increase of charge to the public, can do this.

It is stated in the succeeding paragraph (p. 48), that "the cost at which a party can be conveyed will be as the interest on the capital expended, added to the cost of working the road;" and inversely, as the number carried, should have been added. But this important condition, which totally alters the arithmetical result of the cost of transport, is altogether omitted. Again, in what immediately follows it is said, that if "capital be increased without effecting any material reduction in the cost of working, the consequence will be, that to increase proceeds the rates must be raised. May not the number of passengers and the traffic be increased by such additional outlay, and thereby the proceeds also?

Such are the principles of railway economy which are laid down. I might perhaps avoid the necessity of further discussing them, by dropping them as suddenly and as completely as they are dropped after this last-quoted paragraph in the report, but as an impression is produced (although no direct inference is drawn) by their assertion, I will examine what I conceive to be the views of the writer on their intrinsic merits.

The theory of trade advanced in this part of the report may be stated thus; that the only mode of increasing the gross profits is to increase the profit upon each article by raising the price or by reducing the original outlay. No doubt this is one method, if it can be effected; but I believe it would be difficult to point out any one great branch of trade which has thriven in this country by such a course. But, on the contrary, in every branch of manufacture, each year the necessary machinery and plant become more costly, the price of the articles manufactured is reduced, and the profits upon any given quantity diminished; but the gross profits are at the same time maintained and increased by the great increase of consumption consequent upon diminished prices or improved quality.

In railways, the same principle applies, and, if possible, in a still greater degree; yet in the report it is assumed throughout that the consumption, or, in the case of railways, the number of passengers and the traffic, is a constant quantity which, on the one hand, is secured to the railway whatever may be its comparative inconveniences or defects, and, on the other hand, cannot be increased by any additional accommodation, or by any other inducement held out to the public.

It is upon these views that all the arguments adduced in favour of reduction of first cost are founded in this report; in no single instance is any allusion made to the possibility of increasing the number of passengers by improving the means of conveyance. The great argument of all the promoters of railways, the striking results of experience in every railway—namely, the increased number of travellers consequent upon the increased facilities of conveyance, is totally lost sight of.

It is unnecessary to dwell any longer on this point, more particularly as I shall have occasion to refer to it hereafter; but it appears to me clear that no conclusion founded upon this reasoning can be safely relied upon.

The next question—namely, the effect or value of gradients, is one so susceptible of calculation, that it might be supposed to be a point upon which no great difference of opinion could exist; and when the calculations are exactly made, and the simple results clearly stated, no difference will be found to exist.

In the comparison between gradients of 10 feet per mile and 4 feet per mile (p. 49), in which a diminution of resistance when ascending the latter, as compared with the former, of 17 per cent. is admitted, data are assumed different from those generally given by the best authorities on the subject, and conditions most essential to an accurate comparison are omitted. Ten lbs. per ton are assumed as the resistance on a level; eight lbs. have generally been taken as nearer the truth, and, upon a railway in good order, with carriages also in good order, may safely be taken as the total resistance of a train. The effect of gravity in inclinations of 4 feet and 10 feet will be 1.7lbs., and 4.25lbs., which, with the constant of 8lbs., makes 9.7lbs., and 12.25lbs. per ton; this, or 100 to 126, gives the ratio of the resistance on the two gradients, being already 26 per cent., instead of 17. But if the maximum load that an engine can draw (of course at the regular speed of the trains) up the incline be taken, the weight of the engine and tender must be deducted, in either case, to obtain the effective load. In fast trains, such as those running on the Liverpool and Manchester line, the engine and tender will be about 30 per cent. of the gross weight, in the three cases cited by the writer at p. 8 and 9, the proportion is even greater, being two-fifths, or 40 per cent.; but I will admit even one-fourth to be the proportion, which would be allowing a fast passenger-train to weigh nett 60 tons, with an engine and tender, such as those of the Grand Junction, weighing 20 tons. From 100 and 126 is therefore to be deducted one quarter of 100, or 25, leaving 75 and 101, which are as 100 to 134, being an excess of 34 per cent. instead of 17 in the nett load which the same engine will be capable of drawing at the same velocity up the incline of 4 feet over that which it would draw on an incline of 10 feet; but the writer, after making the calculation, proceeds to sink all comparison by the simple assertion, that "on an inclined plane" of 1 in 528 (10 feet per mile) all average loads "could be taken." Undoubtedly they can, but at a proportionate sacrifice of power or speed, which ought to have been added; without it the statement is incorrect, and with it I do not understand the object of the observation. The naked result of the above calculation is not altered by the omission, although certainly it may in consequence escape the recollection of the reader.

In the next paragraph the same thing is asserted in a different shape. It would have been desirable to have had explained what was meant by a "full average load." It appears to be assumed as a fixed or constant quantity for all railways, and quite independently of the gradients, or even of the power of the engines. I do not understand how any such fixed quantity can exist. Several of the present trains on the Grand Junction railway require two engines; should they increase so as to require three, it will probably be necessary to divide them; the capabilities of the line, or of the engines, will then have influenced the load. In the cases of the three different railways before referred to as quoted in the report, the average nett loads of the trains referred to are, 24 tons, 32 tons, and 40 tons respectively; and the average load in one case is therefore nearly double that in another.

Whatever may be the results on other railways, we know from experience on the Great Western, that our best engines, which are considered so unnecessarily powerful, have been barely sufficient to take the loads which, under certain arrangements of trains, we were obliged to carry, and that intermediate or half-hour trains became necessary. That many such inconvenient arrangements would have been required if the loads had practically been increased 34 per cent., with gradients of 10 feet per mile, I need not tell you who are familiar with the details of our traffic. I regret the necessity of devoting so much space to an attempt to render more clear that which appears to me to be self-evident,—namely, that a load of 134 tons cannot be carried at the same speed and with the same power as one of 100 tons, or, in other words, that the addition of a useless load of 10 or 15 tons to one of our ordinary trains would not be unimportant; but the paragraph I have referred to implies this, and there being no argument advanced in support of it which could be examined, it becomes the more necessary to take notice of it.

The particular arrangement of the gradients on the Great Western railway and their effect upon the traffic are then gone into, and at the end of the paragraph, page 49, the advantage of 17 per cent., before alluded to, is reduced one half, or $8\frac{1}{2}$ per cent. How this is done I have not been able to perceive, as I find neither argument nor calculation to justify it. It is true it is very fairly given as *an opinion*; but, as there are many figures and quantities given in the course of the preceding paragraphs, the word "therefore," at the conclusion of the paragraph, would lead a cursory reader to suppose it was proved by some preceding calculation or reasoning. As some allusion is made to a supposed saving of the power in one direction which is expended in the other, and as $8\frac{1}{2}$ is half of 17, it is barely possible that it is arrived at by a system of averaging the power required in the two directions; but, in the first place, no such average can be taken, the maximum power that is required in any one part of the line must be provided, and must be carried at all times, even if no power at all be required on other parts of the line; and, secondly, if the expenditure of power is to be averaged, then the increase of gradients makes *no difference* in the average power, as the decrease of power in descending is said to be equal to the increase in ascending, and therefore balances it. The fact is, that there is no ground whatever for halving the 17 per cent. (which I have shown to be 34 per cent.) *as a measure of the effective power of the same engines under the two circumstances*, and consequently none whatever for fixing it at $8\frac{1}{2}$ per cent.

After this, the $8\frac{1}{2}$ per cent. is reduced to 2.8 per cent., in so far as relates to the value, in money, of such reduction in locomotive power; and the assertion is made, preceded again by the word "therefore," that a company would do wrong to increase the original capital more than 2.8 per cent., to effect a saving of 2·8 per cent. in the annual expenditure. Can it possibly be meant that if the capital be a certain sum, say 1000*l*., and the annual expenditure 150*l*., leaving 150*l*. of nett profit, that a company would do wrong to add $2\frac{1}{2}$ per cent., or 25*l*., to their original outlay, unless this secures $2\frac{1}{2}$ per cent. saving, or 3*l*. 15*s*. on the annual expenditure, or 15 per cent. for the money? This is evidently a great mistake, arising from the total confusion of the capital with the annual expenses, as if they were the same sum, and the apparent accuracy and proof are produced only by the repetition of the same figures in the two cases, although, in fact, there is no such identity. The way in which a man of business should proceed, would be to capitalize the annual sum likely to be saved at some given rate of interest, which in his opinion would cover all risk, and leave a profit, perhaps of 6, 8, or 10 per cent., according to circumstances, but having no reference to the particular per centage which the annual expenditure might bear to the capital; and this amount a wise man would expend, not only to increase his future profits, but also to *secure permanent advantages to the concern*.

The calculations, erroneous as I think I have shown them to be, do nevertheless, make out a case in favour of good gradients. But upon turning to a statement given of actual results upon three railways, these very calculations are annihilated. These experiments, if they prove any thing, prove an actual advantage in favour of gradients, not of 4 feet per mile, nor of 10 feet, but of very steep gradients of 30 feet per mile. The naked result gives a less expense of power on two lines, on one of which half the length consist of gradients above 26 feet per mile, and on the other, 8 miles out of 20 consist of gradients upwards of 34 feet per mile, over a line the maximum gradient of which is 4 feet per mile. No explanation is given. The question here is not one of the comparative perfection of the lines, in other respects, or of the carriages, or of the probable effects of circumstances not mentioned; it is adduced expressly as a practical measure of the value of gradients, and is left without comment or explanation, to produce its effect on the mind of the reader. As such it does appear to me, and I think must to any impartial man, that the proof is overmuch, and becomes valueless; that the results cannot be correct, and that there evidently must either be an error in the data, or there must be circumstances quite independent of the gradients which require separation; otherwise we are driven to the conclusion that *steep gradients are best*.

I have nothing before me but the results, and therefore I cannot pretend to discover all the sources of error; but I know that some of the data are such as must introduce error; for instance, the consumption of coke given as that of the Great Western railway, includes all that had been used in raising and keeping up the steam in the engines, which, in the first working of a portion of a line, and while the arrangements are not matured, is necessarily great; it includes also the coke expended in ballasting trains and experimental trips.

In fact, during the four weeks ending September 13th, which are referred to by the writer, I find that there were generally seven engines in use, and of these, two were employed upon the line, (not on the passenger traffic,) and one was kept with the steam up, as a spare engine. How can the results of consumption per ton per mile be correct with such sources of error?

I must beg, however, to keep your attention to the 34 per cent. at which I have arrived, as the advantage, in actual *effective power*, of a gradient of 4 feet over one of 10 feet.

The gradients must ultimately govern the power of your engines, their speed, (at all events in one direction,) the size of each of your trains, and consequently their number; and it must always be remembered, that their operation is a *permanent* one, which nothing can remove or even alter, and the effect of which nothing can diminish. On the contrary, I am prepared to show, that the value of low gradients will, in all probability, be much increased.

I have assumed 8 lbs. per ton as the resistance of a train; but as the greatest part of this resistance depends upon the workmanship, the form, and the mechanical construction of the carriages, and other causes, and may be reduced by various contrivances already known, it would be contrary to all experience to suppose that it will not be materially reduced when there is an object to be gained by its reduction.

In many experiments, with all the circumstances favourable, the resistance has been as low as 6 lbs.

In some made by Mr. Hawkshaw, on the Great Western Railway, the resistance of a train, consisting partly of trucks and partly of carriages, only gives 6.22 lbs.

It may therefore be assumed, that we have now within our reach improvements by which the resistance may be reduced to 6 lbs.

With this datum, and making the same calculations as before, we obtain 100 and 144 as the comparative loads which the same engine would take at the same speed up the two gradients of 4 feet and 10 feet per mile.

Such an increase in the capabilities of engines must be of immense importance in passenger traffic. But how undeniably important it must be, even according to the principle laid down in the report, in the conveyance of goods; in this service the maximum power of the engine *is* brought into operation, and *does* constitute the limit; and if the engine, in such case, only forms one-eighth of the gross load, the proportion will still be as 100 to 135.5.

This advantage, large as it is, is a highly probable one, and I venture to predict it as a certain one; but, confining ourselves to the results which may be obtained with the existing rails and carriages, I will consider what is the practical working of an increased useful effect of 34 per cent. by the same engine, or an increased resistance of 26 per cent. with the same load. According to the view of the writer, in page 5, of there being a fixed standard or average power of engine which will be the same in either case, the former,—namely, 34 per cent. of increased effect—would be the correct mode of considering the comparison. I will assume, however, the latter, as being least advantageous, and I will suppose the engines, although different in power, to be of the same weight. Now, the resistance in ascending and descending a plane of 4 feet per mile will be 100 and 66; with the 10 feet per mile, it will be 126 in ascending, and actually only 39 in descending.

In the case of the Great Western Railway, from London to Slough, Maidenhead, Reading, and to the point of departure to Oxford, the maximum rise is 4 feet. Had it been 10 feet, as I must infer would have been the recommendation of Mr. Hawkshaw, the resistance going and coming would have been 126 and 39. Now, of what avail would it have been, that in returning to town the resistance was small? No more passengers or carriages could be brought one way than must be conveyed the other, or, to apply one of Mr. Hawkshaw's own similes, the eight horses required to take the post-chaise out must return with it, though two might be enough. I quite agree with the opinion very strongly expressed in another part of the report, that for the economical working of locomotive engines, their power should *be well proportioned* to the load they have to draw. It is remarked, apparently in allusion to one which we consider the best engine in our establishment, that to use an engine *capable* of drawing 200 tons, to drag loads averaging 50 tons, will be very like fastening eight horses to a post chaise. Although the remark savours of ridicule, I quite concur in it. It is a forcible description of the practical working of a line with gradients of 10 feet per mile, such a line as the imaginary one (A B) described in p. 49 of the report.

Now, on this line (A B), the engines going in one direction would have to exert a power of 126, and this at full speed, and in the other of 39, or as 200 to 62—a proportion not very different from the 200 to 50, which is mentioned only as something that would be very absurd.

Again, at another part of the report (p. 53), it is stated, that engines of little more than two-thirds the power of those on the Grand Junction Railway, and therefore of *considerably less weight*, would be sufficient on our line *from our flatter gradients*. Such an admitted reduction of 25 per cent. in locomotive power seems to me no mean economy to be obtained by these gradients, the effects of which are treated so lightly at other times; but these contradictory results are the necessary consequences of an attempt to argue against the simple facts, that the inclination of the line increases the resistance, and that if a regular speed is to be maintained, you must have power in proportion to that resistance.

All the foregoing calculations upon gradients have been limited to the two cases of 10 feet and 4 feet per mile. These are both unusually favourable, and their comparison therefore is not calculated to render the advantages so striking; but had the gradient of 4 feet per mile been compared with the more ordinary ones of 16 feet and 20 feet, the superiority would have told much more in the discussion of the general question of the value of good gradients. To supply this deficiency, I subjoin a table of the comparative effects of the same engine, with the same consumption of fuel, and travelling at the same speed on the level, and on the four gradients of 4, 10, 16, and 20 feet per mile, with a resistance of 8lbs. for friction, &c.; and for the sake of uniformity with the previous calculations, I take the same standard of 100 as the useful effect, or nett load, up the plane of ten feet:—

	Comparative Effective Power. Ascending.	Descending.
Level	170	170
4 feet per mile	134	226
10 feet per mile	100	400
16 feet per mile	77	1305
20 feet per mile	66;	the load once in motion would *run* of itself.

The discrepancy between these results and those given in the report does not arise merely from different data being assumed, and upon which there might be a difference of opinion; but from errors in the treatment of the calculation of the latter. I subjoin a similar table, calculated upon the basis of 10lb. per ton, being the total resistance on a level:—

Gradients.	Comparative Effective Power. Ascending.	Descending.
Level	156	156
4 feet per mile	129	195
10 feet per mile	100	297
16 feet per mile	80	556
20 feet per mile	69	726

By these tables the great superiority of a line approaching to the level is made apparent, not only is the effective power of the engine in that direction of the line which limits the load much greater, but the average work of the engine is performed more economically by the greater regularity of the resistance. On an inclination of ten feet per mile, as I have before shown, the engine, during half the time, is barely performing a quarter of the work of which it is capable. On gradients of 16 feet per mile, the engine during half the time is barely doing more than driving itself.

These are incontrovertible facts; whether the total resistance arises from friction, from the resistance of the atmosphere, or from whatever cause, the amount is about as stated, and the increase caused by the gradients is in the ratio stated in the above table.

It appears to me almost to weaken the strength and obscure the clearness of a demonstration which is mathematical in its correctness and certainty, to attempt to support it by reference to certain experiments in which other causes might have operated; but on the Great Western Railway we have every day, and with every train, such evident and striking proofs of the effect of gradients, that I should have thought it must be conclusive to any one who has had an opportunity of witnessing them:

With powerful engines and light trains, running at a good speed of 30 to 35 miles per hour, the changes of gradients, (which only vary from a level to 2 feet per mile, and to 4 feet per mile,) are perfectly perceptible in the increased or diminished speed, even without the assistance of a watch, and have been frequently detected by persons previously unacquainted with the levels.

It must always be borne in mind that the resistance arising from the gradients is a permanent evil which, once established by the completion of the works, cannot be remedied, and the probable future effects of this must therefore be seriously considered. In the course of a few years, as railway travelling becomes general throughout the country, and there are opportunities of reaching different parts of England by different roads, the usual results of competition will follow; prices will gradually be lowered; the number of travellers will become immensely increased; and the gross profits and expenditure become proportionably large; bearing then, particularly the latter, a much greater ratio to the original outlay than at present. The profits will then depend mainly upon the economy of transport, and then any saving in the current expens.s will be felt in a far greater degree.

I shall now consider the subject of the width of gauge. The question of the disadvantage of differing in point of gauge from other railways, and the consequent exclusion from communication with them, is the first. This is undoubtedly an incouvenience; it amounts to a prohibition to almost any railway running northwards from London, as they must all more or less depend for their supply upon other lines or districts where railways already exist, and with which they must hope to be connected. In such cases there is no alternative.

The Great Western Railway, however, broke ground in an entirely new district, in which railways were unknown. At present it commands this district, and has already sent forth branches which embrace nearly all that can belong to it; and it will be the fault of the company if it does not effectually and permanently secure to itself the whole trade of this portion of England with that of South Wales and the south of Ireland; not by a forced monopoly, which could never long resist the wants of the public, but by such attention to these wants as shall render any competition unnecessary and hopeless. Such is the position of the Great Western Railway. It could have no connexion with any other of the main lines, and the principal branches likely to be made were well considered, and almost formed part of the original plan; nor can these be dependent upon any other existing lines for the traffic which they will bring to the main trunk.

At the London extremity, from the moment the junction, as originally proposed, with the London and Birmingham Railway was obliged to be given up, there existed no possibility of a connexion with any other line. London will always be the terminus of those main lines now established, and which approach it from distinct quarters, and the traffic of each will cease at this point; and, unless when two such lines unite to form a common entrance into the town, they will have no connexion with each other at this extremity.

The Great Western was therefore free to adopt its own dimensions; and none of the difficulties which would entirely prevent such a course in the north of England had any existence in the west; and consequently, all the general arguments advanced, and the comparisons made, on the supposition of such difficulties occurring—all excellent in case they did—are totally inapplicable to the particular case of the Great Western Railway, to which they have no reference whatever.

The reasons for adopting any increased width of gauge, and the particular dimension of 7 feet, have been so frequently before you, that it is unnecessary for me now to repeat them. The principal positive objection urged against it in the Report is the increased cost, while the mechanical advantages are doubted, but not disproved.

As regards the cost, I have repeatedly shown that this amounts at the utmost to a slight increase in the quantity of earthwork, and that the bridges, tunnels, &c., are not necessarily affected. Mr. Hawkshaw seems to be of the same opinion, as at p. 50 he classes the "tunnels of 30 feet diameter" among "the non-essentials," as "not absolutely consequent on the increase of gauge;" and at p. 50 he clearly limits the increased expense of construction to the earthwork, land, and permanent way. There is some inconsistency in these remarks, when compared with the estimate in page 52, where the width of tunnels is considered a consequence of the wide gauge, and a saving of estimated of 20 per cent. "in the tunnelling yet to be done, by the narrower gauge requiring 4 feet less width."

I have only here to repeat, what is really capable of the clearest proof—viz., that the greater width of tunnels, proposed by me for special reasons, which I have explained on more than one occasion, has nothing whatever to do with the wide gauge, inasmuch as tunnels of the ordinary width could be adopted, and the saving pointed out would not, therefore, be necessarily the result of the return to a narrower gauge. But the arguments advanced at p. 50 in the Report, to show the necessity of increasing the earthwork by 4 feet, are subsequently, without observation, applied to the tunnels. This error is occasioned by neglecting to give precise dimensions to quantities quite capable of it.

Arguments are founded upon the assumption that a certain width is necessary between the centre rails, for repairs. This is true; but the width should be stated in feet and inches. On the Liverpool and Manchester, this space is 4 feet 8 inches; and even with stone blocks, this is found ample for all the purposes of repair; indeed, it is the width which is so perfect in Mr. Hawkshaw's estimation. Four feet 8 inches, with stone blocks (which does not leave more than 2 feet 8 inches between the blocks,) are not equal to 4 feet with longitudinal wooden sleepers, which would leave from 2 feet 9 inches to 3 feet between them. Suppose 4 feet, however, to be necessary; then, with a 7 feet gauge, the distance from centre to centre of the two lines is 11 feet, which is the same as on the London and Birmingham, Grand Junction, and other lines, and which has been adopted to give a general increase of space. The width of tunnels, viaducts, &c., are *therefore not necessarily affected* by the 7-feet gauge. Neither do I understand how the cost of the permanent way can be sensibly increased. The weight of rail would be the same. The engines, in other respects similar, would be, at the utmost, only a few hundred weight heavier, consequent upon the increased length of axles and breadth of frames—the boilers, fire-box, wheels, cylinders, and working gear (about nine-tenths of the whole) remaining exactly the same; and even with our present heavy engines, the greatest weight upon one pair of wheels is not greater than upon the driving wheels of Mr. Bury's engines on the London and Birmingham railway.

If the strength of the rails be not increased, the mere distance between them cannot affect the expense of construction beyond the cost of a few cube feet of ballast per yard forward, and about eight loads of timber to the mile in transoms. If 150*l*. per mile is allowed for these sources of expense, it is far more than enough. This, with the 200*l*., assumed by Mr. Hawkshaw for the earthwork, and 50*l*. for one quarter of an acre of land, which he has not allowed for, makes 400*l*. per mile as the outside of the additional cost incurred in the first construction of the road on the 7 feet gauge. As to the consequent increased cost in the engines and increased expense of repairs, they are treated in so general a way that it is difficult, if not impossible, to meet what is said; but certainly actual experience satisfies me that eventually there will be no material difference in the first cost. The opinion of Messrs. Robt. Stephenson and Company, as quoted page 52, is, that it "will not be very considerable." The wear and tear, I am equally satisfied, will be diminished.

The whole subject of the diminished resistance arising from the increased diameter of wheels, and the opinion of the Irish commissioners in favour of it, is then disposed of in a summary manner. It is assumed that the bearings of the axles must be increased in the same ratio as the diameter of the wheels, and that hence no advantage would be gained, in so far as the friction was concerned; but such is not intended to be the case.

It is asserted that the grinding of the flanges against the rails must be more felt with a large wheel than a small one. No reason is given for expecting such a result, nor why this resistance should not be, as one might naturally expect, inversely as the square root of the diameter, and therefore diminishing with an increased diameter. As in the case of the gradients, however, the whole is set aside by one experiment; this experiment (pages 50 and 51) gives nearly the same result for wheels of 3 and 4 feet diameter. This is not surprising, as the difference in diameter was too small to be clearly detected by the very uncertain and unsatisfactory mode hitherto adopted for ascertaining the resistance. It appears to me also that they were not made under similar circumstances, or even on the same road, and the ratio of the bearings to the wheels seemed to be rather in favour of the small wheels. The experiment, therefore, appears to be perfectly useless and unavailable, and the writer says that he does not think it conclusive. Nevertheless, these are the only experiments adduced, whilst the point is assumed to be proved.

The next inquiry made is on the question of safety. I certainly never thought of the danger of upsetting from the narrowness of base, as a stage-coach occasionally does; and therefore I need not occupy your time in discussing the manner in which this imaginary argument has been advanced and then demolished. But I must call your attention to the extraordinary and contradictory general assertions (p. 51) that "if A be safe, there cannot be the smallest advantage in making B safer." This is a confusion of words. If safety, commonly speaking, meant a total absence of possibility of danger, then the statement is contradictory, and is not even sense; for if B is made safer than A, A cannot be perfectly safe. But safety is a term, after, all only used comparatively, and then the statement assumes this extraordinary shape—that if A be tolerably good, it is useless to seek anything better. Now, although no man, I believe, ever supposed that ordinary railway carriages were much exposed to the danger of being upset, yet no man could witness, as I have had the opportunity of doing, numerous accidents on railways of both dimensions, without being struck with the great difference in the susceptibility of the engines and carriages to being thrown off the rails on the 4 feet 8 inch gauge and on the 7 feet gauge. The reason is obvious enough: the oscillation and the velocity of the angular motion, or, in other words, the jerk caused by any departure from level in the rails, or from any open joint or obstacle, or from collision, must be much greater when acting on a 4 feet 8 inch base than on a 7-feet base, and I have seen many accidents on the 4 feet 8 inch rail arising wholly from this cause, while on the 7-feet gauge I have seen the same causes operating to a greater extent without producing any serious results. I believe, also, that at high velocities much of the resistance from the friction of the flanges, as well as the strain upon the carriages and liability to accident, arising from lateral motion, which is imparted to the carriage by angular motion, or rolling, and which must be lessened in the direct proportion as the base is extended. The great difference in the rolling motion of the engine chimney, when running at high speeds upon the 7-feet gauge, as compared with the same effect on the 4 feet 8 inches, was remarked at once by the engine-drivers sent by several of the manufacturers to erect their engines, and is familiar to all now engaged on the line, although the rails themselves were at that time undeniably in a bad state. Safety, therefore, may, and indeed must, be increased by the width of the gauge. As to the effects of the adoption of the wide gauge by the main trunks upon the branch lines likely emanate from it, as I said before, these branches have all formed part of the general plan, and were considered originally; and therefore the assumption of the writer, that there is uncertainty or danger upon this point, is not correct. The Bristol and Exeter Railway, which is the extension of the Great Western to the south-west of England, is well fitted to this gauge. A great extent of it will be the most level line in England, and is nearly straight. On the Cheltenham Railway, for four-fifths of the length it is free from any objectionable curve; and on the remainder there will be no curves of so small a radius, even in proportion to the 7-feet gauge, as there are on the Grand Junction and many other lines. The objections taken, therefore, are not applicable; and it seems to me that none of the grounds on which the writer founds his somewhat startling advice to alter all that has been done, are tenable. In fact they are none of them brought forward in a clear and tangible shape, except the debit and credit account in page 52.

I will begin with the last, or the credit account. The first item is the largest, and considering that it constitutes two-thirds of the whole, it is a very important one; yet there is no proof, there is not even one single reason given for supposing any such increase; the only reference to it that I can find is in the middle of p. 50, where these words occur:—"The permanent road will also cost more if of the larger dimensions than if of the smaller; for it avails nothing to compare a light rail on the larger gauge, with a heavier rail on the smaller gauge; such comparisons must be made when other things are the same, or they amount to nothing." The assertion here made is unsupported by a single argument or proof. What is meant by the truism contained in the allusion to the light rail and heavy rail I am unable to comprehend. I have quoted it lest it should have some reference to a wide and narrow gauge which I may not perceive.

I have shown, I think clearly, that 150*l*. per mile instead of 1000*l*. is the excess: this makes a reduction of 85,000*l*. in the assumed saving. The 400*l*. excess on the engine and tender I equally dispute; it is also unsupported by anything except the letter from Messrs. Stephenson, and their opinion is even much qualified: their concluding remark is—"If the power or dimensions of the engine be kept the same, the additional expense consequent upon an increase of guage will not be very considerable." In fact, the same engine, in all its material parts, and the same quantity of workmanship, answers for the one as the other; to widen the frame and lengthen the axles is all that is required; and even making no allowance for any increased facilities in the construction, 100*l*. will amply cover this,—say, 150*l*., as the increased expense consequent upon the wide gauge. This, of course, has no reference to any peculiar construction of the engine, such as greater evaporating surface, or larger driving wheels, which are not, in fact, consequences of the width of gauge, but which have been adopted with a view to economy of fuel and wear and tear.

In the next item I should add 50*l*. per mile for land, although neither upon earthwork, and still less upon land, have we 60 miles upon which we can effect the saving. The tunnelling, as I have shown by actual calculation of the measurement required, is not effected by the gauge. The account, therefore, stands thus:—

150*l*. per mile on 100 miles of permanent way . . .	£15,000
150*l*. less on 60 engines and tenders	9,000
250*l*. per mile on 60 miles of earthwork and land . .	15,000
Tunnelling—nothing.	
	£39,000

Instead of 156,000*l*., as given in the Report.

I now proceed to consider the debit account, in which I find an important omission. The change recommended from the 7-feet guage to the 4 feet 8½ inch, is supposed to occupy a year and a half; during this time no advantage could be taken of the extension of the line to Twyford, in the neighbourhood of Reading, which, if the opinions expressed in this Report are to be adopted, must be laid down with the narrow gauge, and it therefore would be useless until one of the lines of the same gauge was open. By this delay at least a year would be lost.

But besides this loss, another would be experienced by the confinement of the traffic to a single line. I believe it would be found impracticable to carry on our trade on a single line; there can be no doubt that it would be materially diminished, which, together with the loss of twelve months' traffic between London and Twyford, cannot fail to make a difference of upwards of 50,000*l*. The gross receipts upon the present line are about 80,000*l*. per annum; the extension of the line from 22½ to 32 miles, (thereby securing all the long traffic, which is now only partially obtained,) and the natural progressive increase of the traffic which would take place on the present line, cannot be estimated to produce less than 60,000*l*. more, or 140,000*l*. per annum. Supposing the expenses to be increased by 25,000*l*., there remains, as increased nett profits, 35,000.; to this add 15,000*l*., as a very moderate allowance for the reduction, to which I have alluded in our receipts, unavoidably consequent upon the working of only a single line, which would certainly not diminish our expenses.

The debit account, therefore, will now stand:—

Expenses of alteration and loss upon stock, as stated in Report (page 24)	£123,276
Loss of profits on the extension to Twyford . . .	35,000
Ditto on traffic to Maidenhead	15,000
	£173,976

Instead of £123,976.

And deducting the amount to be saved, 39,000*l*., it shows a sacrifice of 134,976*l*. as the result of the proposed alteration. Even if the assumed increase of 400*l*. on each engine were admitted, it would still leave 121,976*l*. as the balance against the change, instead of anything in favour of it. In addition to this clear loss, it should also be remembered, that after the conversion of the one line to Maidenhead from the broad to the narrow gauge, the other still remains to be altered. During the whole of this operation, let me repeat, the total traffic to Reading must travel on a single line, which, even admitting it to be possible, must necessarily cause a continued loss of traffic, with great additional inconvenience and expense, and serious risk of accident,—all so much in addition to the amount of sacrifice already calculated.

MAIDENHEAD BRIDGE.

On this head it is unnecessary to say more than that the defective part of the work has been condemned by me, and the contractor called upon to replace it, which he is now doing.

PERMANENT WAY.

The question of the construction of the permanent way appears to have been thought a very unimportant one: three lines of the Report are devoted to it, and these consist of the expression, in rather strong language, of an opinion unfavourable to the mode in which the attempt has been made; but whether the writer approves of the ultimate object sought to be attained—of the plan of continuous support—or not, does not in any way appear. This is to be regretted, as the writer has lately had some experience on this particular point, and it was supposed might have been able to give some useful information upon it.

LOCOMOTIVES.

The question of locomotive power is treated also very concisely; nothing whatever is stated, under this particular head, of the engines of the Great Western Railway. A few general principles are laid down, in almost all of which I perfectly concur,—viz., the necessity of proportioning the power of the engines to the loads; the advantage of keeping down the weight; the circumstance that the weight of the engine will depend on the average load to be taken, and the nature of the gradients. The comparison between the locomotive power supposed to be necessary on the Great Western and on the Grand Junction lines, is a powerful argument in favour of good gradients. On the whole, these principles are precisely those on which I have founded my arguments in the course of these observations, and I think they fully bear out the views I have taken; but the concluding observations of the Report appear to me to be the most strikingly erroneous views that I have yet had occasion to call your attention to, and still arising from the same mistake—that of omitting all consideration of increased profits to be derived from increased accommodation or improved conveyance—objects at which I have aimed.

In the last paragraph but one, after condemning, very properly, any great increase in the cost of a road for the sake of a system, it is asserted that "good gradients will be rendered of non-effect, as to economy, if the speed be greatly increased, for greater speed will entail greater cost, and be tantamount to steep gradients."

It seems to me, on the contrary, that the attainment of a greater speed at the same cost is economical, just as it is to make a better and more saleable article at the same price. And the next and last paragraph exposes still more strongly this fallacious principle, and may be taken as a fair sample of the theory of railway economy advanced in this Report. The words are—"And though the same results may perhaps be obtained on railways of better gradients, with more dead weights, than on railways of bad gradients, yet this seems to be merely bringing down the good line to the standard of the bad;—that is to say, if "more dead weights," or greater loads, are carried with "the same results," or at the same cost, no advantage is gained; so that, if natural or artificial means enable you to carry greater loads, and, in fact, *perform more work*, or, in other words, *carry on a greater trade with the same capital*, you are not to avail yourself of these advantages to extend your business, but merely to withdraw so much capital from a thriving concern. If the sole object were to reduce the out-goings to the lowest possible scale, without reference to the comparative receipts, such a maxim might be good. If the construction of the railway, and the maintenance and working of it, were a compulsory tax levied on the proprietors for the use of the public, without benefit to them, then, indeed, the only advantage of good gradients would be the diminution of exertion and of expenditure of power. To the beast of burden a good road is certainly of little consequence, if he is proportionably laden; but his owner would be surprised at being told that he could gain nothing by being able to carry more goods, because his horse would be worked as much, and worn out as soon, as when he carried less.

I shall now make a few observations on the remarks and the hypothetical cases which I before referred to, and I think, when I have called your attention to them, you will agree with me that they ought not to pass entirely unnoticed.

In p. 48 of the Report, the difference between the Great Western Railway and other railways is compared to the difference between a canal for barges and a canal for ships—a most exaggerated comparison, and one by no means diminished in effect by the qualification introduced by the words which follow, "though not to an equal degree." A ship-canal is a totally different thing from a barge-canal; it is most costly, and if considered as a mere channel for the conveyance of goods, is very ill adapted for the purpose. It is intended solely for the transport of the ships to some inland port. The only change introduced in the Great Western Railway is in the dimension of one of the parts, not for the purpose of carrying larger individual cargoes, but for the purpose of carrying the ordinary cargoes more advantageously. If a comparison be made with canals, it should be simply with the case of a canal which, being intended for quick service, or fly-boats, is made rather wider, to allow the boats more free passage through the water, and thereby diminish the resistance. The comparison apparently is thought to require some apology, as it is said not to be extraordinary "should it appear that the locomotives have twice the power of those on other lines;" and "should it be shown to be a parallel case to build a ship of 200 tons burthen, when there is no probability of ever obtaining a cargo of half the weight." This certainly is tantamount to the statement in a subsequent part of the Report, that the engines have this excess of power, and that we have, in fact, provided for a traffic four times as extensive as we can hope to obtain; yet, after producing this impression, the subject is dropped, and no attempt made in any part of the Report to prove it.

In the next paragraph (page 48) there is a remark that "it is one thing to design that which is pleasing in outline and grand in dimensions, and it is altogether another thing to design that which, under all the circumstances, shall best answer the end in view, one of those ends being a return for the capital invested."

I must deny altogether that such a distinction necessarily exists." To make that large for the sake of appearance which ought to be small, is unquestionably, very different from studying the right size and adopting it; but I think that when a work is evidently well adapted to the object for which it is intended, it is generally satisfactory to the eye; and that then there is rarely any difficulty in making it "pleasing in outline;" the distinction exists only with those who, like a bad architect, commence by designing the exterior of a building, and then make the interior arrangements subservient.

At the end of p. 48, a case is put which is strictly applicable, and which is solved in a manner to assist the subsequent arguments; but the solution seems to me to have no other merit, certainly not that of correctness.

It is supposed (what is indeed the actual case) that it is desired "to give the greatest impetus to the trade, and the greatest advantage to the town of Bristol;" and the way to do this is said to be, as if incontrovertible, "to connect it with the metropolis by a road on which parties could be carried for the smallest sum, and at a velocity not inferior to that at which they can be carried in any other direction." This is the first time I ever heard that to win the race it was sufficient to be not behind your competitor. If such were the rule in trade, why was the Liverpool and Manchester railway made? The means of communication were not merely not inferior to, but probably superior to any in England. Why were railways introduced at all, and the capital embarked in the general means of transit so enormously increased by the addition of totally new works? Stage coaches and canals left all towns exactly in the same position which is here said to ensure the greatest impetus to their trade. Besides, are there no points of inferiority in the case of the port of Bristol which have to be compensated for, in consequence of the superior local advantages of other ports? Bristol has, for some reason or other, fallen far behind Liverpool. Will it be of no advantage to the trade of this port, and thereby to the revenue of this railway, that it should have superior facilities of communication with London? Whether Liverpool continues at eleven-hours' or is reduced to eight-hours' distance from London, it may be said by some to be still a day's journey, while Bristol will be brought within four hours, or four and a half hours' distance; and if this is reduced to three hours, which is undoubtedly practicable, letters and orders may be transmitted and replied to during the business hours of the day; and precisely the same change introduced into the transactions of business that was effected by the Liverpool and Manchester railway, and a great increase in the trade of the place, and in the traffic of the railway must necessarily follow.

This doctrine of the all-sufficiency of a railway, without reference to its quality, and the inutility of attempting to influence the amount of traffic by increasing the advantages, appears, under different forms, in other parts, and I shall not again refer to it, but shall proceed to another part of the Report.

The adoption of a different gauge is compared, at p. 50, to the construction of a canal "in a country of canals, with locks of such a character as would totally shut out the boats of all the canals that surrounded it." Now, in the first place, as I have shown, the west of England is not a country of railways; and, in the next place, there is no similarity in the mode of conducting the carrying department of a railway and a canal. A barge, with its master and his family living on board, may go, and does occasionally go, without inconvenience, far out of the usual beat. Railway carriages and waggons must belong to the particular line on which they run; and, except in such cases as the Grand Junction and Birmingham railways which form in fact one line, although they happen to be made by two companies, it will never pay to trust them in the hands of others.

On the subject of the wide gauge, the opinions of Mr. Booth, of the Liverpool and Manchester railway, (which had been previously expressed in a letter to the Irish Commissioners,) and of Mr. G. Smith, of the Leeds and Selby railway, are quoted in favour of the 4 feet 8 inch guage, and their answer in the negative, given apparently to the direct question whether they thought there was any want of safety, or danger of overturning, on their own railways. The case is purely hypothetical. I never heard of the danger of overturning being advanced as an objection to the narrow gauge, although I have seen such a thing happen; and whether the objection be real or imaginary is the question to be decided by such a reference? At any rate the directors of the Great Western Railway were quite competent to select the referees for its decision.

I have the pleasure of being personally acquainted with both these gentlemen, and entertain the greatest respect for them, but I should never have thought of asking them such a question. If before building the Great Western steam-ship we had written to some of the highly respected and talented gentlemen who command the New York liners, and asked them if they considered there was any danger or inconvenience in the use of sails, and whether they should prefer steam, I think we might have anticipated their answers.

I shall here close my observations with the expression of my regret, that the manner in which the important questions at issue have been treated in the Report has of itself prevented the discussion leading to any very satisfactory or useful conclusion. It has been almost impossible to do more than to show that, whatever may be the state of the case, the views taken in the Report, and the arguments advanced, are incorrect, and prove nothing. Another opportunity will probably occur of entering more fully into the real merits of the question, and for that I shall be prepared.

I am, gentlemen, your obedient servant,

(Signed) I. K. BRUNEL.

London, Dec. 13th, 1838.

REPORT OF NICHOLAS WOOD, ESQ.

TO THE DIRECTORS OF THE GREAT WESTERN RAILWAY.

Killingworth, Dec. 10th, 1838.

* * * * Your instructions were, that I should undertake an examination of that portion of the Great Western Railway now completed, and investigate the result of the whole system which has been adopted; and my attention is particularly directed to those points which may be said to constitute the peculiar features of the Great Western line, as contrasted with those of other railways, including in such inquiries the construction and efficiency of the engines, as well as every matter connected with the locomotive department of the company.

The Great Western Railway differs from the ordinary railways, in the width of gauge adopted, in the construction of the rails employed in framing the road, and in the adoption of much larger driving wheels than ordinary in the locomotive engines.

The subjects for consideration are therefore comprised under the following heads of inquiry, viz., the width of gauge, the mode of constructing the road, and the efficiency, power, &c., of the locomotive engines.

The increased width of gauge might have been adopted, and engines of the same description as those used on other railways might have been used, and it does not necessarily imply that the adopting an increased width, should render necessary the particular mode of construction adopted by Mr. Brunel, except in one point of view in which Mr. Brunel has put it, viz. :—" That the increased width of gauge was necessary for the accomplishment of a high rate of speed, and that he believes continuous timber bearings to be a most essential improvement where high speeds are to be obtained." Still, as the two questions are in some degree distinct, we shall in the first instance consider them separately, and shall afterwards consider them in their connexion with each other, as advanced by Mr. Brunel; and as the elucidation of these two heads of inquiry, includes that of the power of the locomotive engines, we shall not in this place make their consideration a distinct question.

In order, therefore, to bring the subject clearly before you, I shall first of all point out the *objects*, so far as I can learn from the published documents of your body, and from the reports of Mr. Brunel, which have been expected to be realized by these departures from the more general plan of constructing and working railways; I shall then state some of the most prominent objections which have been made against the system, after which I shall give, in detail, the inquiries and experiments which appeared to me necessary, to ascertain how far these benefits have been, or appear likely to be realized, and to what weight the objections appear to be entitled. The result of these inquiries and experiments will be next considered, and with these materials, in obedience to your instructions, the system of construction of the Great Western Railway will be contrasted with the most improved railways of the ordinary construction and width of gauge.

Width of Gauge.—The width between the rails of all the public railways in England is four feet eight and a half inches, the width of the Great Western Railway is seven feet; the difference is therefore nearly one half more, or two feet three and a half inches. From the documents previously alluded to, from a careful perusal of Mr. Brunel's reports, and from personal communications with that gentleman, the following appear to have been the prominent advantages expected to be derived from the increased width of gauge, and which induced the adoption of the width of seven feet.

Attainment of a high rate of speed.—On this point Mr. Brunel remarks, " with the capability of carrying the line upwards of fifty miles out of London, on almost a dead level, and without any objectionable curves, and having beyond this, and for the whole distance to Bristol, excellent gradients, it was thought that unusually high speed might easily be attained; and that the very large extent of passenger traffic, which such a line would certainly command, would ensure a return for any advantages which could be offered to the public, either in increased speed or in increased accommodation." For Mr. Brunel remarks, " I shall not attempt to argue with those who consider any increase of speed unnecessary, the public will always prefer that conveyance which is the most perfect, and speed within reasonable limits is a material ingredient in perfection in travelling," and the attainment of high speed appeared to involve he question of the width of gauge.

Mr. Brunel also considers, " that it would not have been embracing all the benefits derivable from the favourite gradients of the Great Western Railway, unless a more extended gauge was to be adopted, for if carriages and engines of a certain weight have not been found inconvenient upon one railway, greater weights may be employed, and the same results obtained on a railway with better gradients; and to adopt a gauge of the same number of inches on the Great Western Railway, as on the Grand Junction Railway would, in fact, amount practically to the use of a different gauge on a similar railway, for the gauge which is well adapted to the one is not well adapted to the other."

Mechanical advantage of increasing the Diameter of the Wheels, without raising the Bodies of the Carriages.—This comprehends what is deemed by Mr. Brunel, the most important part of the advantage of an enlarged width of gauge, viz., the reduction of friction by the increased diameter of the wheels, while at the same time by being enabled to place the body of the carriage within the wheels, the centre of gravity of the carriage is kept low, and greater stability and steadiness of motion is expected to be attained. Four feet wheels have been put upon the carriages at present in use upon the line, but Mr. Brunel states " that he looks forward to the employment of wheels of a larger diameter; and that he has been influenced to a considerable extent, in recommending the increased width of gauge, by its capabilities of prospective improvements, which may take place in the system of railroads. He states, " that though there are some causes which in practice slightly influence the result, yet practically the resistance from friction will be diminished exactly in the same ratio that the diameter of the wheels is increased," and " considering that the gradient of four feet per mile only presents a resistance of less than two pounds per ton, and that the friction of the carriages on ordinary railways amount to eight or nine pounds per ton, being 8-10ths of the entire resistance, any diminution of the friction operates with considerably more effect upon a road with favourable, than one with more unfavourable gradients;" and he further says, " I am not by any means at present prepared to recommend any particular size of wheels, or even any increase of the present dimensions. I believe they will be materially increased; but my great object would be in every possible way to render each part capable of improvement, and to remove what appears an obstacle to any great progress in such a very important point as the diameter of the wheels, upon which the resistance which governs the cost of transport, and the speed that may be obtained so materially depends."

Admits all sorts of Carriages, Stage-Coaches, &c. to be carried within the wheels.—Presuming that the adoption of wheels of a larger diameter is found beneficial, to the extent expected by Mr. Brunel, it became necessary that the carriages to be conveyed should be placed upon platforms within the wheels, to keep them as low as possible, which could not be done with carriages on railways of the ordinary width, a wider gauge seemed therefore necessary for this purpose.

Increased facilities for the adoption of larger and more powerful Locomotive Engines, for the attainment of higher rate of speed.—Much stress has not been laid upon this by Mr. Brunel, although it has been alleged that great difficulties exist and that considerable expense is incurred by being obliged to compress the machinery into so small a space; and consequently, that a greater width of gauge would enable the manufacturer to make a more perfect machine, and by having more space for the machinery, the expense of repairs would be lessened.

Increased stability to the Carriages, and consequently increased steadiness of motion, not from any danger to be apprehended, by the centre of gravity being higher in carriages of a less width; but that higher carriages are more liable to oscillate upon the railway, than carriages of a greater width and less height, and that a considerable part of the friction is occasioned by the oscillation of the carriages throwing the flanches of the wheels against the rails.

These appear to be the more prominent advantages set forth by Mr. Brunel, as consequent upon the adoption of an increased width of gauge. I have taken the extracts from the report to the Bristol meeting, in preference to quoting from Mr. Brunel's communications to the directors, inasmuch as that report is before the shareholders; and also in that report Mr. Brunel enters somewhat minutely into details on the subject, and gives in a more determined and explicit plan the substance of all his communications to the directors on the subject. It would have increased the bulk of this report unnecessarily to have given all Mr. Brunel's reasons for the adoption of the increased width set forth in that document, and this is also unnecessary, as the report itself is before the shareholders and can be referred to. These representations and recommendations of the engineer, appear to have been the principal reasons which induced the adoption of an increased width of railway, as stated in your report to the shareholders, at the half-yearly meeting of the 25th of August, 1836.

The objections which have been advanced against the adoption of this departure from the ordinary width of railways, have been principally the following, viz.

The increased cost of forming the road track of the Railway, in consequence of a greater width of base required for the superstructure of the rails, and upper works. That the carriages were required to be larger and heavier. That the increased width of gauge caused additional friction in passing through the curves. That it entailed a greater expense of constructing the engines and carriage, increased liability to the breakage of axles, &c. That it prevented a junction of the Great Western with other railways; and above all, that there were no advantages gained, commensurate with the increased expenses and inconvenience of such a departure and disconnection from railways of the ordinary width, and several other objections which have been urged by different persons against the system, which it is not necessary to enumerate.

Previously to entering upon the consideration of the presumed benefits and objections incidental to the width of gauge, it will be advisable to bring before you the second part of the system of Mr. Brunel, viz.: the mode of constructing the railway, and in doing so I shall pursue the same plan as in the case of the consideration of width of gauge; first of all to point the reasons which seem to have influenced Mr. Brunel in the recommendation of this particular plan, and the improvements over other plans which he anticipated from its adoption; I shall then briefly state some of the principal objections which have been urged against it; and lastly, detail and report to you the mode I have deemed adviseable to investigate, and determine all these conflicting questions, and then give the conclusions, which appear to me to result from the enquiries and experiments I have made.

Construction of the Road.—It will not be necessary for me to enter into a detailed description of Mr. Brunel's plan of constructing the Great Western Railway, furtherthan what is absolutely necessary to explain the principles of construction, and in what respects it differs from that of other railroads.

The plan adopted by Mr. Brunel is that of a continuous bearing of timber with piles upon which the iron rails that constitute the track of the wheels are placed.

The construction may be thus shortly described: Longitudinal timbers of a scantling of from five to seven inches in depth, and twelve to fourteen inches in breadth, and about thirty feet long are placed along the whole line. Then these timbers are bolted to cross sleepers or transoms at intervals of every fifteen feet; double transoms each six inches broad and nine inches deep being placed at the joinings of each of the longitudinal timbers, and single transoms of the same scantling being placed midway between the joinings. These transoms stretch across, and are bolted to all the four lines of rails. Within the two lines of rails of each track, piles of beech are driven from the upper surface of the railway into the solid ground, so as to retain a firm hold thereof, and the transoms are bolted to the heads of these piles.—*Vide Description and Construction of the Railway, in Journal No. 7, page* 166, *Vol. I.*

This plan is pointed out very clearly by Mr. Brunel, in his report to you on the 22d of January, 1838, and presented to the shareholders at the half yearly meeting on the 27th of February, 1838.—*Vide Journal No.* 7, *page* 166, *Vol. I.*

At the subsequent meeting (Oct. 10th, 1838) of the Great Western Railway proprietors, Mr. Brunel thus gives his reason for the adoption of this plan of constructing the road:—

" The mode of laying the rails is the next point which I shall consider. It may appear strange that I should again in this case disclaim having attempted anything perfectly new, yet regard to truth compels me to do so. I have recommended in the case of the Great Western the principle of a continuous bearing of timber under the rail, instead of isolated supports, an old system recently revived, and as such I described it in my report of January, 1838; the result of many hundred miles laid in this manner in America, and of some detached portions of railways in England, were quite sufficient to prove that the system was attended with many advantages, but since we first adopted it these proofs have been multiplied; there need now be no apprehension. There are railways in full work upon which the experiment has been tried sufficiently to prove beyond doubt, to those willing to be convinced, that a permanent way in continuous bearings of wood may be constructed, in which the motion will be much smoother, the noise less, and consequently—for they are effects produced by the same cause—the wear and tear of the machinery much less; such a plan is certainly best adapted for high speeds, and this is the system recommended by me and adopted on our road. There are, no doubt, different modes of construction, and that which I have adopted as an improvement upon others, may, on the contrary, be attended with disadvantages. For the system I will strenuously contend, but I should be sorry to enter with any such determined feeling into a discussion of the merits of the particular mode of construction. I would refer to my last report (*vide Journal No.* 12, *page* 325, *vol.* 1) for the reasons which influenced me, and the objects I had in view in introducing the piling; that part which had been made under my own eye answered fully all my expectations."

These appear to have been the reasons for the introduction of this system of railway construction, and the objections raised against it have been—The increased cost of construction beyond that of other modes,—the additional expense of keeping it in repair;—and that it does not accomplish the objects proposed by Mr. Brunel, in recommendiug it to your notice,—that the motion of the carriages is much greater than upon ordinary railways of the best construction,—and that there is a considerable increase of resistance to the carriages.

The professed advantages to be derived from the increased width of gauge, and the construction of the road by continuous bearings and piles, are so extensive and numerous, while on the other hand, the objections alleged against them are equally so, that it appeared to me, as stated previously, with the exception of awaiting the result of the test of time, there was only one mode of determining these complicated questions with any degree of satisfaction, viz., to endeavour to investigate as many of the points as possible, by experiments instituted for the express purpose, and to ascertain if by this mode such a number of facts could be obtained as would, with the aid of the experience already obtained of the working of the system, enable me to arrive at conclusions which would, to unprejudiced persons, determine the important questions submitted to me.

On a review of all the proposed advantages and above-enumerated objections, the most important points to be determined by experiment appeared to me to be comprehended within the following heads of inquiry:—

1. The question of the attainment of a higher rate of speed than on other railways; whether the increased width of gauge is, or is not, either necessary or best adapted for the accomplishment of this object, and to what extent.
2. The mechanical advantage or diminution of friction, by being enabled to increase the diameter of the wheels, without raising the bodies of the carriages; and in what respect, and to what extent, the friction or resistance of the carriages is affected by, or bears upon the peculiar construction of the road.
3. The comparative advantage or firmness of base, or road track, of the Great Western Railway, with continuous timber bearings, either with or without piles, and if it does or does not produce a greater steadiness and smoothness of motion to the carriages, and to what extent.

These were the questions which appeared to me could not be determined in any other way than by experiment, but which appeared to be capable of solution by that method, and which likewise appeared to constitute the foundation of the entire system; for if the plan was not either necessary for the realization, or did not effect a greater rate of speed than ordinary railways; if no diminution of friction was accomplished, and if no increased steadiness of motion to the carriages was produced, at least, a very considerable portion of the inducements for a departure from the ordinary plan would be destroyed: but if, on the contrary, the whole or some part of these desiderata were accomplished, then it remained to be determined whether the advantages did or did not counterbalance the disadvantages or objections to the system.

Attainment of Speed.—The first question to determine was, therefore, that of the attainment of speed. The most conclusive manner of effecting this appeared to be, to subject all the different descriptions of engines upon the line to experiment; to ascertain at what rate of speed they could travel, the loads they were capable of dragging at different rates of speed, and the comparative power required to accomplish these different performances. Having thus obtained the power of the Great Western Railway engines upon that railway, by instituting a similar set of experiments on other railways; we then had the comparative result of the engines as to speed, and performance upon the railways of the ordinary width and plan of construction, and upon the Great Western Railway.

A set of experiments for the purpose of ascertaining the performances of the several engines on the Great Western Railway was therefore commenced, and were conducted as follows:—

A certain number of first and second class carriages were selected and weighed; they were then loaded with such a weight as would equal that of their full complement of passengers, with their luggage. A certain number of trucks were also selected, weighed, and loaded with the weight which they were calculated to carry.

The engine selected for the experiment was weighed, and also the tender,—the quantity of coke in the fire-grate of the engine was carefully observed at the commencement of the experiment, and also the quantity of water in the tender. The engine was then attached to the carriages fixed upon for the experiment, put in motion, and proceeded to the end of the stage without stopping. The coke having been previously weighed into bags, the quantity put into the fire-grate during the journey was recorded, and at the end of the trip the fire-grate was filled up, as nearly as could be estimated, to the same height above the fire-grate as it was at the commencement of the trip, and the quantity thus consumed correctly ascertained. The quantity of water at the beginning of the trip being known, the boiler was kept to the same height during the journey, the quantity of water left in the tender at the end of the journey was gauged, and thus the quantity evaporated in the trip was obtained.

The mode of conducting the experiments was this:—Commencing at Paddington, the engine dragged the train from the depot to the first half-mile post, when it was stopped; the steam was then applied to the cylinders, and the time noted; for the first mile the time was recorded at every 110 yards, for the purpose of ascertaining the progress of obtaining the average speed, and afterwards at every quarter mile. The train then proceeded until it arrived at the twenty-first mile post, when the steam was shut off from the cylinders, and the train allowed to come to rest of itself. The quantity of coke consumed, and water evaporated, during each journey was ascertained as previously explained; and the rate of speed being taken at every quarter mile, the rate of velocity was also obtained, not only during that part of the journey at which a maximum rate of speed was kept up, but also the time occupied in getting up the speed, and also of bringing the train to a state of rest. The same process was observed in the return trip from Maidenhead to Paddington; the engine and train was brought up to the twenty-second mile post and stopped, the steam thrown upon the pistons, and the time, coke, and water, ascertained in the same manner as in the former case.

Table I. is the result of the experiments of the power of the Locomotive Engines on the Great Western Railway, arranged in a tabular form, &c.;

By classifying these experiments, under the respective loads by which the powers of the engines were tested; we have the comparative results, as regards the performances of the different engines with performances of the different engines with specific loads, and the consumption of fuel, or power required to drag these loads at certain rates of speed.

On attentively considering the result of these experiments, as exhibited in the following tables, we find that the extreme mean maximum rate of speed accomplished by these engines, has been 41.15 miles an hour, with the North Star Engine, but the load which was taken at that rate of speed was only 15 tons. It may here be observed, that the rate of speed shown in these tables, is the mean rate from the time the engine obtained its full speed, until the steam was shut off at the end of the experiment; and comprehended a distance generally of 19 miles, as may be seen on inspecting the tables in note E, Appendix. A greater extreme rate was accomplished for a short distance, during some of the experiments, as much as 45 miles an hour. The above expression of the maximum mean rate of speed, is therefore the average rate of travelling from one end of the stage to the other, after the engine had got into full speed, and until the speed was again checked at the end of the stage.

A rate of 40½ miles an hour has, it will be seen, been accomplished by another engine, the Apollo, but with a load of only nine tons; when the load was increased, both with this engine and with the North Star, the speed was correspondly reduced. The result of these experiments show that to effect a mean rate of about 40 miles an hour, exclusive of the time of getting up the speed and stopping at the termination, between the two ends of a stage, about twenty miles in length, the load cannot be more than from 15 to 20 tons, with engines of the power of the North Star.

TABLE I.

RESULT OF THE PERFORMANCES OF THE DIFFERENT ENGINES ON THE GREAT WESTERN RAILWAY.

NAMES OF ENGINES.	Load. Carriages, &c.	Load. Engine and Tender.	Load. Gross Loads.	Rate at full Speed. Miles per Hour.	Mean Rate of Speed. Miles per Hour.	Pressure of Steam per Square Inch.	Coke consumed. During Trip.	Coke consumed. Per Ton.	Coke consumed. Per Mile.	Water Evaporated. During Trip.	Water Evaporated. Cubic Feet per Hour.	Water Evaporated. lbs of Coal per Cubic Feet.
	Tons.	Tons.	Tons.				lbs.	Of Goods.	Gross Load.	Galls.		
NorthStar	15·9	28 89	44·79	41·15	38·51	53·7	980	2·76	·98	695	197·7	8·78
	32·92	28 74	61·66	36 97	31·52	60·6	924	1·25	·66	756	163·8	8 29
	41·61	29·01	70·62	38·8	33·9	56·7	1040	1·09	·64	614	136·5	11·37
	53·58	28·68	79·26	30·63	25·3	62·7	1088	·95	·61	847	153·6	8·48
	82·03	28·57	110·61	32·81	30·66	55·4	1092	·59	·45	846	200·9	8·04
	166·56	28·41	194·7	23·3	18·63	68·7	1162	·306	·256	929	141·4	7·79
Æolus	24·27	28·41	52·75	37·28	33·27	62·6	751	1 37	·63	552	130·9	8·46
	31·22	28·29	59·52	33 25	29 77	59·8	839	1·15	·62	572	117·9	9·68
	48·34	28·27	76·59	28·9	19·72	65·6	692	·62	·40	607	98·5	6·6
	50·46	28·37	78·93	32·26	27·9	64·3	808	·75	·49	615	129·5	8·79
	63·81	28·41	82·23	25·83	23 83	58·8	1114	·92	·56	649	114·7	10·67
	79·69	28·32	108·29	24·59	22·64	59·9	956	·51	·37	657	110 4	8·89
	104·6	28·13	132.73	22 9	17·8	68·5	271	·39	·31	724	105·2	7 95
Venus	31·41	26·58	58·	34·28	30 16	60·4	681	·96	·52	500	111·1	8·49
	50·46	26·44	76·9	27·97	22·5	70·	718	·63	·41	570	96·9	7·84
Neptune	31·42	26·57	58·	34·14	29·77	70·5	601	·84	·45	495	107·6	7·68
	44·81	26 53	74·81	33·11	23·35	65·	603	·00	·37	510	87·45	7·40
	50·46	26·57	77·03	26·	23 53	75·	626	·64	·42	510	92·8	8·89
Apollo	9·37	26·56	35.93	40·5	31·7	70·	644	3·05	·79	511	129·5	7·85
	18·25	26·61	44·86	37·25	33·08	70·	616	1·51	·61	481	117·1	8·12
	31·42	26 5	57·9	35·81	29·8	74·7	725	1·03	·56	549	120·2	8·29
	50·40	25·56	77·02	25 75	21·05	75·	840	·79	·51	601	94·2	8·71
Premier	59·67	24 38	84·05	26·15	24·65	60·	896	·67	·47	832	154·5	6·23
	80·5	24·07	105·46	24·17	22·37	60·	952	·509	·40	842	140·4	7·02
Lion	52.45	24·33	76·78	26·63	22.95	50	854	.73	·46	63	110·3	8·3
	80.5	23·9	104·4	24·07	22.28	50·	1169	.64	·49	80	145·6	9·

TABLE II.

TABLE OF THE RELATIVE POWERS OF THE DIFFERENT ENGINES ON THE GREAT WESTERN RAILWAY.

Loads in Tons of Carriages and Passengers.	North Star Engine, 16 in. Cyl. 7 ft. Wheels. Max. speed in Miles per Hour.	North Star Engine. Consumption of Coke per Ton per Mile.	Æolus Engine, 14 in. Cyl. 8 ft. Wheels. Max. speed in Miles per Hour.	Æolus Engine. Consumption of Coke per Ton per Mile.	Venus, Neptune, and Apollo Engines 12 in. Cyl. 8 ft. Wheels. Max. speed in Miles per Hour.	Venus, Neptune, and Apollo. Consumption of Coke per Ton per Mile.	Premier and Lion Engines, 14 in. Cyl. 6 and 7 ft. Wheels. Max. speed in Miles per Hour.	Premier and Lion. Consumption of Coke per Ton per Mile.
		lbs.		lbs.		lbs.		lbs.
9	....	....	....	....	40·5	3·05	....	....
15	41·15	2·76	....	....	37·35	1·51	....	....
18	....	....	....	....	....	....	....	....
24	....	....	37·28	1·37	....	....	....	....
32	36.37	1·25	33·25	1·15	34·74	·94	....	....
50	34·76	1·02	32·	·76	26·57	·69	26·50	·70
80	32·81	·59	24·59	·51	....	....	....	....
104	....	....	22·9	·39	....	....	....	....
166	13·3	·306	....	....	....	....	....	....

It may be here remarked, that unless very large and heavy tenders are conveyed with the engines, the stages cannot be of a much longer distance than twenty miles; the quantity of water evaporated in this distance, by the North Star Engine, being upwards of three tons.

The performance with the North Star was with a six wheel, and a four wheel passenger carriage, capable of containing 56 passengers; the experiment with the Apollo Engine was with a six wheel carriage capable of containing 32 passengers, the full complement of luggage in both cases being allowed.

It is scarcely necessary to state that, this is a load which cannot be considered a profitable or adviseable one, to be fixed upon as a standard for the weight of the trains; or such a load as should be considered to be the weight of the first class trains on the railroad for permanent adoption. It is only necessary to refer to the experiments to see, at what a sacrifice of power and consumption of coke this rate has been accomplished, to arrive at once at the conclusion, that if such a rate of speed cannot be kept up except at such a sacrifice, the rate must be reduced.

The Æolus engine with 24 tons, realised a rate of 37 miles an hour, and the twelve inch cylinder engines with 18 tons, accomplished a similar p rformance: these are likewise loads below that which it will be necessary to provide for the regular traffic of the railway.

We come now to the next load, on which experiments were made, viz. 32 tons; this would provide accommodation for about 112 people with their luggage, with 2 six, and 2 four wheel first class carriages; and with this load the North Star accomplished a rate of nearly 37 miles an hour, and the other engines about 34 miles. This is likewise a less load than can be reckoned upon for the permanent working of the line, as it does not allow for the conveyance of private carriages, which must always be calculated to accompany the swift or first class trains.

With a load of 50 tons, the speed realised by the Northern Star is nearly 35 miles an hour;—with the Œolus 32 miles;—but with the other engines only 26½ miles an hour.

When the load is increased to 80 tons, the North Star engine performs a rate of nearly 33 miles an hour; but the performance of the Œolus engine is diminished to 24½ miles an hour; and we see that a rate of 22½ miles an hour is the performance of engines such as the Venus, Neptune, and Apollo, with 12 inch cylinders, and 6 and 7 feet driving wheels, respectively.

It does not appear, therefore, that with the best of the engines at present upon the Great Western Railway, a greater velocity can be calculated upon; at the mean maximum rate of speed than 35 miles an hour, with such loads as may be expected to constitute a first class train. For extraordinary purposes, with a diminished load, a rate of 40 miles may be attained, but looking at all the circumstances incidental to railways, with engines and trains travelling at the maximum rate of speed, it does not appear to me, that any standard equal to 40 miles an hour can be depended upon in practice. The weight of two first class carriages, one with six wheels, and one with four wheels, and of two second class close carriages, one with six wheels, and one with four wheels, with their complement of passengers and luggage, will weigh about 31 tons; but this does not allow of any trucks for the conveyance of gentlemen's carriages, or for horse boxes. Upon the London and Birmingham Railway, since it has been opened throughout, the average weight of the trains, including passengers, passengers' carriages, carriage trucks, horse boxes and luggage vans, has been about 65 tons; this includes both first-class and mixed trains, the former being upwards of 50 tons and the latter about 70 tons. Taking this as a standard for the Great Western Railway, it does not appear that, for the first-class trains a less weight than 50 tons can be calculated upon; and with this weight the experiments show that a mean rate of 35 miles an hour between the stages, after getting up the speed, and before its being checked may be accomplished, under circumstances similar to those experienced during the time these experiments were in being performed, and with engines of the power of the North Star. And it will be seen that with a load of 80 tons, which would not much exceed the weight of a second class train, a velocity of nearly 33 miles an hour can be maintained, during the time the engine is at the full rate of speed.

Taking 35 miles an hour, therefore, as the mean maximum rate of speed between the stages, it will have to be considered what general average rate can be kept up between one end of the line and the other; in this calculation we have to take into account, the time lost in getting up the speed, and in stopping the train, the time lost at each station, and all the vicissitudes of wind, weather, and incidental casualties. On the other hand I think it my duty to explain, that these experiments, which are here brought forward as a standard for the assumption of this rate of speed on the Great Western Railway, though it is not expected that more weight should be placed upon them than upon experiments generally, which must be considered as exhibiting more favourable circumstances than the everyday practical result; yet it must be taken into account, that the road for three or four miles from one end of the line was under repair, and would not therefore present what may be considered an average result, or what may be expected to be the permanent result when the road is in the best possible order. We shall see afterwards to what extent this may be supposed to influence the general result; I thought it my duty, however, to mention it in this place, that every circumstance connected with the enquiry likely to operate, in any degree whatever upon the general result, should be brought into consideration.

On a mere inspection of these tables, every person must be struck with the enormous increase of power required to effect a high rate of speed, or a rate of 40 miles an hour, compared with that which is required to propel a load at the rate of about 20 miles an hour. We see the North Star engine, dragging 166 tons at the mean rate of 23.3 miles an hour; while the same engine under similar circumstances is only capable of dragging 15 tons at the rate of 41.15 miles an hour. Again the Æolus engine, drags 104 tons at the rate of nearly 23 miles an hour; and only 24 tons at the rate of 37.28 miles an hour. The engines of less power exhibit precisely the same results, we see them dragging 50 tons at 26½ miles an hour, and only nine tons at 40½ miles an hour.

If this had been the result of theoretical deduction, some suspicion might have existed of its accuracy, but the above is the result of carefully-conducted experiments, made under precisely similar circumstances; and although it might have been desirable that a greater number of experiments had been made in corroboration, there can be no doubt that the results as shown by this experiment exhibit, if not strictly so, sufficiently correct data for all we require in a practical point of view.

I am aware that this aggregate result is composed of the effect of the engines, the effect of the road, and the resistance of the carriages; and that each of these effects are liable to modification, to the extent to which each of them influence the general result, and to which they are susceptible of further improvement. We shall afterwards see to what extent each of these operate in producing the general result, and we shall also see that this result is completely and satisfactorily made out by subsequent experiments, on each of these sections separately; still, in practice, it is the aggregate result to which we must look, and by which we must be guided in our inquiries into the entire system. It is of the utmost importance to inquire into the causes, that we may know how far the general result is capable of improvement, and to what extent; but in practice, conclusions drawn from experiments on a working scale and character, must carry with them considerable weight as a standard.

I must here revert to the often repeated expressions of opinion, that in laying down any standard of power in engines, and especially any standard with reference to the power of locomotive engines, it should be a varying one, dependant upon their presumed increased powers; and, that looking back to the rapid strides of improvement made in the engines, we may naturally look forward to further improvements, and that, therefore, our calculations should rather be founded upon what may probably be the powers of these engines in future, than upon the powers they exhibit at the present time. The force of this is irresistible, but we must not, where the result involves the expenditure of an immense amount of capital, yield to prospective theoretical improvements, unless they carry with them strong, and almost certain grounds of practical realisation. The great impulse of improvement given to these engines has has been their powers of evaporation, in producing a sufficiently rapid evolution of steam with an engine of a tangible weight. The system of small tubes has effected more than could at one time be reasonably expected, and we now not only accomplished an immense rapidity of production of steam; but we have likewise effected this without any waste of fuel, and this is a most important element in the consideration. By an inspection of the tables it will be seen, that the average weight of coke required to convert a cubic foot of water into steam, is not greater than what is required by the best constructed stationary engines, and less than Mr. Watts' standard, viz. 8lbs. of coal to each cubic foot of water. When we consider the ingenuity exercised for so long a period upon this part of the economy of stationary engines, with so little effect, and this, with engines infinitely more favourably circumstanced than the locomotive engine, it becomes extremely questionable to what extent we ought to carry speculations founded upon a presumed increase of evaporating power of these engines. But allowing to the most sanguine every possible extent of imaginative improvement, and supposing that we could effect an equally economical and as great a rapidity of production of steam, with the North Star, as with engines of the weight of the Venus, Neptune, and Apollo, which are only of half the power, and which, it may be presumed, would be the limits of speculation by the most fertile mind, what do we gain, we have a saving of two tons weight. Or, if we were to go even further, and take the lightest engine working on the ordinary railroads, and suppose their powers of evaporation to be doubled, we gain no more than five or six tons upon a railway of the width of the Great Western, and this would give us 20 tons at 41 miles an hour, instead of 15 tons, and so in proportion at other velocities. The only reasonable speculation of future improvements, is in the expectation that increased evaporating powers may be given to such engines as the North Star; and that retaining the same weight of the present most powerful engines, we may so increase their evaporating powers as to produce an increase of effect. Here, however, we have practical data to guide us even in this respect in these tables: the comparative evaporating powers of the Æolus and the North Star, are 165 : 115, and the Venus 165 : 106. These tables show, that with such an increase of powers of evaporation, no more than about three miles an hour is gained by the North Star over the Æolus, both engines being of the same weight. It results, therefore, from these experiments, that it would, practically considered, be imprudent to indulge in speculations which are only necessary in case of considerable improvements being effected in the locomotive engine, and by which a much higher rate of speed can be realized than these engines are at present capable of effecting:—we shall afterwards see that there is a limit to the velocity of railway trains, by an element over which we have no control, and that it would be impolitic in a practical or commercial point of view, to attempt more than a certain rate of speed.

Having thus obtained, as far as the time permitted, the power and capabilities of the engines upon the Great Western Road, the next step was by a similar set of experiments to obtain the powers of the engines on railways of the ordinary width and construction. To accomplish this, application was made to the directors of the London and Birmingham Railway, who very handsomely granted permission to make any experiments which might not interfere with the traffic upon the road. When, however, it is considered that these experiments can only be made in the interval between the trains passing along the line; that on the Great Western Railway, where, from the line being short, much greater facilities are afforded for making the experiments than upon a long line of road, the experiments occupied from the 13th of September to the 13th of October; and when it is also considered that these experiments involve considerable expense, and the almost exclusive attention of the persons connected with the locomotive department, it is quite unnecessary to state that it was extremely difficult to avail ourselves of the permission granted by that company, without such interference with the regular traffic of the road as would have been unjustifiable.

The engines upon these railways, however, are not so varied in their construction as those of the Great Western Railway, and therefore a less number of experiments were necessary; for, instead of having to determine the power of each different kind of engine, it only required experiments to determine the power of almost one engine, the other being so nearly alike, the performance of one correctly ascertained was, in fact, the standard of power of the whole.

Mr. Robert Stephenson, in the most handsome manner, placed at my disposal some experiments made on that railway on the powers of their engines during the summer of this year, and, for the purpose of checking these by my own personal observation, he arranged and accompanied me on an experimental trip from the Camden Town station to Boxmoor and back, and gave me an opportunity of making other trips to corroborate the accuracy of his experiments.

Table III. will show the result of those experiments on the London and Birmingham Railway.

TABLE III.

ACCOUNT OF THE PERFORMANCES OF THE ENGINES ON THE LONDON AND BIRMINGHAM RAILWAY.

NAMES OF THE ENGINES.	Load. Carriages.	Load. Engine and Tender.	Load. Gross Load.	Rate at full Speed.	Mean Rate.	Pressure of Steam per Square Inch.	Coke consumed. During Trip.	Coke consumed. Per Ton.	Coke consumed. Per Mile.	Water evaporated. During Trip.	Water evaporated. Cubic Feet per Hour.	Water evaporated. Pounds of Coke per Cubic Feet.
	Tons.	Tons.	Tons.	Miles per Hour.	Miles per Hour.		lbs.	Of Goods.	Gross Load.	Galls.		
						lbs.		lbs.	lbs.			
Harvey Combe.	32·65	17·5	50·16	32·88	30·51	50	434	·89	·47	300	83·81	8·84
	53·45	17·5	70·95	32·4	28·53	50	601	·59	·4	506	105·9	7·59
	64·36	17·26	81·61	25·53	21·85	50	391	5·40	·36	317	70·66	7·62
Bury's Engine.	34·45	16·32	50·77	32·41	31·29	50	606	1·01	·55	420	91·	8·9
	53·91	16·85	69·76	32·04	29·82	50	590	·58	·41	405	94·42	8·12
	67·2	16·38	83·53	23·81	19·42	50	1220	·36	·29	935	56·81	8·11

These experiments, the results of which are shown in the above table, were made, as will be seen by an inspection of the section, upon a part of the railway, the gradients of which are very variable; the inclination being in some parts 16 feet in a mile, and are the mean result in both directions.

Table IV. is a summary of these experiments arranged for comparison with those on the Great Western Railway.

TABLE IV.

TABLE OF THE POWERS OF THE ENGINES OF THE LONDON AND BIRMINGHAM RAILWAY.

Load in Tons of Carriages and Passengers.	Harvey Combe engine, 12 inch cylinder, 5 feet wheels. Maximum speed in miles per hour.	Harvey Combe engine. Coke per ton per mile in lbs.	No. 15. Mr. Bury's engine, 12 inch cylinder, 5 feet wheels. Maximum speed in miles per hour.	Mr. Bury's engine. Coke per ton per mile in lbs.
32.65	32.88	.80	——	——
34.45	——	——	32.41	1.01
53.45	32.4	.59	——	——
58.91	——	——	32.04	.58
64.36	25.53	.504	——	——
67.20	——	——	23.81	.36

From this it will be seen that, on a railway of the ordinary width, where the gradients are variable, and where the resistance is more than doubled in some parts, a mean velocity of 32 miles an hour may be maintained with loads varying from 32 to 54 tons. These experiments were made for the express purpose of comparison with those on the Great Western Railway, and with the same loads; and they are, therefore, presented as experiments for such a comparison. I have done this in preference to producing as comparisons other experiments made on the Grand Junction, and Liverpool and Manchester Railways; as if I had done so, these experiments not being made in the same manner, many explanations would have been required; it will, however, be seen, on inspecting the results of the other experiments, that the general comparative result of the performances of the engines on the London and Birmingham Railways is corroborated by those other experiments.

On comparing the results of these experiments with those made on the Great Western Railway we find, that with the same load, or with a load of 32 tons, a greater rate of speed is accomplished by the North Star engine; but that the performances of the engines on the London and Birmingham Railway with that load, nearly approach those on the Great Western of a less power than the North Star, but of a greater power than the London and Birmingham engines. With a load of 50 tons, the North Star engine on the Great Western Railway, acomplished a mean velocity of about two miles an hour greater; the Æolus engine the same rate; but the Venus, Neptune, and Apollo engines, of the same power as those on the London and Birmingham Railway, do not come up to the performances of the latter engines by six miles an hour.

We see likewise in the comparison of these performances a much greater consumption of coke per ton per mile, by the engines on the Great Western Railway, than by the engines on the London and Birmingham Railway; and the construction of the engines being nearly the same, we consequently find a proportionate quantity of water, or quantity of steam, consumed. It is scarcely necessary to say, that the quantity of water used, or weight of steam employed, in a given distance, is a correct test of the power expended in performing a certain quantity of work on that stage; we can, therefore, besides knowing the relative dimensions of the engines, apply this as a test of the power employed by the engines on the respective railways in the performance of a similar quantity of work. Adopting the mode of estimating the relative powers of the engines by a well-known rule, viz., that the power of evaporation by the action of the radiant heat of the fire-box, is three times that of the communicative heat of the tubes; the following table will show the relative powers of the several engines on which experiments have been made, according to this mode of calculation, to which I have added the actual powers exhibited by the experiments, as determined by the quantity of water evaporated into steam.

TABLE V.

THE RELATIVE POWERS OF THE ENGINES ON THE GREAT WESTERN, AND LONDON AND BIRMINGHAM RAILWAYS.

NAMES OF ENGINES	Estimated Powers of Evaporation			Cubic feet of Water evaporated per hour.	Mean rate of speed with Trains of 50 tons in miles per hour.	Consumption of Coke in lbs. per tons, per mile of goods.	Comparative powers and Consumption of Coke.		
	Area of Fire Box Square Feet	Area of Tubes. Square Feet.	Aggregate estimated powers of evaporation				Estimated powers of Evaporation.	Actual evaporation per experiment.	Consumption of Coke per experiment
North Star...	70.10	654.76	288.28	105.6	34.76	1.02	100.	100.	100.
Æolus.......	50.3	534.19	228.09	115.3	32.	.76	79.12	69.63	75.85
Venus......									
Neptune....	45.	461.51	198.84	106.2	26.57	.69	68.97	64.13	68.86
Apollo.....									
Harvey Combe	50.72	332.45	163.87	94.85	32.4	.59	56.84	57.98	58.88
Bury's Engine	39.2	378.2	165.26	92.74	32.04	.58	57.32	50.	57.88

We see by the above table, the comparative amount of power required to perform the same quantity of work on the Great Western, and on the London and Birmingham Railways; arising partly from the much greater power and weight of the engines, compared with the useful load on the former than on the latter railway, and partly, as will hereafter be seen, on the increased resistance offered by the rails and carriages.

On examining the account of the experiments on the London and Birmingham Railway, it will be seen that, although the mean rate of speed is 32 miles an hour, occasionally on some parts of the line the velocity was much greater, the maximum being 40.9 miles an hour. I shall, for the present, defer making any further comparison of these results, and shall now offer to your notice some experiments made on other railways, as corroborative of the above.

Through the kindness of my friend Mr. Booth, secretary to the Liverpool and Manchester Railway, I have been enabled to make some experiments on deflexion on that railway; and the resident engineer, Mr. Edward Woods, has furnished me with some experiments on the powers of the engines on that railroad.

TABLE VI.

SUMMARY OF EXPERIMENTS ON THE LIVERPOOL AND MANCHESTER RAILWAY.

NAMES OF ENGINES.	Load.			Mean Rate of Travelling in Miles per Hour.	Coke consumed.		
	Carriages, &c.	Engine and Tender	Gross Load		During Trip.	lbs. of per ton, per mile.	
	Tons.	Tons.	Tons.		lbs.	Of Goods.	Gross Load.
Planet, Sun, Lightning, Phalaris, Firefly, and Sirius...............	137.3	17.	154.3	19.16	12.18	297	.20
Planet and Lightning....	26.	16.4	42.4	29.1	747	957	.687

Having been informed, that several experiments had been made on the Grand Junction Railway, on the consumption of coke, and some portions of that Line being particularly favourable with respect to gradients, for experiments on the friction of the carriages; I made application to Mr. Moss, the Chairman of the Directors, for permission to make some experiments on that railway, and received from that gentleman a letter, stating that he had laid my application before the Board of Directors, and that they had authorized him to say that they had much pleasure in meeting my wishes, leaving the arrangement in the hands of their engineer, Mr. Locke.

On applying to Mr. Locke, he at once placed in my hands the result and particulars of a most valuable set of experiments, made on the Grand Junction Railway, and met me on the spot to arrange about any other experiments which I might think advisable to make.

The following are the experiments made on the Grand Junction Railway on the consumption of coke of the locomotive engines.

These experiments are presented for a different purpose than the preceding ones, the former gives the consumption of coke and powers of the engines, with respect to speed, from the time of starting at one end of a stage until they arrived at the end of that stage, or the consumption and rate of travelling during the time of performing the journey alone. The experiments on the Grand Junction line gives the consumption of coke, from the time of lighting the fire until the engine has finished the journey, including all the waste at each end; or, in fact, showing what is equivalent to the consumption in the regular working of the railway, from the time the fire is lighted until the engine has finished the day's work.

Table VII. is the result of these experiments:—

TABLE VII.

SUMMARY OF EXPERIMENTS ON THE GRAND JUNCTION RAILWAY ENGINES.

NAMES OF ENGINES.	Date of Experiments. 1838.	Load.			Rate of Travelling.			Coke.				Water evaporated.		
		Carriages &c.	Engine and Tender.	Gross Load.	Total Distance.	Time.	Mean Rate.	Total Quantity.	Per Mile.	Per Ton per Mile. Goods	Per Ton per Mile. Gross Load.	During Trip.	Cubic Feet. Per Hour.	lbs. of Coke. Per Cub. ft
		Tons.	Tons.	Tons.	Miles.	H. M.	Miles per hr	lbs.	lbs.	lbs.	lbs.	Galls.		
Phalaris ..	May .. 30, ... 31, June .. 5, Ju .. 5	39.2	20.—	59.2	778	33.46	23.05	28.812	37.03	.95	.62	17230	81.9	10.43
Prometheus	June .. 5, ... 6, ... 7, ... 8	36.7	20.	56.7	778	34.33	22.58	26.715	34.3	.93	.60	17610	81.7	9.39
Prometheus	June .. 11, ... 12, ... 13	32.8	20.	52.8	583.5	26.6	22.38	24.403	41.9	1.28	.79	12740	78.2	11.97
Phalaris ..	June .. 14, ... 15, ... 16	42.6	20.	62.6	583.5	26.28	22.08	22.488	38.3	.90	.61	11450	67.8	12.24
Prometheus	June .. 22, ... 23, ... 25, ... 26	41.1	20.	61.1	778	[illegible]	21.49	[illegible]	47.1	.77	.77	16060	84.6	11.96

The experiments were made for the purpose of ascertaining the comparative qualities of the different descriptions of coke, and were consequently made with the greatest care by Mr. Alcard, the resident engineer.

For the purpose of comparing this result, with that of the consumption of coke of the engines on the Great Western Railway, I have made out Table VIII., from documents furnished me by Mr. Saunders.

We see therefore, that these statements corroborate the result of the former experiments made in a different manner, and show, for the reasons previously explained, a greater expenditure of power, or consumption of coke, on the Great Western Railway, than on the Grand Junction Railway, for the performance of the same quantity of work.

On a careful consideration of the data furnished by these experiments, the conclusions which appear to result from them, as regards the first proposition, viz., the attainment of speed, &c., &c., appear to be as follows:—

1st. That the extreme rate of speed, accomplished on the Great Western Railway, has been 45 miles an hour, with the North Star engine, and with a load of fifty tons, for a short distance.

TABLE VIII.

CONSUMPTION OF COKE ON THE GREAT WESTERN RAILWAY.

AMES OF GINES.	Date of Experiments.	Load. Carriages, &c.	Engine and Tender.	Gross Load.	Rate of Travelling. Distance.	Average Time in 22½ Miles.	Mean Rate.	Coke. Total Quantity in lbs.	lbs. per Mile.	lbs. per Ton per Mile. Goods.	Gross Load.
		Tons.	Tons.	Tons.	Miles.	Min.	Miles per Hour.				
rth Star.	From 4th June to 30th Sept. 1838.	40.5	28.5	69.	8848.	.881	25.45	420784.	47.5	1.17	.69
olus……		40.5	28.4	68.9	7292.	.237	23.81	353300.	48.4	1.19	.71
……		40.5	26.5	67.	240.	.100	22.5	12656.	52.7	1.3	.78
ptune….		40.5	26.5	67.	4728.	.949	23.83	188384.	39.8	.95	.59
pollo…..		40.5	26.5	67.	4392.	.942	23.81	193080.	43.9	1.08	.65
emier….		40.5	25.	65.5	3024.	.99	22.73	159936.	52.8	1.3	.87
…….		40.5	24.	64.5	3973.	.96	23.43	226576.	57.	1.4	.89

2d. That with a load of 50 tons, which may be considered to be the xtreme load of a first-class train, a mean rate, at full speed, of 35 miles per our, in both directions, has been accomplished upon the line at present pened, viz., 22½ miles, the extreme gradient being 4 feet per mile; nd that this has been performed with engines of an average evaporating ower of 165.6 cubic feet of water per hour, and with driving wheels 7 feet iameter; and cylinders, 16 inches diameter.

3rd. That with engines of a less evaporating power, or equal to 115 cubic eet of water per hour, the average speed with a load of 50 tons has been 32 iles an hour; the engines having eight feet driving wheels, and twelve ich cylinders.

4th. That the extreme rate of speed accomplished on the London and irmingham Railway, has been 40.9 miles an hour, with the Harvey Combe ngine, and with a load of 34½ tons, but only for a short distance.

5th. That with a load of 50 tons, a mean rate of 32 miles an hour, at full peed, has been accomplished, on a stage of about the same length as upon e Great Western, or 24¼ miles; the extreme gradient being 16 feet per ile, and with engines, the mean evaporating power of which is equal to 4.85 cubic feet of water per hour, and with 5 feet driving wheels, and ylinders 12 inches diameter.

6th. That on both railways, the consumption of coke, or power required o accomplish the above stated performances, has been as nearly as possible, s the ratio of evaporating powers of the respective engines.

7th. That a high rate of velocity can only be attained by a very great acrifice of power, the following table, shewing the relative performances of wo of the most powerful engines on the Great Western, with respect to peed and load, and also the consumption of coke per ton per mile:—

TABLE IX.

North Star Engine. Load in Tons.	Speed in Miles per Hour.	Consumpt. of Coke per Ton Per Mile. lbs.	Æolus Engine. Load in Tons.	Speed in Miles per Hour.	Consumpt. of Coke per Ton per Mile. lbs.
16	41.	2.76	24	37½	1.37
33	37.	1.25	31	33¾	1.15
50	35.	1.02	51	32	.76
82	33.	.59	80	24½	.51
166	24.	.306	104	23	.30

We come now to the determination of the first section of the report, viz.: —the question of the attainment of a higher rate of speed, on the Great Western Railway than on other railways, whether the increased width of gauge, is or is not, either necessary, or best adapted for the accomplishment of this speed, and to what extent.

We find, from the results previously enumerated, that a higher rate of speed has been attained on the Great Western Railway, than on other railways. This has been accomplished by the increased power of the engines employed on that railway, above that of those on other railways; before, however, we can determine whether the increased gauge, is or is not, necessary, or best adapted for the accomplishment of this object, and to what extent, we must enquire whether engines of the power by which such performance was effected on the Great Western Railway, or such a power of engine as would accomplish that rate of speed, can be applied on railways of the ordinary width.

The estimated powers of evaporation, of the largest of the engines on the Great Western Railway, is 288.28, as per table; and this engine performs a mean rate of speed with 50 tons, of 35 miles an hour. The evaporating power of the Harvey Combe engine is, by the same table, 163.87, and this engine performs a mean rate of speed of 32 miles an hour. The largest engines manufactured by Messrs. R. Stephenson and Co., and in use upon the Newcastle and Carlisle Railway, have, however, an evaporating power of 253.21; and an engine, built by the same manufacturers, for the Leicester and Swannington Railway, has an evaporating power of 263.8. The Æolus engine on the Great Western Railway, which is the next powerful engine on that line, has an evaporating power of 228.09, and this engine effects a mean rate of speed of 32 miles an hour, with 50 tons.

We see, therefore, that there are engines in use upon Railways of the ordinary width, more powerful, in the proportion of 263 : 228, than an engine upon the Great Western Railway, which effects a rate of speed, within three miles an hour, of the most powerful engine on that railway. We have had no opportunity of subjecting these more powerful engines, on ordinary railways, to experiment, which would have been very desirable on the present occasion; but we find such engines with an evaporating power of 165.26 effecting the same rate of speed on those railways, as the engine of 228.09 on the Great Western; and therefore the presumption is, that engines on railways of the lesser width of gauge, of the evaporating power of 253.21, or 263.8, would effect an increased velocity, quite equal, if not greater, than that of the largest engine on the Great Western Railway.

This conclusion results from the engines on the ordinary railways, yielding a greater comparative useful effect than the engines on the Great Western Railway; partly owing to the much greater disproportion between the weight and power of the engines, and the useful load on the latter than on the former; and partly owing to the increased resistance of the road, and also of the carriages themselves. Those parts only of the increased resistance, however, which relate to the additional strength and weight of the engines, and carriages, and which is produced by the enlarged wind scare of the carriages, are attributable to the wide gauge. We shall afterwards see, how much of the increased power, on the Great Western Railway, exhibited by the preceding experiments, as being necessary to drag the same quantity of goods, at the same rate of speed, beyond that on railways of the ordinary width, is to be placed against the width of gauge; the inference which appears to me to result from these experiments is, that with engines of the same power, a greater result, and consequently a greater rate of speed, may be realised on the ordinary width, than upon the increased width of gauge of railway. If the object be to accomplish the greatest possible speed, a wide gauge is unquestionably better adapted for the construction of the largest possible engines, than the narrow gauge; considerable doubts may, however, be entertained if a gauge of seven feet is the best for this purpose, and whether a less width of gauge, taking into consideration every circumstance affecting the question, would not afford every requisite facility for the erection of engines, capable of attaining a maximum rate of speed.

The question, therefore, whether an increased width of gauge is or is not necessary, depends almost entirely upon the determination of what rate of speed it is advisable to attempt, or it is resolved upon to establish. If a mean rate of 32 miles an hour at full speed be sufficient for the purpose, or such increased rate as engines of the largest dimensions now in use on other railways can accomplish, then it will not be necessary, so far as the motive power is concerned, to increase the width of gauge. But if a greater rate of speed is required, the question assumes a different shape; and it must then be ascertained if an engine can be erected upon the lesser width of gauge to perform that rate of speed.

As this appeared to be a very important part of the inquiry, I asked Mr. Brunel the question as to the rate of speed proposed for both passengers and goods. His answer was:—"The rate of speed proposed I conceive also to be quite uncertain, my own opinion being, that it will always be fixed at the highest which we can maintain with regularity. With moderate loads we might fix it at 35 miles an hour, and shortly, when the road is in complete repair, and kept cleaner, when the short trains are established, so as to render one stopping unnecessary, and our engineers more experienced in the management of the engines, at higher speeds, I think we may attain 38 to 40 miles."

If the object be the attainment of the rate of speed assigned by Mr. Brunel, the present engines, it will be seen by these experiments, cannot accomplish that performance, including all the vicissitudes of weather and other casualties; and, therefore, if a mean rate of speed of 40 miles an hour, including stops, is to be attempted, more powerful engines will be required.

These experiments, however, show the immense sacrifice of power incidental to an extreme high rate of speed, or the accomplishment of a rate of 38 or 40 miles an hour, above that of 32 or 35 miles. If economy of conveyance is to be taken into consideration, it becomes a serious question whether such a system should be acted upon as that of providing for an indefinite rate of speed, or that a maximum rate should not be determined upon, and that such standard should be composed of that speed which will best suit the public conveyance generally, and at the same time comprehend every possible economy and regularity. It is, however, not necessary to enter further upon this at present, as the determination will be influenced to a certain extent by other facts elicited in the course of this inquiry, and which, in my opinion, leads to the conclusion that the limit of practical speed, combined with the requisite economy, is that which can be attained by engines capable of being erected on a lesser width of gauge than seven feet.

The preceding experiments having been made for the purpose of ascertaining the comparative power required to work the trains upon the Great Western road, contrasted with the power required to work trains on railways of the ordinary width and construction,—and were quite necessary, in a practical point of view, to show the comparative aggregate amount of effective power given to the load by the engines at present employed on that line, and the effective power produced by the engines on other railways. But these experiments, however extensive and valuable, do not determine the whole question, for although they show the amount of power required to work the respective railways, yet that power is employed to overcome the aggregate resistance of the engines, the friction of the carriages, and the resistance of the road; it became, therefore, extremely desirable that we should separate the results, to arrive at practical conclusions, by which to make a comparison between the two systems of an increased and ordinary gauge of railways.

If the object had been only to ascertain and develope the power required to work the Great Western Railway, this would have been shown by these experiments, and it would have been less an object of utility to determine what part of that power was expended in overcoming the resistance of the engines, what part was due to the friction and resistances of the carriages, and what amount of obstruction was caused by the road. But when the inquiry was extended to a comparison with other railways, it then became necessary to separate the results, the engines employed on the Great Western Railway being, in some respects, different from those employed on other railways; the carriages are also different, and the construction of the road varying likewise.

The carriages on the Great Western Railway are mounted on wheels four feet diameter, whereas the wheels of the carriages on the other railways are generally, and those on which the experiments were made were upon wheels three feet diameter. The first inquiry, therefore, appeared to be to determine the comparative friction of four feet and three feet wheels, or wheels of different diameters.

Again, the experiments with the trains included the resistance opposed to the carriages and engines by the road, and the construction of the rails being different from those on which the other experiments were made, it became necessary to determine what effect the peculiar construction of the road had upon the aggregate resistance determined by these experiments, and to ascertain the comparative friction of a road with continuous bearings and piles and a road upon isolated supports, or such as those on which the several experiments were made.

These investigations, therefore, comprise the second proposition, viz.:—The mechanical advantage or diminution of friction, by being enabled to increase the diameter of the wheels without raising the bodies of the carriages, and in what respect, and to what extent the friction of the carriages is affected by the peculiar construction of the road. The first process will, therefore, be to determine the actual friction or resistance of the carriages on the respective railways. Many modes have been adopted by different experimentalists, of determining this on railroads; that of variously constructed dynamometers, the force of gravity, and several other modes.

The action of the dynamometers is so very irregular, requires such perfect instruments, and even with the utmost possible care it is extremely difficult to ascertain the correct resistance; the vernier in a state of constant vibration or oscillation, that no correct mean result can be determined by observation. I had a dynamometer constructed in 1835, which was mounted on a truck, and, by a set of rollers connected with the travelling wheels, unwound a roll of paper, upon which the vibrations of the vernier was traced by a pencil. By this mode of application the real vibrations of the vernier was recorded, in a precisely similar manner to that which will hereafter be shown to have been used in these experiments to record the motion of the carriages, and by which a mean result can at any time be obtained by admeasurement of the diagram. This machine being, however, constructed for a 56 inch gauge of railway, and being rather cumbrous and bulky, could not be adapted to the Great Western Railway in time for the purpose of this inquiry, and this instrument is likewise liable to the objection of all dynamometers; that being placed behind the tender, they do not show the entire resistance of the train, the tender intercepting the effect of the atmosphere, and diminishing, therefore, the entire resistance.

The gradients of the Great Western Railway also, being nearly that of a level, the action of gravity could not be made use of for determining the friction; and therefore there appeared no other mode than the following, by which the resistance could with any degree of accuracy be determined:—

A piece of road, perfectly straight, and as nearly level as could be obtained, was selected; this road was staked out with posts at every 110 yards. An engine and train of carriages, the friction of which was to be ascertained, was brought to one end of the stage so staked off; the steam was set on, and the engine and train put in motion, until they acquired a velocity of about 20 miles an hour; the steam was then shut off, the engine stopped, and the train of carriages being previously detached from the engine, they were allowed to run along the line until the friction and resistance of the atmosphere brought them to rest; during the whole of the experiment, the time of passing each post was carefully noted down, and also the time when the carriages came to rest.

Note P, Appendix, is an account of the experiments and formulæ, for ascertaining the comparative friction of three and four feet wheels on the Great Western Railway.

Note Q, the experiments made on that and other railways, for the purpose of ascertaining the comparative resistance of railway trains.

These experiments were made at a velocity, at the commencement of the experiment, not exceeding 20 miles an hour, and varying from that until the carriages came to rest; and appeared to be the only mode of obtaining the friction by a precisely similar manner on the Great Western and other railways. The resistance of the most important section of the experiments with the engines are not, however, comprised within the rate of speed at which the preceding experiments with the engines were made. We have already remarked the very great diminution of effect at a high rate of speed, especially when a velocity of from 35 to 40 miles an hour was attained; it became, therefore, of the utmost importance to ascertain whether the diminution of effect was referable to the engines, or to the resistance of the carriages at those higher rates of speed.

The chief part of the resistance to which practical attention has been directed is that which is properly called *friction*. That the atmosphere offered some resistance has been always, of course, admitted, but this resistance has been generally considered to be so insignificant, compared with the resistance depending on friction, that in all calculations which have come within my knowledge it has been wholly disregarded.

It became, however, of the greatest importance to investigate, to the fullest extent, every resistance offered to the motion of railway trains, especially at high rates of speed, and it was therefore determined to institute a course of experiments, with a view to determine, by some direct and conclusive means, the actual amount of atmospheric resistance, independently of any principles of calculation founded upon the laws of friction.

The method adopted was founded upon the following considerations:—By numerous experiments which have been made by different philosophers on the resistance of the air, it has been satisfactorily ascertained that that resistance varies in a proportion somewhat higher than that of the square of the velocity of the moving body. Whatever, therefore, might be the actual amount of this resistance, at any particular speed, it was to be expected that its increase would be very rapid, even by a small increase of speed. If, therefore, a railway train was moved down an inclined plane, of an inclination so steep that gravity would produce considerable acceleration of motion, the resistance of the motion, so far as that resistance depends on the air, would be subject to a rapid increase. Now, if the resistance of the atmosphere be considerable, it is quite clear that the speed which the train would acquire in descending the inclination might be such as to render that resistance so great that, combined with the friction, it would be in equilibrium with the gravitation of the train down the inclination; and in such case the necessary consequence would be that the train would cease to be accelerated, that it would require an uniform speed in the descent, which it would retain without any augmentation until its arrival at the foot of the plane.

The Whiston inclined plane on the Liverpool and Manchester Railway being straight and about a mile and a half in length, falling at the rate of 1 in 96, afforded a favourable opportunity for the experimental test. A train of four first class carriages was accordingly prepared and brought to the level at the summit of this inclination. In the first instance the carriages were not loaded, save by the persons employed in making the observations, and the gross weight of the train was 15, 6-10th tons. An engine was placed behind them, so as to push them towards the summit of the plane, and then to dismiss them down it with a considerable speed. They commenced the descent accordingly, moving 100 yards in seven seconds, or nearly 30 miles an hour. As was expected, a uniform speed was soon acquired, which suffered no change until the arrival of the train at the foot of the plane; this uniform speed in the first experiment was 45 feet per second. The experiment was repeated in the same manner, when a uniform speed was again attained of 46, 3-tenths feet per second, the mean speed in these two experiments being 45, 6-10ths feet per second, or about 31 miles an hour. The carriages were now loaded with a weight equivalent to their usual load of passengers, by which the gross weight of the train was increased to 16 tons 1 cwt.; the gravitation of the train being thus increased it was expected that the speed would also increase, the momentum of the descending body being adequate to encounter a proportionally greater resistance of the air. Three experiments were then made with the trains thus loaded, which showed results of considerable uniformity; in the first experiment the uniform speed attained was 46, 8-10ths feet per second; in the second, 48 feet; and in the third, 47 1-10th feet per second, the mean of which is 47, 3-10ths feet per second, or 32¼ miles an hour.

The force exerted by 15, 6-10ths tons down an inclination of 1 in 96 is equivalent to 364 pounds, and as this was the weight of the train in the first experiments, it follows that such a coach train moving at 31 miles an hour suffers a resistance of that amount, which includes both friction and atmospheric resistance.

Again, the force exerted by 18 ton 1 cwt. down the same inclination is 421.12 pounds, and as the train having this weight moved with a uniform velocity of 32¼ miles an hour down the plane, this was its resistance at that speed.

These experiments are quite conclusive as to the agency of the atmosphere, in resisting the motion of trains on railways. It has never been pretended that the actual resistance from friction amounts to more than nine pounds a ton of the load, and many have stated that it does not exceed seven pounds, and some that it is so low as six pounds. But even if the highest of these estimates be taken, it would follow that the whole of the resistance of 421 pounds, encountered by the train moving at 32¼ miles an an hour, only 162 pounds are due to friction, while about 260 pounds are due to the atmosphere. But we shall presently show that this estimate of the resistance from friction is overrated, and that, therefore the amount of the atmospheric resistance here referred to is considerably underrated.

In comparing the results of these two sets of experiments, it will be apparent in how great a degree the resistance is increased even by a small increase of speed. The mean speed in the first two experiments was 13 miles an hour, and in the last three 32¼; the ratio of these velocities is about 100 to 103, the speed being in the latter case increased three per cent. Now the resistances in the two cases were in the direct ratio of the gross weight of the trains, which ratio was 100 to 115. Thus to gain an increase of speed amounting to 3 per cent., an expenditure of power amounting to 15 per cent, is necessary. Nor can it be said, that the great amount of resistance here manifested was produced by a head wind, though even were such admitted to be the case, such an admission would equally involve the principle of a powerful atmospheric resistance; but in fact, in all the experiments performed upon this plane, there was a pretty strong wind directly in favour of the motion of the train down the plane.

Scientific experiments shew, that the increase of resistance from the atmosphere is in a higher ratio than that of the square of the velocity; the experiments just mentioned confirm this, for while the squares of the velocities increase in the ratio of 100 to 107, or 7 per cent., the resistance is increased in the ratio of 100 to 115, or 15 per cent.

These experiments, though conclusive as regarded the effect of the atmosphere in this case, and though they give a total amount of resistance, were insufficient to determine the proportion in which this resistance was due to the atmosphere, and to friction. Various methods of determining this presented themselves. If a train were moved down an inclined plane commencing from a state of rest, or with any given speed, and allowed to be gradually accelerated, subject to the combined resistances of friction and the atmosphere; the circumstances of its motion could be investigated by the principles of mathematics, assuming that the friction was, as it is generally considered to be, independent of the velocity, and that the atmosphere varies either as the square, or as any other assumed power of the speed. This, however, comprehended complicated problems, and it therefore became desirable that some more direct method of deriving the required quantities should be adopted, and if possible by direct experiment. By subjecting to experiment the same or similar trains down different inclinations, different velocities would be attained, and these velocities would balance the different resistances due to such inclinations, and distinct data would be thus obtained, which being properly combined and compared, would show the friction and the atmospheric resistance separately. It was difficult, however, to find inclined planes precisely suited to this purpose, and the following experiments, combined with those on the Whiston Plane, were made for the purpose.

An inclined plane occurs on the Grand Junction Railway, descending from Madeley towards Crewe, the inclination of which is 1 in 177; four carriages were selected, and loaded so as to render the gross load equal to that of the four carriages with which the last three experiments were made on the Whiston Plane,—that is, their gross load amounted to 18 tons 1 cwt. These carriages were propelled by an engine to the summit of the Madeley Plane, and descended down it in the same manner, as was done with the carriages in the former experiments on the Whiston Plane. A uniform speed was in like manner obtained, which continued to the foot of the plane. In the first experiment this speed was 30, 4-10ths feet per second, and in the second 31, 4-10ths feet per second; the mean of the two being 30, 9-10ths feet per second, or 21 miles an hour. The force of 18 tons 1 cwt. down this plane being 228·4 lbs. it follows that this represents the resistance of such a train moving at 21 miles an hour. From this and the experiments down the Whiston Plane, two distinct data were obtained for the total resistance, including atmosphere and friction, viz. at 32½ miles an hour, the sum of the resistances was 421 lbs., and at 21 miles an hour it was 228½ lbs. By combining these results, a simple mathematical process gives us the resistance due to friction equal to one 433rd part of the weight, or 5·17 lbs. per ton; hence the total resistance due to friction for the coach train used in these experiments was 93½ lbs. and therefore the resistance due to the atmosphere moving at 32½ miles an hour was 329 lbs., and at 21 miles an hour 135 lbs.

From these experiments, therefore, it follows, that of the whole resistance which the moving power had to encounter in these experiments, when a speed of about 32 miles an hour is maintained, 22 per cent. only is due to friction, while 78 per cent. is due to atmospheric resistance.

Having thus ascertained that a comparatively small proportion of the whole resistance is due to friction, it ceased to be a matter of surprise that the methods of calculating the resistance of trains, based exclusively on the laws of friction, should give discordant and unsatisfactory results. Yet such methods are the only ones which appear to have been hitherto applied to this enquiry. By such methods the common estimates of from 7 to 9 pounds a ton from friction have been obtained, and as such estimates have been derived from carriages in motion, and without any allowance for atmospheric resistance, it is obvious that to whatever extent that resistance may have affected the calculations, to the same extent has the estimate of friction derived from them been augmented beyond the truth; and this will satisfactorily account for the amount of friction derived from the above calculations, which are independent of atmospheric resistance, being so considerably under the common estimate.

These comparative results were, however, obtained from one set of experiments only on each plane; and although they determine most conclusively, that a very considerable resistance arises from the effect of the atmosphere; yet I would not have it understood that the amount of friction, properly so called, as determined by these experiments, should be adopted as a standard; there can be no doubt that its precise amount is much less than the received opinion, but it would require further experiments, more in number, and more varied, to determine the amounts which should be adopted as a standard at different velocities and with different weight of trains.

The experiments on the comparative friction of the four and three feet wheels, and also those made to ascertain the resistance of the road, having been made by putting the carriages into considerable velocity, and allowing them to come to rest, the velocity was therefore variable, from the extreme motion to rest. As the atmospheric resistance varies as the square of the velocity, while the friction of attrition on the axles, and the resistance of the wheels on the rails are constant at all velocities it requires a complicated formula for calculating the amount of each separately, and it requires also a series of experiments to come to a correct conclusion.

As, however, that part of the resistance of carriages which depends upon the increase of the diameter of the wheels, has been, by the preceding experiment proved to be so extremely small in proportion to the entire resistance; and as the experiments with the three and four feet wheels were made upon waggons, (there not being both descriptions of wheel upon the passengers' carriages), I did not think it advisable to give results deduced from complicated formula, in this report; they are, however, given in the Appendix, Note S, together with the formula by Dr. Lardner, for calculating the resistance.

There can be no doubt, that the friction on the axles, and also the resistance of the wheels on the rails, will be diminished in the ratio of the diameter of the wheels; but on the other hand, if large wheels have the effect of presenting an increased frontage to the carriages, it is doubtful to what extent they are productive of a diminution of resistance, at high rates of speed:—with heavy loads at a slow rate of speed, there is no doubt that a reduction of friction will be effected by them, but our enquiries are with high rates of speed, and, therefore, until further experiments are made, it cannot be determined what the effect will be by an increase of diameter of the wheels.

The above reasons, likewise, preclude us from determining with perfect accuracy, the relative resistance of the Great Western rails, and those of other railways; the mode of conducting the experiments being the same as above stated, viz. of putting the carriages in motion and running them to rest. The atmospheric resistance being affected by a difference of the area of frontage of the carriages, and the carriages on railways of a narrow width having a less frontage than those of the Great Western, unless we could determine what effect the increased frontage had at all the varying velocities, we could not determine that part of the resistance which arises from the wheels upon the rails.

This is, indeed, more difficult than that of determining the relative resistance of wheels of different diameters, the experiments in the latter case, being made with carriages of the same construction, whereas in the former case, they made with carriages of a different construction.

It will be afterwards seen, that the rails of the Great Western Railway present a less rigid surface to the wheels than stone blocks, but about the same or rather less than wooden cross sleepers; and as it may be presumed, every other circumstance remaining the same, that the resistance opposed to the rolling of the wheels upon railroad, will be in some degree proportionate to the rigidity of the surface on which they roll, especially when the material composing the surface is the same; we may, therefore, conclude that the resistance opposed to the carriage wheels upon the Great Western Railway, will be about the same as that of a railway laid with cross sleepers, but greater than one constructed with stone blocks:—to what extent the present question is affected by this, will be afterwards considered.

We come now to the first part of the third proposition, viz. The comparative advantage, or firmness of base or road track, of the Great Western Railway, constructed with continuous timber bearings, with or without piles.

The only mode by which this could be determined in a satisfactory manner, appeared to me to be by direct experiment, by ascertaining the extent of deflection produced on the rails of the Great Western Railway by the passage of trains of known weights along them; and by making similar experiments on other railways differently constructed, thus to determine which of them were least affected by the passage of the load.

In an enquiry in 1835, as to the best description of rails and fastenings for the Liverpool and Manchester Railway, by Professor Barlow, he employed an instrument which he called a Deflectometer, to test the amount of deflection produced by the passage of the trains along rails of different descriptions. This instrument, however, only recorded the extreme or maximum deflection, and as in many cases jerks were produced by the lurching of the engine and carriages, which threw the vernier of the instrument upwards in a very distorted manner, the result was by no means so satisfactory as could be wished. He likewise only employed one instrument, consequently the observed deflections in the middle of the rail, being affected by the depression of the blocks supporting each end, the entire effect was not shewn.

It occurred to me that by improving the form of this instrument, and by applying the same apparatus which has been previously described as being used for the dynamometer, the motion of the arm of the deflectometer, or instrument showing the deflection of the rails, might be recorded, and we should then obtain a diagram of the deflections of the rails as the trains passed over them; and by employing three instruments at the same time, one at each point of bearing at the blocks, (or transoms of the continuous rails,) and one midway between the transoms, or in the middle of the rail, and having all these connected together, so as to record their action at the same time, we thus obtain correct diagrams of the deflections produced at each of these points as the train passes over.

By this plan we not only had produced diagrams, showing the actual amount of deflection of the rails and bearings; but we had exhibited upon paper, the nature of the action of the deflection produced, and consequently a correct outline of the effect of the passage of the trains on rails of different kinds.

On considering the subject of the deflection produced by the passage of the trains on a railroad, it will be readily conceived that the deflection vertically is not the only effect; if the rails are not perfectly perpendicular, and the rim of the wheel perfectly cylindrical, which in practice is seldom or ever the case; or, if the base of the block or timber bearing be not perfectly horizontal, supporting the load with equal firmness throughout the whole area of its base; when the incumbent weight comes upon the rail, there will be a certain extent of deflection horizontally, as well as vertically. On almost all railroads the periphery of the wheel is conical, and the rails are laid at such an angle as to correspond with the cone of the wheels; the line of pressure of the incumbent weight is not therefore vertical, but in a line at right angles to the cone of the wheel, and has of course a tendency to produce horizontal deflection, and this will also be further increased when the flanch of the wheel presses against the rail. The combined action of all these effects will be, a certain amount of deflection in the direction of the resultant of the several forces, considered in connection with the position of the base whereon the blocks or sleepers ultimately rest. The direction of the combined action of the incumbent weight upon so yielding a base, and liable to be affected by so many circumstances; must, it may be supposed, vary in almost every case, and, therefore, no instrument could be so placed as to indicate the resultant effect of these various motions.

The only mode of determining this appeared to be, the application of an instrument to measure the extent of horizontal deflection, in addition to that of the vertical deflection, when it will at once be seen that the two motions could be resolved into their resultant.

In a practical point of view, independently of being able to resolve the two motions into one, it appeared desirable to know the amount of horizontal, or lateral deflection, as well as that of vertical; a particular plan of construction of railway might exhibit very perfect results, as regarded the amount of vertical deflection, and yet be very inferior, as regarded the lateral motion, or horizontal deflection, and vice versa; the investigation could not, therefore, be complete without having developed the extent of each description of motion.

The mode of conducting the experiments was as follows :—

These instruments were first of all applied to the rails of the Great Western Railway, one instrument being placed opposite a single transom, another instrument opposite a double transom, and the third midway between the transoms. The trains were then run along the rails, at first with a slow motion and diagrams taken, the motion was gradually increased, and diagrams were again taken; several diagrams were thus taken at different parts of the line, with the rails in their working state. The piles were then detached from the transoms, by withdrawing the bolts, and diagrams taken in the same manner; next, the transoms were cut asunder, thereby allowing the longitudinal timbers to act independent of any support from the transoms or piles; and in some experiments, after the transoms were detached from the piles, they were cut asunder between the two lines of way, when they acted as cross sleepers between the timbers without piles, diagrams being taken in all these variety of cases.

The instruments were not, however, always placed in the positions above stated, they were varied, both as regarded the places where joints of the iron rails occurred, and also with respect to the joints of the timbers, as regarded their position with the joint of the rails. The experiments were likewise made on embankments and in cuttings; and also on the longitudinal timbers where no piles existed.

It was also found to be desirable to ascertain if any motion of the rail upon the timbers existed, and consequently diagrams were taken by applying the instruments successively to the rail, and to the timbers.

The next set of experiments were made upon the London and Birmingham Railyway, two of the instruments were here placed as near the chairs or points of support as possible, and the other midway between them. Diagrams were taken on 50lb. and 62lb. rails respectively; but the vertical deflection only, was taken on this railway, and on stone blocks.

Experiments were likewise made with the same instruments, on the Liverpool and Manchester Railway, of both horizontal and vertical deflection, on 60lb. rails with four feet bearings, and 75lb. rails with five feet bearings.

A more extended course of experiments were made on the Grand Junction Railway; on this line all the rails are of one weight and section, but they are placed in some parts of the road on stone blocks, on other parts of the line on cross wooden sleepers, and upon the Dutton Viaduct on longitudinal timbers. Diagrams were taken at varying rates of speed, of both horizontal and vertical deflection of rails supported by stone blocks, wooden cross sleepers, and longitudinal timber bearings respectively: the instruments were then applied to the chairs, and diagrams of the deflections of these taken, and lastly, they were applied to the blocks, sleepers, and timbers respectively, and diagrams taken of the depression produced by the passage of the trains on these different description of bearings.

The next railway on which experiments were made, was the Manchester, Bolton, and Bury; this railway is constructed partly of continuous stone blocks, but mostly of continuous timber bearings, with cross timber ties, or transoms, and without piles. It became, therefore, an object of great interest to ascertain the comparative effect upon the road by the passage of the trains, over continuous bearings on this line without piles, and on the Great Western Railway with piles. Experiments were therefore made, in every respect the same as those on the Great Western Railway, the instruments being applied successively to the rails and timbers, Upon the stone bearings resting upon masonry there was in fact no depression or yielding whatever, and therefore these diagrams, though taken, are not given in the book.

The following tables will show the vertical and horizontal deflection of the rails and timbers in the several varieties of application of the instruments, on the Great Western and other railways in parts of an inch :—

TABLE X.

GREAT WESTERN RAILWAY.

Engine.		*Coaches.*		*Instrument*	
Lateral.	*Vertical.*	*Lateral.*	*Vertical.*	*applied to.*	
·0102	·0991	·0083	·0697	Single transom	Piles Perfect.
·0232	·1669	·0293	·1477	Midway	
·0102	·1274	·0366	·0981	Double transom	
·0043	·1116	·0030	·0827	Single transom	Piles Cut.
·0136	·0894	·0111	·0616	Midway	
·0130	·0927	·0112	·0634	Double transom	
·0042	·1217	·0029	·0862	Single transom	Transom Cut.
·0068	·0918	·0051	·3579	Midway	
·0044	·1188	·0026	·0674	Double transom	

TABLE XI.

LONDON AND BIRMINGHAM RAILWAY.

50lbs. Fish-bellied Rails, 3 feet bearings on Blocks.

Instrument applied to the Rail at

	Single Chair.		Midway.		Joint Chair.	
	Engine.	Coaches.	Engine.	Coaches.	Engine.	Coaches.
Vertical.	·0283	·0133	·0522	·0362	·0638	·0488
	60lbs. Rails, 3·75 bearings on Blocks.					
ditto	·0492	·0266	·0633	·0344	·0372	·0273

TABLE XII.

LIVERPOOL AND MANCHESTER RAILWAY.

62lbs. Parallel Rails, and 3 feet bearings on Blocks.

Instruments applied to Rails at

	Single Chair.		Midway.		Joint Chair.	
	Engines.	Coaches.	Engine.	Coaches.	Engine.	Coaches.
Vertical.	·0676	·0501	·0743	·0415	·0445	·0249
ditto	....	....	·0210	·0197	....	....

TABLE XIII.

MANCHESTER AND BOLTON RAILWAY.

Instruments applied to Timber at

	Transome.		Midway		Joint Midway.	
	Engine.	Coaches.	Engine.	Coaches.	Engine.	Coaches.
Vertical.	·0980	·0630	·0699	.0440	·0661	·0641
	Instruments applied to Rails.					
ditto	·1007	·0661	·0587	·0331	·1310	·1604

TABLE XIV.

GRAND JUNCTION RAILWAY.

Rails of 65lbs. four feet bearings.

Engine.		Coaches.		Instrument	
Lateral.	Vertical.	Lateral.	Vertical.	applied to	
·0111	·0478	·0078	·0259	Single chair	Rails on Stone Blocks.
·0212	·0641	·0122	·0344	Midway	
·0150	·1366	·0096	·0906	Single Chair	Rails on Cross Sleepers.
·0226	·1307	·0144	·0855	Midway	
.....	·2161	.....	·1327	Joint Chair	
·0200	·0283	·0135	·0149	Chairs on Blocks	
·0112	·1095	·0070	·0717	Chairs on Sleepers.	
·0053	·0223	·0007	·0174	Blocks	
·0125	·0821	·0080	·0511	Sleepers	
·0247	·1105	·0170	·0688	Rails midway from Chair	Dutton Viaduct on Longitudinal Timbers.
·0350	.....	·0272	.....	Rails at Joint Chair	
·0387	·0823	·0265	·0570	Chairs	
.....	·0808	.....	·0633	Timbers at Chairs	
·0139	·0574	·0099	·0494	Ditto Midway	

On an attentive examination of the results of these experiments, as exhibited by the preceding tables, but more particularly on examining the diagrams themselves, and the measurement of each, it will be seen that stone blocks (except in some cases where they were not properly seated), afford decidedly the firmest, and most unyielding base; that there is not much difference in the firmness of base between cross timber bearings, and continuous timber bearings without piles, as exhibited on the Grand Junction, and Manchester, Bolton and Bury Railways; but that there is a greater variety in the results of the different experiments in cross sleepers than in continuous bearings.

It will likewise be seen, that on isolated supports there is a greater amount of deflection shown in the rails than in the chairs; and still less deflection in the blocks and wooden sleepers than either the chairs or rails. The inference from this is, that the rails in these cases were not firmly fixed down to the chairs; and also that the chairs were not immoveably secured to the blocks and sleepers; and as the experiments comprehend a great many cases, it may be presumed that such is the case generally on isolated bearings.

On the Manchester and Bolton Railway, the joints of the rails rest on flat chairs, the rails being on either parts of their length fixed to the timber bearings with iron clamps; here also we find a considerable yielding of the rails upon the timbers, the latter showing less deflection than when the instruments were applied to the rails.

The experiments on the Great Western Railway, shew in the table a less difference of deflection between the rails and the timbers, than any of the modes of fastening either on isolated supports or on the continuous bearings of the Manchester and Bolton Railway; and hence we may conclude, that the mode of fastening the rails to the timbers on that railway by screws, effects a firmer junction than any of the other modes of fastening. On examining the table it will be seen that notwithstanding the assistance of the piles, the diagrams show a greater amount of deflection of the timber bearings of the Great Western Railway than the stone blocks, and quite as much as the continuous bearings without piles; the firmness of base as shown by these experiments, is, therefore, less than with stone blocks, and not greater than with continuous bearings, without piles, but less than cross isolated timber bearings. It must, however, be remarked, that these tables show the deflection on the Great Western Railway, with engines and carriages much heavier than those used in taking the deflections on the other railways of the ordinary width; and although they exhibit the comparative deflections produced by the passage of the trains, according to the respective systems of working the railways at present in use, and which may be considered as the practical result of the effect of the trains on the rails; still, if we wish to know the actual comparative firmness of base, we must take into account the relative incumbent weights of the respective trains. I have not yet been able to obtain the pressure upon the rails of the Great Western Railway by the engines, there being no weighing machines on that railroad by which this could be ascertained, when these weights are known, the comparison can then be made with the engines; the weight of the carriages are known, and the comparison can therefore be made with them. The weight on each wheel of the Great Western Railway carriages may be taken at about 1·5 tons, and of the carriages on the other railways at 1·125 tons; and consequently the deflections have been produced with incumbent weights, in the proportion of 4 : 3.

We come now to the effect which the piles have upon the firmness of base of the continuous timbers on the Great Western Railway; the reasons assigned by Mr. Brunel for adopting piles was, for the purpose of securing and holding the timbers down to the ground with much greater force than merely the weight of the timber itself, and thereby to effect a closer contact between the timber and the ground. It became, therefore, necessary to ascertain whether the timbers were held down to the ground, or if they were supported by the piles. To accomplish this, the instruments were first of all applied to the rails with the piles in action, or without being disturbed, and the deflections taken; the transoms were then divided near to the timbers, or between the timbers and the piles, the instruments remaining applied to the rails, and the effect produced by the separation of the timbers from the transoms was thus obtained; in almost all, if not in every case, the timbers fell, on the transoms being divided, showing that the action of the piles was not to hold down, but to support the timbers. This was also shown very conclusively in the effect exhibited by the diagrams taken, before and after the transoms were divided;—the first diagram taken after the transoms were divided, showed a greater amount of deflection from the original line of the rails, than when the piles were in action; it was found, however, that the rails did not rise to their original level, but that, in fact, a permanent depression to a certain extent had taken place;—in continuing the experiments the deflection became less, showing quite decisively, that the timbers were supported by the piles, and that they were not in fact in such close contact with the ground when attached to, as they were after being detached from, the piles. This was the result in every instance. Most of the diagrams were taken upon that part of the line near to Paddington which had been recently packed, and being clayey ground presented a wet and spongy base, and the packing was not so perfect as in some other parts of the line; the extent of the deflections on this part should therefore be taken as being more unfavourable than an average result; but on applying the instruments to a part of the line, selected as being in the best order, the same relative results were exhibited; the timbers dropped on their division from the transoms and piles, and it was found that the amount of deflection was less after the piles were detached than before, after the train had run along the rails for a few times.

Some part of the Great Western Railway is laid with continuous timbers, without piles; an experiment was made upon this, where the ground was not the most favourable, or similar to that where the diagrams were generally taken with piles, and deflections similar to the above were obtained;—an experiment was however made, and several diagrams taken, upon an embankment with timbers without piles; when the result was an amount of deflection much less than that where the piles were in action, and very little, if at all, inferior to that of stone blocks, taking into account the difference of the insist[?] weight. At this place, however, the scantling of the timbers was greater than ordinary, being ten inches in depth, the general depth being six to seven inches.

The experiments on the Manchester and Bolton Railway, it will be seen, exhibit a considerable amount of deflection, quite as much, if not greater, than that of the Great Western generally, taking into account every circumstance of the scantling of timbers, section of rails, and weight of the engine and trains.

The result of the whole of these experiments is, that stone blocks afford the firmest base; and that there does not exist any material difference of deflection between longitudinal timber bearings with a continuous rail, and cross timbers with isolated supports; the difference, if any, being in favour of continuous bearings.

The previous observations apply to the vertical deflection only, during the progress of the experiments on all rails resting on chairs, it was found that in a great many cases the rail was deflected inwards, the great majority of cases, however, being outwards; it has been, therefore, extremely difficult to reduce the results into a tabular form, some of the diagrams exhibiting both inward and outward deflection in the same experiment. The cone of the wheel having a tendency to press the rail outwards, and also the action of the flange having the same tendency, it is quite clear that when the deflection is inwards, it must be the result of some accidental cause; a want of solidity of the base of the blocks or sleepers on the inner edge, or from the rail not bearing horizontally in the chair, or at the proper inclination to the cone of the wheels. Upon the Great Western Railway, the horizontal deflection was invariably outwards, and this is no doubt owing to the particular construction of that road admitting of a more perfect and permanent adaptation of the rail to the cone of the wheels. Want of time precludes me from going into the particular results, exhibited by these experiments on horizontal deflection; the general result, however, appears to be, that they assimilate very nearly to the vertical deflections, both in their nature and extent, on the different descriptions of bearings.

The remaining part of this inquiry is the latter part of the third proposition, viz.; whether a greater steadiness and smoothness of motion is produced to the carriages, and to what extent, on the Great Western Railway, by the increased width of gauge.

The solution of this question also appeared capable of being subjected to the test of experiment, although not without considerable difficulty. The motion of carriages on railways being the effect of so many distinct causes, it was extremely difficult to contrive an instrument to detect and record each motion separately.

For instance, any sinking of the blocks, or supports of the rails, or the deflection of the rails themselves, produce a corresponding depression of the wheels of the carriages on that side where such yielding takes place;—the subsidence or shrinking of the base, or formation level of the railway, generally produces also an inequality of level on the two sides of the railway; and these variations of level between one side and the other, tend to produce a continual rocking motion in the carriages transversely, which is aggravated more or less in proportion to the frequency and extent of these inequalities of level of the two sides of the railway. The same causes, viz. the inequalities of level, likewise produces a pitching or undulating motion, longitudinally; and those two motions combined, the undulatory motion in the direction the carriages are travelling, and the rocking motion traversely, produce a vertical motion. Any change likewise in the direction of the road, throws the carriage wheels from a straight line against the interior side of the curve, and thus produces a lateral motion of the carriages, and when the curve again changes, or the line of direction becomes straight, the wheels are thrown to the opposite side of the rails. The difference of level between the rails on the two sides of the railway, besides producing a rocking motion transversely, causes the carriages to vibrate from side to side, in proportion to the extent of the inequality of the level; the depression in the first instance causing the carriages to fall towards that side of the road, and the flanch of the wheel to press against the rail, the conical form of the wheel immediately throws it off towards the opposite side; and we thus have a continual contest between the gravitation occasioned by the difference of level between the two sides of the railway, and the line of direction incidental to the conical action of the wheel:—As these effects are continually in action, we hence find that the lateral oscillatory motion is the most predominant of all the varieties of motion which occur on railways; and when a very high rate of speed is attempted, this lateral motion is very considerably increased, so much so that in extremely high rates of speed a sort of swinging lateral motion is produced, the carriage wheels on each side being thrown alternately back and forwards against the sides of the rails:—probably from the cone of the wheels, not having time, in extremely rapid velocities, to accommodate itself to the proper line of direction.

Considering, therefore, the variety of motions in action at the same time in railway carriages, the different causes by which these are produced, and the numerous adventitious circumstances operating to increase, modify, or counteract them, it is not to be wondered that a difference of opinion should exist in the public mind generally, as to the relative smoothness of motion of railway carriages on different railroads;—an increase of a few miles per hour in the velocity, not perceptible to a traveller, will make a considerable variation in the motion;—the number and nature of the curves;—a difference in the construction of the carriages;—the position of a carriage in the train;—or even different bodies of the same carriage, all tend to influence the aggregate amount of motion in a railway carriage; and few, if any, of the causes whereby these different motions are produced, are sensible to the observation of a passenger, at least to the great majority of passengers; they judge from the quantity of motion, without reference to the causes, and hence the difference of opinion, which has arisen as to the comparative smoothness of motion on some of the existing railways.

To the most attentive observer, knowing all the causes which produce these variety of motions, it would be extremely difficult, if not impossible, to judge from observation of the relative smoothness of motion, or at any rate of that which properly belongs, or has reference to, the construction of the railway.

These circumstances, therefore, rendered it almost absolutely necessary to subject this part of the inquiry to experiment, it not appearing possible to arrive at any conclusive determination by common observation; and after considerable difficulty a set of instruments were contrived, which subjected all the different motions of railway carriages to experiment, and which produced diagrams of all the oscillations of the carriages from one end of the line to the other.

The different kinds of motion produced on railway carriages may therefore be comprised within the following heads, viz.:—

1st. A rocking motion transversely, produced by the inequalities of the level of the two sides of the railway.

2nd. A pitching or vertical motion, in the centre of the carriages, being the combined action of the alternate rocking motion of the two sides of the carriages, produced by the undulations of the road.

3rd. A lateral, or oscillatory motion horizontally, produced also by the inequalities of the road, and the other causes previously enumerated, throwing the carriage wheels from side to side against the rails. * * *

Having thus, agreeably to your instructions, and to the extent to which the time and opportunities afforded has enabled me to accomplish, investigated by experimental data and inquiries all the properties of the system of construction and working of the Great Western Railway, I now beg to lay before you the conclusions which appear to me to be the result of these investigations. I think it my duty however, in this place, to represent to you that I have not been able, in drawing out this report, to avail myself fully of the vast mass of valuable information elicited in the course of this inquiry, owing to the short period, (only six days,) between finishing the experiments and being required that the report should be printed; and I trust that this will be a sufficient excuse for the imperfect manner in which it is presented to your notice; at the same time, I beg to add, that I have in the short period allowed to me, availed myself of every fact or discovery of a practical nature, which appeared to me to bear upon the question, or to be in any way conducive towards your interests. I have, in the appendix, given in detail all the experiments which I thought would be of any utility, and from which, at any subsequent period, the valuable information contained therein may be extracted and investigated; and it occurred to me to be very important that these documents should be given in such a manner and in such detail, that it should be in the power of yourselves or your engineer at any time, to examine into and compare the conclusions which I have arrived at, and which appear to me to result from these experiments, with the experiments and investigations themselves.

Width of Gauge.—Pursuing the same arrangement as set out with in the first part of this report, I shall now consider in what manner, and to what extent, the results of these investigations and experiments bear upon the reasons which induced the adoption of the increased width of gauge, and the particular construction of the Great Western Railway.

The first is the attainment of a high rate of speed. The experiments on the power of the locomotive engines show, that the engines at present employed on the London and Birmingham Railway accomplish an average rate of speed of 32 miles an hour, with weights equal to that of a first-class train, (Table III.); but that engines in the proportion of 263 : 165, more powerful than these, are in existence on the same width of railway. The less powerful engines accomplish a rate of speed within three miles an hour of the most powerful engines on the Great Western Railway, (Table V.); and, therefore, the presumption is, that if the more powerful engines on the ordinary railways had been tried, they would have accomplished a higher average rate of speed than the most powerful engines on the Great Western Railway, the effective power apparently yielded by the former being much greater than the latter. But we now find that a cause exists which perfectly accounts for this comparative diminution of effect, and that it is, in fact, if not almost entirely, attributable to the greater atmospheric frontage of the Great Western Railway carriages, than those upon the London and Birmingham Railway, and the powerful effect which the atmosphere has upon the resistance to be overcome.

The experiments on atmospheric resistance being as yet confined to the carriages of the narrow gauge, we cannot satisfactorily determine what the precise increase of resistance will be by an enlarged frontage; the carriages of the Great Western Railway are 10 feet high from the rails, and 9 feet wide = 90 square feet, whereas the London and Birmingham Railway carriages are only 9 feet high and 6¾ feet wide = 60 square feet; but an open space exists below the wheels, which is only partly filled up by the fire-box of the engine; taking, in each case, a foot from the rails to be clear space, the relative area of frontage will be 81 : 53. Every circumstance being the same, we may suppose that the atmospheric resistance will be as the area of frontage, but the figure of the engine preceding the carriages, the comparative length of the train, and several other circumstances, may affect the result; and, therefore, until the question has been satisfactorily determined by experiment, no comparative standard can be assigned of the relative amount of atmospheric resistance to trains of different areas of frontage.

For these reasons, therefore, I shall not go into an analysis of the presumed resistance of the Great Western trains, as compared with those of the London and Birmingham Railway; for the same reasons, likewise, it will at once appear to be impracticable, with the data we are at present in possession of, to determine with any degree of accuracy the comparative advantage of large and smaller driving wheels to the engines;—the incontrovertible conclusion, that a very large proportion indeed of the resistance of railway trains is attributable to atmospherical resistance, is quite sufficient to account for all the differences of results between the engines on the two descriptions of railways; but to what extent, and what portion is attributable to atmospherical resistance, what part to the engines, and what portion to the carriages, varying as both engines and carriages do, in the diameter of their wheels, cannot be conclusively determined at present.

There can be little doubt that the atmospherical resistance varies at least in the ratio of the square of the velocity; considering, therefore, this rapid increase of resistance, it appears to me, that no other conclusion can result from these experiments, than that it is not advisable to attempt an extreme rate of speed, and that 35 miles an hour, with the existing engine powers, may be considered as the limit of practical speed for passenger trains; combining economy with regularity of transit, and giving due weight to the necessity of accommodating the public, as regards celerity of travelling, to the utmost practicable extent.

If such a conclusion is warranted by these investigations and experiments, then it results that it is not necessary for the attainment of such a rate of speed, that the gauge should be seven feet.

The next proposition is the mechanical advantage of increasing the diameter of the wheels, without raising the bodies of the carriages. We see that there is a diminution of friction by the increase of the diameter of the wheels, but it is doubtful to what extent this is modified by elevating the bodies of the carriages; a broad gauge by allowing the bodies of the carriages to be placed within the wheels, and thus to reduce the height of the carriages, and consequently diminish the area of frontage, is an advantage, considering the great amount of resistance arising from the atmosphere. Then to carry out the premises fully in this respect, we must not give any greater width of frontage than is absolutely necessary for that purpose; it will depend upon the result of further inquiries, as to what superficies in terms of length and width of train affords the requisite accommodation, and presents the least resistance to the atmosphere, which has not been yet determined.

The next proposition, that the increased width of gauge admits all sorts of carriages, stage coaches, &c., to be carried within the wheels, is readily answered; any width of gauge which reduces the height of these carriages above the rails, will be preferable to that width which does not admit of such an arrangement; and the ordinary width, not admitting them within the wheels, renders an increased width, in this respect, advisable, this can, however, be effected with a less width than seven feet.

Increased facilities for the adoption of larger and more powerful engines, for the attainment of a higher rate of speed, has been answered previously; it not appearing necessary for such a purpose that the width should be seven feet. The remaining proposition is, that a wider gauge affords increased stability to the carriages, and, consequently, increased steadiness of motion. The diagrams given will shew how far this has been effected on the present portion of the Great Western Railway, and certainly these documents would prove that this has not yet been accomplished. Considering, however, the causes of the different motions of railway carriages, there can be no doubt, that an increased width of gauge must tend to produce that effect. In the present instance this has been counteracted by the construction and present condition of the road and carriages; and therefore it appears to me the only conclusion we can come to is, that in similarly constructed railways the wider gauge will afford greater stability and steadiness of motion to the carriages.

The objections alleged against the increased width, as detailed in page 8 of this report, no doubt exist to a certain extent: the expense of forming the road track of the railway is increased. This Mr. Brunel estimates at 151,840*l*. for the entire line. The carriages are larger and heavier, and so far, therefore, as the weight acting upon the rails may be objectionable, must be admitted; but I find that Mr. Brunel's statement of the relative weight, per passenger, given in his report at the last meeting of the shareholders (vide Journal No. 12, page 324, vol. 1), confirmed by my enquiries, which shows that there does not exist a greater weight, per passenger, with the Great Western than with other carriages.

The increase of friction in passing the curves does not apply with much weight in your case, the radius of these being so great. The comparative expense of construction of the engines and carriages are not matters of great moment, as there would not be any material difference if the engines were similarly constructed; and the amount, per passenger, is nearly the same with the carriages. The next objection, that it prevents a junction with other lines, does not apply with such force to the Great Western Railway, as it would to some other lines; that railway being complete of itself between the two sides of the island. How far this may be affected by the branches, I am not capable of judging, it being more a commercial than an engineering question; and an opinion could only be satisfactorily given, by an intimate acquaintance with all the circumstances attending the required communication with the adjacent country.

The last objection, that there are no advantages gained commensurate with the increased expense and inconvenience of such a departure, and connection from railways of the ordinary width, does appear from a full consideration to be substantially confirmed; at the same time I must be allowed to say, that there are counteracting advantages, incidental to an increased width of gauge, above that of 56 inches, which should not be overlooked.

Almost all the results arising from these enquiries go to establish a conclusion, that 7 feet is beyond that width which may be considered the best; but these investigations are far from conclusive, in the present state of our information, as to what other width is, under all circumstances, the most advisable to be adopted. Under these circumstances, and considering the great sacrifice of property which would result by the removal of the present rails, and the substitution of any other width; it appears to me that such a step would not be justified by the result of these enquiries. We have only determined one part of the proposition, viz., that seven feet is too great a width; we have not determined the most important section, to what injurious extent it will operate practically. The only results bearing upon this is the increased power required by the enlarged width, and that is in some respects shewn by the increased consumption of coke; which, as per table V., appears to be with the North Star, 21½lbs. per mile, and with the Æolus, 8¼lbs. per mile additional, the former, however, effecting an increased rate of speed of two miles an hour. It is also necessary to state, that the results elicited in the course of this enquiry shew, that considerable modifications may be beneficially made in both engines and carriages; and, therefore, until we have determined, in the most satisfactory and conclusive manner, the precise extent of injury arising from the retention of the present width of gauge, and what width best effects all the objects required, and which, under all the circumstances, is most conducive to the interests of the company, and affords the greatest accommodation to the public, it appears to me the present width should be retained.

Construction of the Road.—The question of the construction of the road comes next under consideration, and here, I presume, there will be less difficulty than in determining on the width of gauge. No doubt can exist, after these experiments, that the piles do not contribute to the firmness of base of the railway, their action seems to prevent the contact of the timbers with the ground; and it is unquestionably proved, that the passage of the engines and carriages along the rails, contributes, with a more powerful effect, to consolidate the road, and produce a greater firmness of bearing to the rails, than the packing connected with the piles.

The principle of having at the end of every 15 feet, viz. at the transoms, a comparatively unyielding bearing, with a scantling of timber intervening very far short of the requisite strength to support the weight of the engines and trains, renders it extremely difficult, if not impossible, to produce a uniform rigidity of surface throughout; and this uniformity cannot be effected by any system of packing, dependent upon manual labour. If continuous bearings are preferable to isolated supports, it appears to me that the most economical, and most perfect plan of construction of continuous timber bearings, is with common transoms; and that a more uniform and firm base will be obtained, by depending on the weight of the trains to ultimately consolidate the base of the timbers, than upon any system of piling, presuming always, that a proper and firm base is prepared in the first instance.

The next consideration is, whether continuous timbers or isolated bearings are preferable; the experiments on deflection show that there is a greater amount of deflection on the continuous timber bearings on both the Great Western and the Manchester and Bolton Railways, than on stone blocks on the other railways; the latter will consequently afford the least resistance to the carriages; and the weight of the stone blocks intercepting to a considerable extent the impact of the trains, they afford a permanently firmer base. We have seen, however, that in high rates of speed, the resistance of the road itself is small, compared with the aggregate resistance; and, therefore, if continuous timber bearings are preferable in other respects, a little additional friction cannot be of very great importance.

There is no doubt that timber bearings produce less noise in the carriages: and it has been urged with considerable force, that the wear and tear of the engines and carriages are less than with stone blocks. I have endeavoured to ascertain this, which is a very important consideration; but the returns of the expenses of the different railways do not, in my opinion, produce conclusive evidence on this part of the subject. The impression produced in my mind by the information obtained, however, is, that with longitudinal timber bearings of adequate rigidity and strength, the injury to the engine and carriages will be less than with stone blocks. The case of the Dublin and Kingstown Railway has been often quoted, as exhibiting an instance of the great destruction to the engine and carriages, and road itself, by the use of stone blocks; and the cross wooden sleepers in Chat Moss, and the American railways, as instances of the utility and cheapness of keeping in repair, the timber bearings. Every engineer, however, knows that the Dublin and Kingstown rails were much too weak for the stone blocks on which they were placed; and the inferior rate of speed on the American railways affords no criterion whereby to compare with the effect of stone blocks in this country, where a much higher rate of speed is practised,—the peculiarity of base of Chat Moss likewise, does not admit of any comparison with stone blocks on a firm foundation. Notwithstanding this I am inclined to think, that the wear and tear of the carriages and engine upon timber bearings of a proper strength will be less than upon stone blocks;—of the comparative durability no definite comparison can yet be made.

These experiments, however, show that the present scantling of timber on both the Great Western and the Manchester and Bolton Railways, are much too small for the loads which come upon them; and that they do not present a sufficiently rigid and unyielding base for a railway. One set of experiments (No. 7, Part I. Book A.), on the Great Western Railway, on the continuous timbers without piles gave very satisfactory results, but here the scantling of the timber was 10 inches; it appears to me, therefore, that if continuous timber bearings are used, they should be of a scantling of timber greater than that at present in use; and it appears, also, that a more rigid section, and greater weight of rail should be adopted.

This will, no doubt, make the continuous timber bearings more expensive than stone blocks, against which we have less noise, and a smoother, and a more perfect road for high rates of speed; sufficiently strong continuous timbers present, in fact, a more perfect, but a more expensive line of road than stone blocks;—of the comparative durability no satisfactory conclusion can be drawn. At a lower rate of speed, and where economy is an object, stone blocks being cheaper, will be preferable.

I have not in this comparison noticed cross timber sleepers, as compared with continuous timber bearings; as temporary roads, during the consolidation of embankments, the cross sleepers will be preferable; but the result of the experiments on deflection show, that there is not only a very considerable yielding of the timbers, but that there is likewise an imperfect fastening between the chairs and sleepers, which cannot be remedied without increased expense and difficulty; this road is much cheaper than either adequately strong continuous timbers, or stone blocks, but it is less perfect, and cannot be considered as a permanent description of road.

With respect to that part of your request, which relates to the examination of the Maidenhead Bridge; while on the works in September last I minutely examined the state of the arches and the plan of construction;—the cause of its failure appeared to me to have been occasioned by the centering being prematurely drawn, and before the cement was perfectly hardened and had taken a set in the interior of the brickwork forming the ring of the arch. Mr. Brunel at that time pointed out to me the remedies which he proposed to repair the defects, in which I concurred, and those I understand have not yet been completed.

In conclusion, I trust that the magnitude and variety of the objects, and the great and imposing interests embraced in this inquiry, added to the great responsibility attached to the investigation, will be a sufficient excuse for the protracted time occupied in making the experiments; and I trust, also, that these reasons, together with the unexpected and important results which have arisen out of these inquiries, will be deemed by you and the shareholders at large, to be a sufficient apology for the delay which you have experienced in not receiving this report at the time originally contemplated; to comply with which, to the utmost extent in my power, must also be my apology for the imperfect manner in which this document is presented to your notice.

I am, Gentlemen,

Your most obedient servant,

NICHOLAS WOOD.

REPORT OF I. K. BRUNEL, ESQ.

TO THE DIRECTORS OF THE GREAT WESTERN RAILWAY COMPANY.

Gentlemen,—I have now before me the report of Mr. Wood, the latter part of which I received only on the 17th. The appendix, without which, for all purposes of investigation, the report is incomplete, I have not yet received.

Considering the great mass of valuable matter contained in this report in the shape of numerous experiments, of calculations founded upon them, and the discussion and examination of the results and their consequences, the collection and consideration of which have occupied several persons for about three months, it will not surprise you that I should find a few days a very short period in which to make myself sufficiently master of its contents to be able to lay before you my observations thereon.

The extremely short time which circumstances allow me will prevent my entering into a detailed examination of the various tables of experiments which appear in the body of the report, or, in fact, doing more than refer to the principal points and those general results which appear to have mainly influenced Mr. Wood's opinions. Fortunately, the clear and methodical manner in which these various results are arranged, and the fair and impartial way in which they are treated, will render this an easy and comparatively an agreeable task, and will enable me to select such points as I consider most important, and to separate such facts and conclusions as relate to these particular points.

The satisfaction which I feel in approaching a subject, when treated in this manner, is, however, very much diminished by one source of great regret; and if in the course of the following observations I should have occasion to differ from Mr. Wood, either in the view he takes of the reliance to be placed on, or the consequences resulting from, any particular experiment, I ascribe this difference of opinion almost entirely to the cause which I shall refer to.

I think it is deeply to be regretted that Mr. Wood should not have been able himself to have attended to and conducted all the experiments. I do not mean to imply the slightest doubt of the accuracy of the records of the facts as they were observed; but that constitutes but a small part of the duty of collecting evidence upon doubtful points, particularly when they relate to questions of mechanics and science, which may be affected by a great variety of causes, and where the results may be influenced and entirely changed by the manner in which they are obtained.

It is certainly my opinion, that had Mr. Wood personally superintended the experiments; had he brought his own practical knowledge of the subject to bear upon them; he would have discovered many operating and interfering causes, which either would have led him to repeat his experiments by other methods, or to explain apparent anomalies, and thus, in my opinion, upon many of the most important points to come to very different conclusions. But more especially do I think his opinions would have been changed upon all those points which are necessarily capable of alteration and amendment by the knowledge and experience daily gained in the working of a system new in many of its details; and that before he drew definite conclusions, founded, inevitably, upon very imperfect data, he would have made a larger allowance for that progressive improvement which practice, observation, and experience, never fail to produce.

To no part of the system do these remarks apply more strongly than to that of the performance of the locomotive engines, and the question of the practicability of attaining high speeds; and as almost the only conclusions arrived at in the report upon which I think it necessary to epxress any material difference of opinion, are founded entirely upon the results of experiments made to determine these points, I shall apply myself principally to the consideration of them, and the experiments by which they were obtained.

In order to show that I am not attaching undue importance to any one part of the report, or to any one section of the experiments, I shall refer briefly o the general arrangement of the report, and to the order in which the conclusions are arrived at.

After stating the general questions to be treated, and the advantages and objections which have been urged for and against the plans which have been adopted on this railway, Mr. Wood arranges under three principal heads the points to be determined by experiments, viz.:—

"1st. The question of the attainment of a higher rate of speed than on other railways; whether the increased width of gauge is, or is not, either necessary or best adapted for the accomplishment of this object, and to what extent.

"2nd. The mechanical advantage or diminution of friction, by being enabled to increase the diameter of the wheels without raising the bodies of the carriages; and in what respect, and to what extent, the friction or resistance of the carriages is affected by, or bears upon, the peculiar construction of the road.

"3rd. The comparative advantage or firmness of base, or road track, of the Great Western Railway, with continuous timber bearings, either with or without piles, and if it does or does not produce a greater steadiness and smoothness of motion to the carriages, and to what extent.

"These were the questions," the report continues, "which it appeared to me could not be determined in any other way than by experiment, but which appeared to be capable of solution by that method, and which likewise appeared to constitute the foundation of the entire system."

The first division consists of summaries of experiments, the details of which are to be given in an appendix, and of observations upon the performance of the Great Western engines, as compared with those of other railways, and the comparative performance of all at different velocities. These constitute the first section, and occupy the report to page 63. From thence to page 65 of the report is devoted principally to some experiments made upon the resistance of the air to the moving train, with a view to account for, and to ascertain the causes of, the results apparently obtained in the experiments recorded in the preceding section. The third section, from pages 65 to 68, is devoted to the investigation of the stability of the rails and carriages. The remainder of the report is occupied with the conclusions arrived at, founded upon the preceding observations and results.

As regards the construction of the road, to which the third section principally relates, Mr. Wood appears to be of opinion, that for high speeds, continuous longitudinal bearings of timber form a good road, and that the mode adopted on the Great Western Railway of securing the rail to the timber is good; but that the system of piling is bad, and that the weight of rail and scantling of timber hitherto adopted on the portion of the line completed, are insufficient. All this is in perfect accordance with the plans proposed for the future construction of the road. A rail considerably stiffer and longitudinal timber of greater scantling are prepared, and a plan has been recommended to you and approved of, in which the use of the piles is abandoned. Though I do not, therefore, differ from Mr. Wood in his results, I think it right to say here, as regards the experiments themselves which are recorded, that those upon the deflection of the rails of the Great Western Railway necessarily give a much less favourable result than would have been obtained had an average been taken of experiments over the whole line: these experiments have been confined almost exclusively to a short space of about two miles in the clay cuttings in the neighbourhood of Paddington, where we have always met with the greatest difficulties, and which is undoubtedly the worst part of the road. I conclude that this was accidental, and that want of time alone has prevented further experiments being made; nevertheless, the results must not be taken as a correct average of the line. As regards those upon the comparative smoothness of the carriages, I am bound to say that I doubt the accuracy of the instruments. I always maintained that they were not correct in principle, and were quite capable of indicating greater movements in an easy carriage or on a good road, than in a rough carriage or on a bad road, if the motion of the former should happen to coincide with the natural motion of the instrument; or, if the former should be of a character to which the instrument, from its construction, might be more susceptible. If the instrument were good as a comparative measure, it would, of course, in each experiment, indicate the rough and smooth portions of our line. Now certainly, according to the Table 15, there are no indications which would enable us to point out correctly these different parts of our line, although they are distinctly perceptible to the traveller, and well known to us. And, upon turning to the Table, and the corresponding portions of the line referred to, I find, from an exact knowledge of every part of it, that the numbers indicate rather the reverse of the fact, giving the lowest amount between the second and seventh miles, which is a bad part, and the highest between the seventh and fifteenth, where the road is good. It is not, however, upon this discordance in the results that I found my objection to the instruments used. They might have been correct, whilst the instrument was faulty. But considering the principles upon which they were constructed to be unsound, and as I do not hence attach much importance to the results, I only now allude to them, to prevent my silence being misunderstood.

But, in the absence of an accurate instrument, the public are perhaps most competent to determine whether, on the whole, they find the travelling on the Great Western Railway as comfortable, and the motion as easy, even at present, as upon other lines; and this, notwithstanding the shorter time our road has been opened, the greater speed of our engines, and that as yet we work under all the disadvantages of new tools (carriages and road inclusive), in which experience is absolutely necessary to adapt the various parts to each other. Unless, indeed, instruments are contrived which shall separate the different sources of motion, and measure them accurately, they will hardly afford as correct information as the mere sensations of a careful observer.

Upon the question of the assumed amount of resistance from the air, as deduced from experiments made upon that part of the Liverpool and Manchester Railway called Whiston inclined plane, if, practically, the high speed be it attainable, as I will prove it to be without the extravagant consumption of fuel which was supposed to be unavoidable, it is perhaps unnecessary to occupy your time at present with an inquiry into the subject. But as it has been looked upon as the discovery of a new cause brought into operation, from which we are to apprehend new and hitherto unexpected results, I must say a few words upon it. The resistance to a body moving through the air has long been known, and although perhaps not with perfect accuracy, yet tables giving a near approximation were made and published sixty or seventy years ago, by Smeaton, (Phil. Trans. 51st vol.,) as well as by other eminent men, and are now to be found in most elementary works.

Any calculations founded upon these Tables shew that resistance of the atmosphere is very considerable, and varies in some ratio approaching to that of the squares of the velocities. I have long since, and frequently, made such calculations, which I believe, if judiciously made, would give more correct results, though not nearly so large as the experiments before us; they would at least be free from several very serious sources of error.

That there must have been some great sources of error is evident from the striking discrepancies between the result of the experiment on the Whiston plane and every day's experience upon it. The passenger train, in descending this plane, with the steam shut off the engine, which then causes some considerable resistance, frequently acquires a very high velocity, exceeding forty miles rather than thirty miles per hour, and requiring the use of the break. This I have seen occur without any favouring wind, while in the experiments, notwithstanding the assistance of a breeze, the carriages did not acquire a velocity of more than 32½ miles per hour. Although this is so contradictory, there is nothing really inconsistent with the full operation of resistance of the atmosphere, but merely an evident indication of the circumstances being quite dissimilar in the experiment from those which occur in actual practice. Again; in the experiments themselves, a circumstance is mentioned which destroys the apparent agreement between the result and the theory, and which would prove that the resistance of the atmosphere is even much greater than is stated, and in fact makes it so excessive, and so different from the result obtained from the experiment on the Madeley inclined plane, which is also given, as to destroy any dependence upon either of them.

It is stated in p. 65, that "there was a pretty strong wind directly in favour of the motion of the train, down the Whiston plane." Now, 10 miles an hour is below the velocity of anything that can be called "a pretty strong wind," —but assume 10 miles, so as to be on the safe side—deducting this from the 32½ miles, we have 22½ as the real velocity of the train passing through the air, or the velocity to which alone any atmospheric resistance could be due. At this velocity, 2,3lbs. per square foot would be the utmost effect that could be produced by the air, and the 329lbs. ascribed to atmospheric resistance would therefore require 143 square feet of surface: if the four carriages had been placed by the side of each other instead of behind, this surface would hardly have been obtained; or, again, if the 329lbs. were due to the atmospheric resistance of four carriages of the narrow gauge at 22½ miles per hour, at 40 miles the same four carriages would meet the resistance of 1,063lbs., which alone, without any allowance for friction, or for the increased width of carriages, would be a greater resistance than the North Star engine is capable of overcoming. But the North Star, as I shall hereafter shew, does take a train of seven carriages, weighing 46 tons, and having seats for 188 passengers, at 40 miles per hour, which according to the above data would require, including friction, a tractive power of somewhere about 1,500lbs., probably nearly double that which the engine can possibly exert at that speed. But these discrepancies are easily accounted for.

The experiments were made with very light loads, 15½ and 18 tons; and consequently the assumed comparative resistance for the air, which would be nearly the same even had there been 50 tons, appears much larger. The friction of 50 tons would have been 285lbs., and the atmospheric resistance being still 329lbs., the relative per centage of the total resistance would have been 44 and 56, and to the 44 per cent. has to be added, all the friction of the engine itself, which is also a constant quantity independent of any resistance of the air; taking this at 15, or one-third of that of the trains, the proportion becomes 51 for friction, and 49 for some other resistance, instead of 22 and 78.

But the sources of error to which I have alluded are much more serious, and appear to me so incapable of measurement, and consequently of correction, as to render the experiments useless.

The circumstances were not really, though apparently so, in any one point similar to those of an ordinary train in motion. In the first place, the carriages are sent with the square end to meet and receive the full resistance due to their surface, which is totally different from the case when the engine precedes them. In the next place, this resistance is acting entirely against the front of the first carriage of the train, while the motive power,—viz. the gravity, is behind, that is, acting upon each carriage, and pushing one upon another. Everybody experienced in railways knows that in such a case the carriages are thrown out of square, and a degree of resistance created which would alone account for the whole.

The ultimate conclusions, however, at which Mr. Wood arrives on all the principal points, will, upon perusal, be found to have been governed by the results of the experiments upon the performance of the engines, and the assumed resistance of the trains at high speed; the experiments upon the resistance of the air being made to ascertain if this assumed increase of resistance could be accounted for.

The mechanical advantage of large wheels for the carriages is, of course, admitted; but high speeds being assumed to be practically or economically unattainable, the reduction of friction is considered unimportant. I shall now, therefore, consider this branch of the subject—the performance of the engines.

The locomotive engines running upon the ordinary railways are the result of nearly ten years' experience; during which time the most talented manufacturers have been constantly engaged, not in inventing any new construction of engine,—for certainly, seven, if not eight years since, Messrs. Stephenson constructed, what, in form and general arrangement, was exactly similar to that now made,—but simply in adapting and proportioning the different parts the one to the other, and by such trifling changes, if they can be called so, important improvements have been effected, and greater speed and economy attained.

On the engines made for the Great Western Railway the same experienced manufacturers have been employed; but as a higher speed was sought, a larger evaporating surface of boiler was required; and many of those proportions which had been long studied, and in which perfection had to a great extent been attained, were necessarily altered: and yet these machines, brought into operation without the possibility of any sufficient previous trials, in which their defects could be discovered or improvements introduced, are taken as the full measure of what can be effected in the new system of which they form a part. It is certainly contrary to all experience to suppose that they should at once be well adapted to a new system; for not only would this have required more foresight than the most eminent of those engaged in their construction could possibly possess, but it involved a departure from many rules in favour of which long and successful experience had, to a certain degree, created a prejudice.

The experience of at least some months of the actual working of these engines, and that at a time when we should be sufficiently free from all the embarrassments of the first opening of the line to allow of such alterations being tried as appeared likely to effect improvements, which involves the ability to throw out of work any engine upon which it might be necessary to make the trial; some such short experience and such trials were at least necessary to bring the system even on a par with others long previously in operation; but this opportunity we have not yet had.

From the results obtained up to the present time, therefore, little could be hoped for beyond very clear and decided indications of all defects, while the advantages were still to be acquired; and if, under such circumstances, the performance had been nearly equal to that obtained on other lines, with the benefit of long experience, I should have been satisfied We should have had a right to expect great improvements; we should have started from the point at which others had arrived; and when we had attained the same relative perfection in all parts which they had, with all the advantage of their previous experience, and which we might calculate upon doing in a much shorter time, we should be as much in advance of our present state as they are now of the state in which they were some years ago.

But I am prepared to shew that we are now in that position; that the performance of our engines is not merely as great, but greater, than that which has yet been attained on other lines; that those changes and improvements to which I have alluded are just commenced; and that, even since Mr. Wood made his experiments, the advance has been so great, that if he were now to repeat them he must arrive at totally different conclusions.

Tables III. and IX. of his report give the performance of engines with different loads on the London and Birmingham, and on the Great Western Railway. From them it would appear, that on the Birmingham Railway the same engines which took 60 and 64 tons at 24 and 25½ miles per hour, were only capable of taking 34½ and 33 tons at 32½ and 33 miles per hour, with nearly double the consumption of coke per ton; while on the Great Western Railway the same engine—the North Star, was capable of carrying 82 tons at 33 miles per hour; only 33 tons at 37 miles per hour, and 16 tons at 41 miles, and to obtain which last additional velocity of four miles per hour the consumption of coke per ton was more than doubled.

Such an enormous diminution of effect by a comparatively small increase of speed, if unavoidable, or necessarily consequent on the increased resistance of the train, would undoubtedly justify the conclusion arrived at by Mr. Wood, that to attempt to exceed 35 miles per hour is not advisable; and consequently, that so far as the system of the Great Western Railway was adapted for high velocities it was unsuccessful. But these conclusions are founded upon the statements above referred to. Experiments have since been made giving very different results, and I can prove, that if an engine be properly constructed for high speeds in the manner which I have always proposed, that there is no such "immense sacrifice of power incidental to an extreme high rate of speed, or the accomplishment of a rate of thirty-eight or forty miles per hour above that of thirty-two or thirty-five miles," (page 63;) and that the same engine, which was then only capable of taking sixteen tons at an average velocity of thirty-eight and a maximum of forty one miles and a half per hour, is now capable of taking forty tons at an average velocity of forty miles per hour; and further, that the consumption of coke per ton, so far from being extravagant, is not so great as that of the engines on the London and Birmingham Railway, when only travelling at a mean rate of thirty miles per hour.

The experiments have been made with the same engine and the same class carriages as those used in Mr. Wood's experiments, and in every other respect conducted in the same manner, and without any attempt to diminish the resistance of the air, which may be done to a great extent, and which as I shall hereafter have occasion to state, was always my intention, and has been prepared for in the construction of engines and carriages.

The comparison between the performance of this engine in September last and at the present time will therefore stand thus:—

	Load. Tons.	Average speed.	Consumption of Coke per ton per mile.
September,	15.9	38½	2.76
December,	40	40	.90

From which it appears that in less than three months (the change has really been effected but lately) the performance of the engine is nearly trebled, while the consumption is reduced to a moderate quantity, or by two-thirds of that of the former experiments.

The explanation of this change is easily given. The great diminution in the useful effect of the engine in the former experiments did not arise solely from the increased resistance of the train—which might have been more difficult to overcome—but principally from the diminished power of the engine at that speed. This might appear, at first sight, to be the same thing, but such is by no means the case. The increased resistance of the load to be moved might arise from causes which could not be controlled. The diminished power of the engine might be a mechanical defect, capable of being remedied, and investigation has proved the truth of this most satisfactorily. The engines at that time were so regulated by the proportion of some of their parts, that their power was crippled when the speed was increased. The great quantity of steam which is required, could not, in fact, escape, and if allowed to escape more freely, there was a deficiency of draft in the furnace. This was a difficulty incidental to the high speeds, and also to the increased diameter of the driving wheels, but it is a difficulty which is capable of being overcome, and, in a great measure, has been overcome. There is, however, no doubt, still room for improvement; but if, in so short a time, we have made this great advance, it is fair to presume that we may make still further improvements.

If, therefore, great speed is attainable—if there are no natural causes, no insurmountable obstacles—the position taken by Mr. Wood (and in taking which he was perfectly justified, by the evidence before him) becomes totally changed. The hypothesis is no longer correct on which the opinion was formed and expressed in page 68, in the following words:—"If such a conclusion"—viz., the practical limit of 35 miles per hour—"is warranted by these investigations and experiments, then it results that it is not necessary for the attainment of such a rate of speed that the gauge should be seven feet." But all the advantages pointed out in the two following paragraphs of the Report as resulting from an increased width of gauge over the four feet eight inch, apply in a still greater degree than under the circumstances which existed at the time. Some doubts are expressed as to the advantage of so great an increase of gauge as seven feet; but these doubts, again, appear to arise entirely from the circumstance, that the results of the experiments then made upon the performance of the engines were unfavourable. The reverse appears now to be the case; the work performed with a given consumption of coke is much greater than in any of the experiments made upon other lines, the details of which are given in the Report.

On the subject of the seven-feet gauge, I can add very little to what I have said before. It was adopted expressly to enable us to effect that arrangement which is recommended at page 68.

"We see that there is a diminution of friction, by the increase of the diameter of the wheels, but it is doubtful to what extent this is modified by elevating the bodies of the carriages; a broad gauge, by allowing the bodies of the carriages to be placed within the wheels, and thus to reduce the height of the carriages, and consequently diminish the area of the frontage, is an advantage, considering the great amount of resistance arising from the atmosphere."

To effect this, with the most convenient form of body, similar to that ordinarily adopted on railways, does require, as I have frequently stated in previous reports, a width of at least 6 feet 10 inches.

The advantage of stability is probably directly in proportion to the increased width; and upon this point I will quote the words of Mr. Wood, page 68:—

"The remaining proposition is, that a wider gauge affords increased stability to the carriages, and, consequently, increased steadiness of motion. The diagrams given will show how far this has been effected on the present portion of the Great Western Railway, and certainly these documents would prove that this has not yet been accomplished. Considering, however, the causes of the different motions of railway carriages, there can be no doubt that an increased width of gauge must tend to produce that effect. In the present instance this has been counteracted by the construction and present condition of the road and carriages; and therefore, it appears to me, the only conclusion we can come to is, that in similarly constructed railways the wider gauge will afford greater stability and steadiness of motion to the carriages."

As regards the expense of forming the railway of increased width, Mr. Wood has made a mistake, which I believe he will correct in the Appendix. The estimate of the increased cost is £39,000 only, instead of £151,840. Upon all these points I have so frequently explained my views to you, that I shall take the liberty to quote a passage from my report of the 15th of August, which contains in a small compass the grounds upon which I adhere to my opinions in favour of the width of gauge I have selected:—

"It has been asserted that four feet eight inches, the width adopted on the Liverpool and Manchester railway, is exactly the proper width for all railways, and that to adopt any other dimension is to deviate from a positive rule which experience has proved correct; but such an assertion can be maintained by no reasoning. Admitting, for the sake of argument, that, under the particular circumstances in which it has been tried, four feet eight inches has been proved the best possible dimension, the question would still remain—What are the best dimensions under the circumstances?

"Although a breadth of four feet eight inches has been found to create a certain resistance on curves of a certain radius, a greater breadth would produce only the same resistance on curves of greater radius.

"If carriages, and engines, and more particularly, if wheels and axles of a certain weight, have not been found inconvenient upon one railway, greater weights may be employed, and the same results obtained, on a railway with better gradients.

"To adopt a gauge of the same number of inches on the Great Western Railway as on the Grand Junction Railway, would, in fact, amount practically to the use of a different gauge in similar railways. The gauge which is well adapted to the one is not well adapted to the other, unless, indeed, some mysterious cause exists, which has never yet been explained, for the empirical law which would fix the gauge under all circumstances.

"Fortunately, this no longer requires to be argued, as too many authorities may now be quoted in support of a very considerable deviation from this prescribed width, and in every case the change has been an increase.

"I take it for granted that, in determining the dimensions in each case, due regard has been had to the curves and gradients of the line, which ought to form a most essential, if not the principal, condition. In the report of the commissioners upon Irish railways, the arguments are identically the same with those which I used when first addressing you on the subject in my report of October, 1835.

"The mechanical advantage to be gained by increasing the diameter of the carriage wheels is pointed out; the necessity, to attain this, of increasing the width of way; the dimensions of the bridges, tunnels, and other principal works, not being materially affected by this, but, on the other hand, the circumstances which limit this increase being the curves on the line, and the increased proportional resistance on inclinations (and on this account it is stated to be almost solely applicable to very level lines), and lastly, the increased expense, which could be justified only by a great traffic.

"The whole is clearly argued in a general point of view, and then applied to the particular case, and the result of this application is the recommendation of of the adoption of 6 feet 2 inches on the Irish railways. Thus an increase in the breadth of way to attain one particular object—viz., the capability of increasing the diameter of the carriage-wheels, without raising the bodies of the carriages, is admitted to be the most desirable, but is limited by certain circumstances,—namely, the gradients and curves of the line, and the extent of traffic.

"Every argument here adduced, and every calculation made, would tend to the adoption of about 7 feet on the Great Western Railway.

"The gradients on the lines laid down by the Irish commission are considerably steeper than those of the London and Birmingham Railway, and four and five times the inclination of those on the Great Western Railway; the curves are by no means of very large radius, and, indeed, the commissioners, after fixing the gauge of 6 feet 2 inches, express their opinion that, upon examination into the question of curves, with the view to economy, they do not find that the effect is so injurious as might have been anticipated, and imply, therefore, that curves, generally considered, of small radius on our English lines, are not incompatible with the 6 feet 2 inch gauge; and lastly, the traffic instead of being unusually large, so as to justify any expense beyond that absolutely required, is such as to render assistance from government necessary to ensure a return for the capital embarked. As compared with this, what are the circumstances in our case? The object to be attained is, the placing an ordinary coach body, which is upwards of 6 feet 6 inches in width, between the wheels; this necessarily involves a gauge of rail of about 6 feet 10 inches and a half to 6 feet 11 inches, but 7 feet allows of its being done easily; it allows, moreover, of a different arrangement of the body; it admits all sorts of carriages, stage-coaches, and carts, to be carried between the wheels. And what are the limits in the case of the Great Western Railway, as compared to those on Irish railways? Gradients of one-fifth the inclination, very favourable curves, and probably the largest traffic in England.

"I think it unnecessary to say another word to show that the Irish commissioners would have arrived at seven feet on the Great Western Railway by exactly the same train of argument that led them to adopt 6 feet 2 inches in the case then before them.

"All these arguments were advanced by me in my first report to you, and the subject was well considered."*

All the opinions expressed, and the arguments advanced by me on that occasion, I consider to be supported by the general arguments of Mr. Wood, and fully borne out by the experiments recorded in his report, when taken in conjunction with those recently made.

The experiments made during the progress of Mr. Wood's investigation, and those, few in number, which I have been enabled to make since, have given much useful information upon many points connected with the working of the line; and, while they confirm the views which I had previously taken, they also point out many imperfections which are capable of removal. Upon the value of gradients particularly, the records of the experiments made for Mr. Wood, give most conclusive evidence. Upon an average of about eighty experiments made with several different engines, and various loads upon our line (with the manuscript details of which Mr. Wood has kindly furnished me), the mean velocity, after the speed was acquired in ascending a plane of eight miles in length of four feet per mile, was 30¾ miles; on a short level summit of only half a mile, the speed increases to 32¼; and the average of the next seven miles, on which the levels vary from 4 feet to 2 feet per mile descending, the velocity was 34¾; and upon the remainder of the line, which varies from 2 feet to 4 feet per mile ascending, the velocity is 33½. The velocity upon the latter part is rather greater, from the circumstance of its being near the conclusion of the journey, the engineer being thereby enabled to reduce the feed or the supply of cold water to the boiler, or to avoid adding fresh fuel and in other ways to maintain the steam.

This result gives a clear difference of four miles per hour between the velocities in ascending a plane of eight miles in length, at four feet per mile, and descending a plane of seven miles in length, averaging about two feet six inches per mile. Nothing can be more conclusive as to the actual practical effect of even any very slight increase or diminution of the gradient of a line, notwithstanding the vaguely expressed assertions—not that I mean to imply that such are found in Mr. Wood's report—that after a certain degree of perfection is attained it is useless to seek a nearer approach to a level.

The observations which I have lately made upon carriages moving with a high velocity satisfy me that a very great portion of the resistance at such velocity is caused by the rolling of the carriage wheels from side to side. And in proportion as this source of resistance is removed, which it undoubtedly may be in a great measure, if not entirely, so will the useful effect of the engine be greatly increased.

I should have been glad to have taken this opportunity of entering more fully into the various questions, the agitation of which has led to these experimental inquiries. But in order to comply with your desire to have my observations printed and circulated this week amongst the proprietors, I am compelled, though most unwillingly, to bring them to a conclusion.

It is but justice to myself to add, that being thus limited in time, I am deprived of the opportunity of which I should, under other circumstances, have readily availed myself, to examine most minutely every experiment and inference drawn in the report, as well as of fully explaining, and I hope I may add, of vindicating, the views and principles which, with your sanction and approval, I have hitherto acted upon in the construction of the Great Western Railway.

I am, gentlemen, your obedient servant,

(Signed) I. K. BRUNEL.

London, December 27th, 1838.

At the special meeting of the shareholders, held on the 9th of January, the report of the directors was approved and adopted.

* Vide Mr. Brunel's Report in Journal, No. 12, pages 383 and 394, vol. I.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

[It affords us much pleasure to publish the following very interesting annual report of the Institute, and to announce the removal of the Institute to premises in every way suitable to the station and rank in which the profession is justly held by the public. The house which has been lately fitted up for the members is one of the splendid mansions in Great George Street, Westminster. In the rear there is a very convenient theatre, capable of holding at the least 150 members, where the proceedings and discussions of the Institute will be conducted.]

Annual Report, 1839.

It is with feelings of the greatest satisfaction, that the council invite the attention of this meeting to the following report, the presentation of which terminates the trust confided to them by the last annual general meeing.

The twentieth year of the proceedings of the institution has been marked by events of considerable importance, furnishing the strongest evidence of the steady progress and success which has attended the labours of the council, aided as it has been by the unanimous co-operation of the general body. To meet on the present occasion, under circumstances more favourable than perhaps attend any similar society is most gratifying; but the gratification stops not here, to form a proper estimate of your present condition, it is necessary to contrast that of earlier years with the steadily increasing progress of the last. In fulfilling the more extensive duties consequent on this progress, as well as on the many important changes which have taken place, the council have always been deeply sensible of the high responsibility committed to them, and that their endeavours have been well directed, will they trust be apparent from the present report, to the details of which they now solicit your careful attention.

New Premises.—The hopes which were at the last annual meeting held out respecting the present premises have been more than fully realised. The kindness of the commissioners of compensation, in resigning at midsummer, that portion of the premises in which the more important alterations were to be made, has enabled the council to commence the session in the present place, and though the repairs be yet incomplete, the council believe they will be completed ere the institution again meets. The alterations and repairs will be executed for about £1,000. More than £700 has been already subscribed, and among the many gratifying circumstances of the past year, the council would particularly select the liberality with which all have come forward to further this object.

Such has been the unanimity of feeling evinced in this respect that the council believe ample resources will be found, and that the future council will not have to avail themselves of the liberal offer of your president to advance whatever sum the institution might require.

The existing furniture is all available for the present premises, and the outlay which will be required for what more may be desirable for your comfort and suitable accommodation will not be greater than the growing resources of the institution can conveniently meet, so that there is no danger of any permanent debt being entailed on the funds of the institution. By the terms of the lease you are secured from the expense of serious repairs, and from the completeness with which on the present contract they will be executed, the council do not anticipate that any thing further of importance will be required for many years to come.

By-laws.—The council would next advert to other subjects which have occupied their attention during the past year, some of which were dwelt upon at length in the last annual report. It will be in the remembrance of most, that during the year preceding the last annual meeting, some changes were made in the constitution of the general body and of the council. The more important of these changes were, the incorporation into the class of members, without distinction of residence, of all those whose professional qualifications were recognized as the same; the creation of a new class under the term graduates, to include those who either as pupils or assistants to engineers, were qualifying themselves for the practice of the profession on their own account; the increase of the number of the council, and the addition of two as representatives of the class of associates. The council, on the experience of the past year, conceive that these and other important changes recommended by their predecessors in office, and adopted by the general meeting of members, have contributed to the success and permanent stability of the institution.

The council conceive that the introduction of two from the class of associates may be attended with great benefits to the institution. This change has been objected to by some zealous friends of the institution among the associates themselves, on the ground that such an introduction might tend to divert the attention of the institution from objects strictly professional. The council, however, do not conceive that such fears have any just foundation, so long as the rest of their body consists of men honoured by the confidence of the profession, but on the contrary, that the class of associates containing many distinguished for their attainments in pursuits intimately connected with the practice of the civil engineer, will furnish those who may co-operate in advancing not only the interests of the institution, but the cause of general knowledge. The council cannot omit to bear testimony to the valuable services of Mr. Carpmael and Lieutenant Denison during the preceding year, and they would repeat the recommendation made to the last annual meeting, that two of the class of associates be elected on the council of the ensuing year.

Other alterations have been suggested, on which the council have bestowed much deliberation, and in case the future council should think it advisable to summon a general meeting of members to consider the propriety of making any alteration in the existing laws, it may be advantageous briefly to advert to one or two of the proposed alterations which have occupied the attention of the council during the past year. It has been suggested that the annual election of the council should be conducted in a somewhat different manner from that at present pursued. That a greater number than that constituting the council should be nominated, and that each person at the annual general meeting instead of, as at present, erasing one name and substituting another, erase as many names as the number on the ballotting list exceeds the constituted number of the council. It has also been suggested whether it may not be for the advantage of the institution, that the council should be increased by the addition of two members; that as frequently some of its most distinguished members are inevitably prevented by professional engagements from attending the ordinary meetings, the council should be enlarged to as great an extent as may be consistent with the true interests of the institution.

Members.—The council have frequently experienced difficulty in deciding on the qualifications for admission into the class of members. It is a peculiar feature in your institution that the class of members should consist of those strictly engaged in the practice of the civil engineer. The objects of the civil engineer are defined by your charter, and the council, considering that the success and permanency of the institution must depend in a great measure on the care exercised in admission into this class, have repeatedly considered this subject with the view of presenting some definite rules for the guidance of themselves and others. It has appeared that they will be aided in this difficult task by adhering as much as possible to the two following conditions; either:—

He shall have been regularly educated as a civil engineer according to the usual routine of pupilage, and have had subsequent employment for at least five years in responsible situations as resident or otherwise in some of the branches defined by the charter as constituting the profession of a civil engineer; or, he shall have practised on his own account in the profession of a civil engineer for five years, and have acquired considerable eminence therein.

It is thought that the first condition will include those who by regular education have done their utmost towards themselves for the profession, and that their subsequent employment in responsible situations will be a guarantee that they have availed themselves of the opportunities which they may have enjoyed.

In the earlier days of the science of the civil engineer such a condition would have been inapplicable; then the force of native genius sufficed to place the individual in that position of professional eminence which commenced with a Brindley and a Smeaton, and was in our own time exemplified in a Rennie and a Telford. To such, of whom there are many illustrious examples amongst us, the second condition is strictly applicable.

Transactions.—Since the close of the last session the second volume of the Transactions has been published. The council regret that the volume should have been delayed so long beyond the expected time, but they would remind the meeting that the preparation of a volume containing 23 highly-executed plates, is a work of no ordinary difficulty, and that a delay in any part will of necessity preclude the publication of the volume. The danger of delay, when a whole volume is to be published at once, has led the council to consider whether it would not be for the interest of the institution to publish in parts of volumes, and from time to time, as they can be prepared, such communications as are destined to occupy a place in the Transactions. The advantages resulting to all parties from such an arrangement would, it is conceived, be great; delay in the publication of a body of communications, by reason of the incompleteness of one of them, would be entirely avoided, authors would surely gladly avail themselves of this method of transmitting papers to the world, since all the merit due to priority of claim would then be undoubtedly secured to them.

Minutes of Proceedings.—Should, however, the succeeding council consider the propriety of adopting some plan similar to the above, for the publication of the Transactions, the council would urge the importance of adhering to the publication of the minutes of proceedings. In these are recorded many communications of partial and transient interest, which would be comparatively of little value unless published at the time. By these the public is at once brought into immediate contact with the institution, the labours of authors can be extensively made known, their merit in the priority of invention and discovery secured as a matter of history, and their opinions canvassed almost as soon as promulgated by many competent judges, who are unable to attend the meetings.

Telford Premiums.—At the close of the preceding session the council issued a list of subjects to adequate communications, on which they would award Telford premiums. The following communications were received:—A most elaborate and beautiful set of drawings of the Shield at the Thames Tunnel, from Mr. Brunel, and two sets of drawings of Huddart's rope machinery, the one from Mr. Birch, the other from Mr. Dempsey. The merits of this celebrated shield, and its value as a means of executing works similar to the Thames Tunnel, are so well known, that it were superfluous here to insist upon the benefits which Mr. Brunel has, by the invention of it, conferred on the civil engineer. The council, feeling that this communication and the invention of the shield were entitled to a high mark of approbation, determined on presenting Mr. Brunel with a silver medal, accompanied by a suitable record of the sense entertained of the benefit conferred by him on the practice of the civil engineer. Feeling also that the beauty of the drawings fully merited some mark of approbation, they determined on presenting the draughtsman, Mr. Pinchback, with a bronze medal in testimony thereof.

The communications by Mr. Dempsey and Mr. Birch on Huddart's Rope Machinery, likewise called for some special mark of approbation on the part of the council. The liberality of Mr. Cotton, the intimate friend of the late Captain Huddart, proprietor of the machinery, in throwing open to the institution the works at Limehouse, is fresh in the recollection of most present; with that same liberality he at once acceded to the wish of the council, to allow any person to attend and make drawings of this celebrated Rope Machinery for the institution. Two young men availed themselves of this liberality, and with great perseverance measured and took drawings of this elaborate machinery, and the results of their industry are the two beautiful sets of drawings, accompanied by suitable manuscript accounts, presented by them to the institution. Of the accuracy of these drawings Mr. Cotton and Mr. Roberts have spoken in high terms; of their merits as mechanical drawings the institution has had ample opportunity of judging. The council felt that to have attempted to distinguish betwixt the merits of these two communications would have been both difficult and invidious, they have therefore awarded a Telford medal in silver, accompanied by books to the value of five guineas, both to Mr. Birch and Mr. Dempsey.

The council have already spoken of the liberality with which Mr. Cotton had responded to the wishes of the institution; his liberality stopped not, however, here, but he has promised to supply to the institution that account and history of this machinery of his late distinguished friend, which he alone has the power of doing.

On the other subjects then issued the council have not yet received any communications of great merit. They have, however, the pleasure of being able to announce that your associate Mr. Jones has made considerable progress with an account of the Westminster sewage, that your associate Mr. Johnson has promised some drawings and models connected with the Breakwater, and your member Mr. Oldham a communication on the means which he has adopted for warming and ventilation at the Bank of England. On the nature and properties of steam considered in reference to its application as a moving power, and on the ratio betwixt the velocity, load, and power of locomotive engines on railways, no communication to which a premium could with propriety be adjudged has yet been received. The subjects on which no communication deserving a premium has been received, have consequently been issued with others for the present session.

But though the council received no communication in which the subject of steam was treated in the wide and comprehensive manner which was desired, they deemed worthy of premiums the following communications on parts of this great subject. On the effective Pressure of Steam in the Cornish Condensing Engines, by your member, Thomas Wicksteed. On the expansive Action of Steam in the Cylinder of some of the Cornish Condensing Engines, by W. J. Henwood; and on the Evaporation of Water in the Boilers of Steam Engines, by your member, Josiah Parkes. To each of these the council have awarded a silver medal.

The communication by Mr. Wicksteed is of great value, as containing the only recorded experiment in which the water raised was actually weighed. It will be in the recollection of most present, that this is the second communication from Mr. Wicksteed on the same subject. The two are valuable additions to our knowledge on the subject. The water raised was weighed and measured. The weights raised in the stamping machinery were also accurately ascertained, and a comparison instituted between the duty of the single engine in raising water, and of the double-acting and crank engines in working stamps.

The communication by Mr. Henwood is remarkable for the extreme minuteness of detail with which the observations were conducted, the communication consists of two parts; the one, on the quantity of steam employed and the mode of its distribution on the working stroke, the other on the duty performed with a given quantity of fuel. Under the former the indicator is accurately described, and the evidence furnished by the diagrams explained. Under the latter is exhibited one of the most valuable specimens of detailed observations on record. It is a peculiar feature in the system pursued by Mr. Henwood, that he never interfered with the ordinary working of the engine; he observes with accuracy what is going on. Thus his paper is a record of observation in the highest sense of the term. It is of importance to practical men to keep in mind a distinction which has been often insisted on betwixt observation and experiment. In the former, the phenomena which are going on are noted as they go on, the circumstances under which they occur being untouched; in the latter, the phenomena are produced for the purpose of the experiment. The former consequently requires great care in referring effects to their proper causes, the latter in guarding against the results being influenced by the circumstances necessary for the production of the phenomena. The two are distinct, each requires their respective talents, the former would lead a Newton to the law of gravitation, and guide a Smeaton in the construction of an Edystone; the latter a Watt and a Black to a knowledge of the properties of steam; the two combined would guide a Davy to the construction of a safety-lamp.

In the communication of your member Mr. Parkes, we have an instance of both these methods combined; he observed what was going on under particular circumstances of evaporation, and then, having altered the circumstances, recorded the results of these experiments. The researches of this author led him to push slow combustion to its utmost limits. It would be foreign to the object of this report to trespass on the time of this meeting, further than to remark that the contents of this paper will furnish many most useful hints to the practical engineer in the management of the fires of his steam boilers, and to the theorist some important facts towards a true theory of combustion.

The council have also awarded a silver medal to the communications of your associate, Lieut. Denison, on the Strength of American Timber, and of your member, Mr. Bramah, on the strength of cast iron. Each of these communications must be viewed as valuable additions to our knowledge. The series of experiments by Lieut. Denison was undertaken by that highly talented officer, when stationed abroad, with a view of establishing some proportion betwixt the strength of different kinds of American timber, and of affording a means of comparing it with European. It is a peculiar feature in these experiments, that the effect of time in increasing the deflection is noted. After the elastic limit is passed the deflection increases with the time which the beam is loaded, the amount of this increase is recorded in most of these experiments. The council cannot but regret that Lieutenant Denison should have returned to this country before the very extensive series which he had contemplated, and for which he had made preparation was complete; his intention of determining the change of strength and the amount of shrinkage betwixt green and dry was thus unfortunately frustrated; and they most earnestly concur with him in the expression of hopes that officers and others employed in the colonies will be induced to turn their attention to this subject. They point out the above communication with especial pleasure as an example to other military engineers, of the very valuable services which their opportunities will enable them to render to the science of the civil engineer.

The other communication by Mr. Bramah is also a valuable addition to our knowledge, undertaken with a view of verifying the principles assumed in the widely-circulated work of Tredgold on Cast Iron; they surpass every other series in existence in their extent—the number of experiments being nearly 1500, and in the care taken to ensure accuracy, since two similar specimens of each beam were made the subject of experiment.

The principles, with the view of establishing which this series of experiments were undertaken, are, that the forces of compression and extension are equal within the elastic limit, and that consequently a triangular beam, provided it is not loaded beyond this limit, will have the same amount of deflection whether the base or apex be uppermost, and a flanged beam the same deflection, whether the flange be at the top or the bottom.

This communication is accompanied by some valuable observations by your associate, Mr. A. H. Renton, pointing out the agreement which subsists between the experiments and the results of the formula of Tredgold. The council have peculiar pleasure in pointing out the preceding, as communications of a kind on which they conceive the Telford medals may be most worthily bestowed. The undertaking a series of observations and experiments with a view of establishing important physical principles, and from a desire after the truth, is an object worthy of the highest approbation of this institution.

A silver medal has also been awarded to your member, Mr. Green, for his communication on the Canal Lifts on the Grand Western Canal; to your member, Mr. Harrison, for his communication on the Drops on the Stanhope and Tyne Railway, and to your associate, Josiah Richards, for his most elaborate drawing of the Rhymney Iron Works.

The perpendicular lifts erected by Mr. Green on the Grand Western Canal involve some ingenious applications of simple principles, and present many considerations of interest to the civil engineer. The principles of their construction are simple, and the economy of construction and saving both in time and water gives them great advantages in certain cases over locks for the purposes of canal navigation.

The Drops on the Stanhope and Tyne Railway for the purpose of shipping coals, present another instance of simple mechanical adaptation. These have several points in common with the lifts just spoken of; the original drawing of these by Mr. Harrison is an exceedingly beautiful example of what drawings of this nature ought to be.

Of the drawing of the Rhymney Iron Works by Josiah Richards, it would be difficult to speak in too high terms; it is a most elaborate drawing, exhibiting all the details of the manufacture of iron. The institution has not yet received the description which will be necessary to render the communication complete; but the council have the gratification of stating that your associate, Mr. Rowles, the chairman of the company, has promised that Mr. Richards shall be furnished with every facility towards completing a communication which, they doubt not, will be a most valuable acquisition to the records already existing in the institution.

The council have also awarded a silver medal to Francis Whishaw for his History of Westminster Bridge. Of the great labour and research of Mr. Whishaw in collecting these documents, it would be difficult to speak in adequate terms. The history is extracted from voluminous records contained in the Bridge-office, and you are indebted also to the kindness of your member, Mr. Swinburne, for the facilities which he furnished the author in the execution of his difficult task. The history of this bridge, the only one of the old bridges now remaining, is interesting to the general reader no less than to the engineer. The difficulties which presented themselves gave rise to contrivances then for the first time brought into use, of which the introduction of caissons is not the least remarkable. The difficulties and progress of the work are well set forth in the reports of Labelye, of which the more interesting are embodied in this communication; and the account of the work furnishes a very complete history of the state of this department of practical engineering a century ago.

This communication accompanied by an atlas of eleven drawings showing the site and various details of the construction of the bridge is one of those historical records which it is especially the object of this institution to collect, and which, from the labour and research employed upon it called for this mark of approbation of the council.

The institution received during last session from your member Mr. Rendel, a very elaborate and beautiful set of drawings, accompanied by a suitable description of the Torpoint Floating Bridge. This interesting communication is fresh in the recollection of most, and it would be difficult to speak in too high terms of the forethought, skill, and design, displayed in the construction of these bridges, and the perfect success which has attended their establishment. It does not often happen that the same individual has the genius to invent and the good fortune to see his invention brought into general use. In this respect Mr. Rendel has been singularly fortunate, as these bridges have been already established in several difficult and dangerous passages. It would be foreign to the present occasion to dwell more at length on this invention; but the council feel that in awarding a silver medal to Mr. Rendel, accompanied by a suitable record of the sense entertained of the benefit conferred by him on the inland communication of the country, this, the highest acknowledgment in their power to make, is most amply merited.

A bronze medal has been awarded to your associate, Mr. Ballard, for the drawing of his ice-boat, and description of his method of breaking ice by forcing it upwards; this simple method is applicable at about one-third the labour of the ordinary ice-boat. A bronze medal has also been awarded to Thomas Macdougal Smith, for his drawing and account of Edward's, or the Pont-y-tu-prydd Bridge, in South Wales. Mr. Smith being for a short time in the neighbourhood availed himself of this opportunity to make accurate drawings of this curious and interesting structure. The council would point out this as an example of the way in which every young man may, by availing himself of the opportunities afforded by his professional engagements, forward the objects which the institution has in view; and they would earnestly impress on all young men the importance of availing themselves of such opportunities, and of recording their observations on every work with which they may be connected. This habit is of the greatest advantage to the individual, since only by such an habitual self-improvement can any one hope to obtain eminence in the profession.

The council have also awarded five guineas to Mr. Guy for his method of making perfect spheres; this great desideratum in the mechanical art has been in a great measure supplied by the ingenuity of this individual, and a simple method furnished of readily producing spheres of metal, or other hard substance, with a great degree of accuracy.

The preceding are the communications of the last two sessions to which the council have awarded premiums. The council in disposing of the premiums placed at their disposal by the munificence of your late President, have endeavoured to select from the great number of communications which have been brought before the institution, such of each class as especially deserved this mark of distinction. They trust that these premiums may act as a stimulus to many, to forward to the institution records of matters of interest to the profession, and that thus the object of the noble benefactor of the institution will be fully realized.

The council cannot dwell on the numerous communications received during the last session, of which an ample account will be found in the Minutes of Proceedings, they cannot however omit to remark on the great interest of the discussions and on the value of the record of opinions and facts which is thus obtained. They would especially refer to the discussions on the duty of steam engines, and on the explosions of steam boilers, as having led to the collection of much valuable matter; the practice of recording the minutes of conversation is almost peculiar to your institution, and is calculated in an especial manner to forward the interests of practical science.

Life of Telford.—The council, in reviewing the events of the past year, cannot omit to express their gratification at the publication of the Life and Works of Telford. Every thing connected with his name is interesting to this institution, and the life and works of so distinguished a man, written by himself, cannot fail to be received with the greatest satisfaction by all who knew him or are able to appreciate his works. Through the kindness of your honorary member, Mr. Rickman, the editor of the life and works, and acting executor of Mr. Telford, the institution has been put in possession of two copies of this valuable work.

Monument of Telford.—The council have also the satisfaction of announcing through the medium of this report, that the monument to Telford is nearly finished, and that a place has been found for it in Westminster Abbey. The site which the Telford committee have selected and hope to obtain, is one well adapted for the statue, and they trust that by the next annual meeting the monument will be placed among those who, by the benefits conferred on their country, have justly deserved this tribute of respect.

Charles Tennant.—The institution has to regret the loss by death of Mr. Charles Tennant, of Glasgow, the eminent practical chemist. Mr. Tennant was born at Glenconna, in Ayrshire, in 1767, and commenced his career as an improver in the chemical arts before the end of the last century. The great revolution in the practice of bleaching which then occurred was carried out by the discoveries made by him, first of the solution of chloride of lime, and afterwards of the dry chloride of lime or bleaching powder,—an inestimable gift to the arts with which the name of Mr. Tennant will always be associated. The chemical works of St. Rollox, near Glasgow, which now form so conspicuous a monument of his energy and success, were erected for the purpose of manufacturing this article, for which he held a patent.

The manufacture of sulphuric acid, and of alkali from salt, was also greatly improved at St. Rollox, and first conducted there on a scale commensurate with their national importance. The manufacturing interests of this country possess an advantage in the extraordinary cheapness of these and other chemical products, which they owe in a great degree to Mr. Tennant's scientific talents, and activity as a manufacturer.

The arts are deeply indebted to Mr. Tennant for other benefits, particularly for his exertions in removing the duty on salt. This he ultimately succeeded in accomplishing, after a struggle of many years with the kelp proprietors. Few legislative enactments have been so beneficial to the country, as is well attested by the immense increase of alkali manufactories.

For some years past, Mr. Tennant left the chief management of his manufacturing affairs to his sons, and devoted a great portion of his energetic mind to the welfare of his fellow citizens, among whom he was considered a leader in every philanthropic undertaking.

The success of railway undertakings occupied latterly much of his time and attention; the last great struggle in which he was engaged was in favour of the Edinburgh and Glasgow line, the passing of the bill for which he had the happiness to live to see. He died at his house in Glasgow on the 1st of

October, aged 71, and has left a name which will long continue to be extensively known, and associated with practical science.

Presents.—The presents during the preceding year have been numerous and valuable, and the council have made several advantageous exchanges with other societies publishing transactions. From the Society of Arts, from the Geographical Society, and from the Society of Literature, the institution has received complete sets of Transactions. The Royal Society of Edinburgh, and the Philosophical Society of Manchester, have promised as complete a set as their stock will furnish.

The council have also to acknowledge the continued obligations of the institution to the Lord Lieutenant of Ireland, the Master General of the Ordnance, and Colonel Colby, for those maps of the Irish and English survey which have been published since the last annual meeting; they have also to acknowledge the liberality of your president in presenting that beautiful painting of the Menai bridge and adjacent scenery, which is placed in the library. They have also to acknowledge the liberality of your solicitor, Mr. Tooke, who has refused to accept any remuneration for the advice and information furnished to the council, accompanying his refusal with the most obliging expressions of the deep interest he takes in the welfare of the institution.

The following abstract of the receipts and expenditure, during the year ending the 31st of December, 1838, will show the present state of the funds of the institution:—

CASH ACCOUNT FOR LAST YEAR.

RECEIPTS.		£	s.	d.
To Balance in hands of Treasurer		27	1	5
Subscriptions and Fees		1040	0	6
Dividends		71	8	10
House Subscriptions		299	0	0
Sale of Stock		183	0	0
		£1620	10	9

By House. EXPENDITURE.		£	s.	d.
Rent, Taxes, and Repairs, No. 1, Cannon-row		140	6	0
Repairs, &c., 25, Great George-street		250	0	0
Lease of Ditto		24	12	0
Salaries and Commission		353	12	1
Contingencies.				
Postage and Parcels	20 13 8			
Stationery and Engraving	43 3 1			
Coals, Oil, &c.	47 2 8			
Tea and Coffee	34 6 5			
Printing	35 16 1			
Sundries	44 9 1			
		225	11	0
Library		62	19	10
Publication		36	15	0
Furniture		52	9	0
Telford Premiums		168	7	0
Balance		305	18	0
		£1620	10	9

It will be observed with satisfaction; that the balance in the hands of the treasurer, at the close of last year, was 305*l.* 18s. 10d., whereas at the close of the preceding year the balance was only 27*l.* 1s. 5d. The statement of this balance does not represent the funds of the institution in a sufficiently favourable point of view, as the amount of outstanding bills on the current expenditure at the commencement of the present year was considerably less than at the commencement of the last. The institution also possesses 335*l.* 3 per Cent. Consols, available for general purposes, and a lease of the house in Cannon-row, for which a good premium may reasonably be expected.

Conclusion.—In conclusion, the council cannot but offer to the meeting their sincere congratulations on the prospect which now lies before them. They congratulate the meeting on the recent accession of many names distinguished in their respective branches; and trust that the details of the preceding report not only attest their own unremitting attention, but also will be found to record many zealous and talented efforts on the part of the general body to promote the objects of the institution, and the progress of professional knowledge. From every quarter have been received the most liberal aid and sympathy—the most cordial co-operation. That by which you have been enabled to meet in the present more spacious and convenient premises will be readily appreciated.

The state of the funds is more prosperous than at any previous period; and in every point of view the present condition of the institution may form a subject of general congratulation.

The council now resign into your hands the trust committed to them, with a sanguine confidence in the future importance and dignity, as well as prosperity of the institution, and of its forming a national establishment for the advancement of professional knowledge, conspicuous even in an age of general improvement.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

The Ordinary Meeting was held on Monday, January 7, CHARLES BARRY, *Vice-President, in the Chair.*

The meeting proceeded to the election of the following gentlemen as Fellows:—Messrs. Ferrey, Walker, Wyatt, and Watson. As Associates:—Messrs. Brandon, Flower, Woodthorpe, Bury, Wright, Miles, Prichard, Peirce, and Eales.

Amongst the correspondence read, was a letter from Signor Nicolini, of Naples, accompanying an Italian translation of the several publications of the Institute, published by the Royal Neapolitan Academy of Fine Arts. These consisted of the constitution and by-laws of the Institute, the proceedings of the opening meeting in 1836, and the series of questions drawn up for the information of members, and which being thus circulated it was anticipated would lead to eliciting valuable information on architectural subjects from the Two Sicilies and the whole of Italy.

Mr. Richardson exhibited drawings of the Old and New Bethlehem, and there were also some interesting drawings of the architectural remains of the period of Elizabeth and James, from a collection in the museum of the late Sir J. Soane.

Donations were also announced from M. Valdermini, who has been employed in the reconstruction of the Imperial Palace at St. Petersburgh, which was recently burnt down; and from Mr. J. Wells, of drawings of the doorway of the famous Baptistry at Florence.

Mr. Fowler read a paper by Mr. Pocock, on the bond of brickwork, which occupied the remainder of the meeting.

Ordinary Meeting, Monday, 21st January, PHILIP HARDWICK, *Vice-President, in the Chair.*

The meeting proceeded to the election of the Signor Besia, architect, Professor of the I. and R. Academy of Brera, at Milan, as honorary and corresponding member.

The following donations were announced as having been received:—

Signor Cavaliere Gasse, hon. and corresponding member of Naples, three volumes, folio, of lithographed views in the Kingdom of the Two Sicilies.

Mons. Suys, hon. and corresponding member of Brussels, one volume of Illustrations of the Portico of the Pantheon at Rome, and prints of the Botanical Building at Brussels.

Mons. Leon Vaudoyer, Illustrations of the Monument to General Foy, erected by him in the cemetery of Pere la Chaise, Paris.

The following papers were read:—

Some observations on the heights of Entablatures, by Joseph Gwilt, Architect, F.S.A.

A description of the baronial castle of Sheriff Hutton, Yorkshire; illustrated by drawings, being a restoration sent in for the Soane medallion.

The thanks of the meeting were voted to Mr. Gwilt, for his interesting paper.

Mr. Catherwood, hon. and corresponding member of New York, being present, at the request of the meeting gave some explanation of the mode practised in America of transporting houses from one site to another, upon which the chairman conveyed to him the best thanks of the members.

ARCHITECTURAL SOCIETY.

At a Monthly Meeting, held at Lincoln's Inn Fields, on Tuesday evening, 15th January, 1839, WILLIAM TITE, ESQ., *President, in the chair,*

John Griffiths, Esq., Finsbury Pavement, was elected a member of the Society.

E. W. Brayley, jun., Esq., F.L.S., F.G.S., &c., delivered the first of a Course of Lectures; the subject of which was, "On the Geology and Mineralogy of Building Stones."

At the conclusion of the lecture, the President gave notice that the next public meeting would be held on Tuesday evening, the 12th February, when Mr. Brayley would deliver his second lecture—subject, "On Limestones and other Substances affording Materials for Cement;" and a third lecture on the 12th March—subject, "On Artificial Substances employed as Substitutes for Stone."

MEETINGS OF SCIENTIFIC SOCIETIES.

Royal Society and Society of Antiquaries, Somerset House, Thursdays, at half-past eight, P.M., 7, 14, 21, 28.

Institution of Civil Engineers, 25, Great George-street, Westminster, Tuesdays, at eight, P.M., 5, 12, 19, 26.

Royal Institute of British Architects, 16, Lower Grosvenor-street, Mondays, at eight, P.M., 12 and 26.

Architectural Society, 35, Lincoln's Inn-fields, Tuesday, at eight, P.M., 12.

Society of Arts, Adelphi, Wednesdays, at eight, P.M., 6, 13, 20, 27.

LAW PROCEEDINGS.

TITHE SURVEYS.

At the sitting of magistrates at Horsham, in December, a Mr. Baker, who is employed in surveying the parish of Lower Beeding, appeared to answer an information, charging him with having cut down certain trees and tellows, the property of R. Aldridge, Esq. The defendant admitted that he had cut down the trees, but pleaded that it was necessary to do so, in order to make a correct survey. After hearing evidence, the magistrates decided against the defendant, and fined him 5s., costs 40s. Mr. Baker intends to appeal to the quarter sessions.

DUTY ON GLASS.

An important case as affecting the manufacture of glass was brought before the magistrates of Sunderland last month, in an appeal by the Messrs. Hartley, glass-manufacturers of that town, against the amount of duty levied by the Excise. Messrs. Hartley, it appears, have recently taken out a patent for the manufacture of "broad glass," which bears a duty of £1 10s. per cwt.; but as the quality was found to resemble "German sheet," a superior kind of glass, which is chargeable with a duty of £3 13s. 6d., the excise officers made a surcharge on 80 cwt., amounting to £174. Mr. Wright, solicitor of Sunderland, who appeared for the appellants, conducted the case with great ability; and showed, by a reference to the act of Parliament, the distinction which the Legislature laid down as regulating the duties on glass. "Broad glass," chargeable, with the low duty of £1 10s. per cwt., was required to be annealed in an oven having but one opening, and the cylinder was required to be cut hot, whereas "German sheet" was allowed two openings to the oven, and the cylinder to be cut cold. By the introduction of various improvements, without infringing the clauses of the act of Parliament in reference to broad glass, Messrs. Hartley were enabled to manufacture glass bearing a close resemblance to German sheet. After a long investigation, the magistrates remitted the surcharge, thereby allowing the manufacturers to proceed, on payment of the smaller duty. Mr. Johnson, of Durham, appeared on behalf of the Crown. —*Newcastle Journal.* [It is a disgrace to the country that such obstacles should be put in the way of improvements in our manufactures. Ed. C. E. and A. Journal.]

STEAM NAVIGATION.

Great Western Steam Ship.—During her stay in the Royal Dock-yard at Milford great alterations have been made on board, all of which, we are assured, will very materially contribute to the comfort and convenience of the passengers. The whole of the lower berths under the saloon have been thrown into cargo space, and the passengers' berths reduced to a number which must ensure every comfort and accommodation. The house on deck has been removed, and in lieu thereof the cuddy has been carried forward more to the middle part of the vessel, and has a range of cabins on either side. The splendid saloon is lighted from upper skylights. Great additional room has been gained by the alterations, and a space under cover is obtained sufficient for a promenade for the whole number of passengers. The whole of the cooking establishment has been very much increased, and several other conveniences have been built on deck. The vessel, on examination, was found to be in the very best order, without even a single strain or so much as a ruck in her copper.

Steam from Glasgow to New York.—The merchants and manufacturers of Glasgow intend to try steam navigation to New York. They meditate, it is said, the building of an iron vessel, of very large dimensions and great steam power, to ply regularly between the Clyde and the Hudson.—*Scotsman.*

Steam from the Clyde to New York.—Glasgow is not to be behind Bristol or Liverpool in having a line of steamers across the Atlantic.—*Glasgow Chronicle.*

The splendid steam-ship Hecla, of 814 tons, was launched on the 14th January, at Chatham. This fine vessel was built under the superintendence of Mr. S. Read, from the School of Naval Architecture, Portsmouth, foreman of the shipwrights of this yard. This is the finest steam-ship ever built; her cabins, store-rooms, and indeed the whole of her fitments, are superb. She will carry two of those tremendous engines, eighty-pounders, on swivels, with four smaller guns.—*Maidstone Gazette.*

The last letters from Madras by the overland mail (the great irregularity of which has caused much complaint) mention that the association to promote steam navigation with Europe at that presidency has coalesced with the association at Calcutta, and that the united body will endeavour to promote the comprehensive plan of steam navigation between Europe and India.

The little wooden steam-boat, I told you some time ago was building at Cairo for the Pasha's use, was launched the other day there, and has turned out a very pretty boat. Another is ordered to be built immediately, and *the engines to be made in Cairo!*—another step in the progress of civilization in this country.

Novel Mode of Navigation.—The French Government steamer Veloce has been fitted out on a new principle for working the vessel with either sails or steam, and is now on her voyage from Rochefort to Mexico, for the purpose of testing this important invention. When fallen in with of late by a Spanish ship, north lat. 40°, long. W. of Paris 14°, the captain reported that her rate of sailing under topsails, studding-sails, and royals, had been for two days and a half upwards of eleven knots an hour.

France and America.—According to the plans proposed in its report by the committee of merchants of Bordeaux for the steamers to run between that port and New York, the vessels are to be 220 feet in the keel, width from 32 to 36 feet in the beam, and 21 to 22 feet in depth; they are to measure from 2,090 to 2,650 tons, are to be moved by engines of 450-horse power, and are to carry a crew of 67 individuals. The report calculates on an average of 60 passengers each trip, which would generally occupy 16 days, and the charge of passage is estimated at 1,000fr. The total capital required for the constructing and establishing one such vessel is estimated at 1,400,000fr., and the annual net profit resulting from seven voyages at from 200,000fr. to 280,000fr.

Spain.—A Barcelona letter of the 21st December states that the French merchants in that city had just presented a handsome sword to M. Gaufier d'Arc, the French Consul, in testimony of the good services he has so long rendered them. This gentleman, the letter adds, has forwarded to the Government at home a project for establishing a line of steamers to run from Marseilles to Barcelona, Cadiz, and the Canaries, thence to cross the Atlantic to Martinique and Cuba, and so to return home. Each vessel would carry engines of 200 horse power, would start the first day of each month, and, according to his estimate, would only cost 25,000f. on its voyage out and home.

Germany.—Arrangements are being made for extending the steam navigation of the Danube from Ratisbon to Ulm. If the undertaking succeeds, and there appears little doubt of it, the distance between these two cities may be performed in a single day, and from Ulm to Vienna in three days. This operation will open the Danube from its nearest navigable point to the Rhine, and thus offer the readiest mode of communication between London and Constantinople.—*Journal de Francfort.*

Holland.—Amsterdam, Dec. 29.—We hear that the English steam-boats will soon be obliged to come to Scheveningen. It is to be hoped for the sake of travellers that measures will be adopted to prevent the ground of complaint which existed last year.

The *Basle Gazette* says a second line of steamers is to be set up next spring between that city and Strasburg.

Gottingen.—A German paper gives the speech of the King of Sweden in reply to one of the numerous addresses presented to him in the course of his progress through his dominions. His Majesty told the authorities of Gothenburgh that he only awaited the concurrence of the British Government, to establish a regular communication by steam between Sweden and England.

PROGRESS OF RAILWAYS.

South Eastern Railway.—In the neighbourhood of Tonbridge the cuttings and embankments are proceeding with vigour, and a considerable quantity of brickwork, in culverts and occupation bridges, is completed and in progress. The culverts vary in diameter from 2 to 12 feet. At Dover the works are proceeding with great vigour. In another page of our present number will be found some particulars of the manner of carrying on the operations at this place.

Great Western Railway.—To make up for the time which has been lost on the Great Western Railroad near Reading, upwards of 100 extra workmen are now employed, who work at night by fire-light.

Manchester and Birmingham Railway.—The viaduct across the valley and river at Congleton has been let to Messrs. Nowell and Sons, Dewsbury, for £110,000. The length is 1030 yards, and the greatest height 98 feet 6 inches. It is to be finished in two years and a half.

Liverpool and Manchester Railway.—At the last half yearly general meeting of the proprietors of the Liverpool and Manchester railway, which took place on Tuesday, 22d January, in the Cotton Sales' Room, Exchange-buildings, the report stated that there had been an increased traffic in every branch as compared with the corresponding period in the preceding year; and that in the department of merchandise this result had been contributed to by the revival of trade from the depression under which it had laboured. Between Liverpool and Birmingham the traffic had also increased, and since the 31st of October last, the North Union railway had been opened for the conveyance of passengers, though arrangements for the transportation of goods had not yet been made, and perhaps no correct idea could yet be formed of the extent of the coach traffic from what had taken place in two months of the worst period of the year. The report concluded by stating that the directors intended to apply to Parliament, in the coming session for a bill empowering them to form a junction line, through the town of Salford, to Leeds. A draft of the bill would be drawn up and submitted to Parliament; and after the bill had been once read, the whole subject of the extension of the railway to Leeds, will then be brought before the proprietors.

The receipts for the half-year were:—

Coaching department	£79,277
Merchandise	54,215
Coals	3,200
Total receipts	£136,692
The total expenditure for the same period was	80,978
Leaving a balance of	£55,714

The largest items amongst the disbursements were—coach department, £11,061; carrying ditto, £11,189; coals, £743; engineering department, £26,427; carting £3,072. The accounts further stated that to the net profit of £55,714, there was to be added the sum of £853, being the balance after providing for last year's dividend, and thus making a total of £56,567. The total amount of shares were equal to 10,496 £100 shares; and the directors recommended that a dividend of £5 per cent. should be paid, which would leave a balance of £4,092.

ENGINEERING WORKS.

The Coffer Dam of the new Houses of Parliament was enclosed on the 24th of December last, since that time the men have been actively employed in clearing away the silt within the coffer; a fine stratum of gravel covers the whole site, and that part where the river wall is to be erected is now being excavated down to the clay substratum for the foundation, the dam stands remarkably firm, there are very little signs of leakage in any part of it. We shall, in our next number, give some account of the works in progress.

Dover, Jan. 13.—For the last few days past our harbour's mouth has been so completely choked up with shingle, in consequence of the prevalence of southerly and westerly gales, that all ingress or egress of vessels, foreign or domestic, may be said to have been entirely cut off. Even the small class of government packets have been compelled either to put into Ramsgate harbour, or to anchor in the Downs, there to await the precarious chance of our inefficient sluicing power enabling them to effect an entrance by the next tide. The sluices have been run to night. The only effect these playthings seem to have is to throw the beach in a heap a few yards beyond the pier-head at low water, that it may be thrown back into its old position each succeeding surge as the tide returns.

Caledonian Canal.—We are happy to learn that R. Steuart, Esq., one of the Lords of the Treasury, visited the Caledonian Canal lately, and we believe government seriously contemplates completing this great work, and rendering it suitable to the purposes originally contemplated, viz., to afford facilities of trade between the eastern and western coasts of the island, and the means of speedy and safe passage to vessels from the east coast of America, and the west coast to the Baltic. Even in its present state, we learn a good many vessels of this class have passed lately, and the trade is daily increasing. When tug steam boats are established, we have no doubt it will afford government an ample revenue. It should be recollected the Forth and Clyde Canal did not pay the original speculators for many years after it was opened, but it is now one of the most profitable public works in the country.—*Inverness Herald.*

Embankment of the River Thames.—At a late Court of Common Council, a report was presented from the Navigation Committee, recommending the embankment of the Thames, and regulating the line of wharfs on both shores of the river. The following letter, written at the desire of the corporation by Mr. Remembrancer, and addressed to Alexander Mylne, Esq., one of the Commissioners of Woods and Forests, fully explains the objects sought to be attained:—

"Guildhall, Sept. 17, 1838.

"Sir,—I am requested by the Navigation Committee of the Corporation of London to state to you, for the information of the Commissioners of her Majesty's Woods, &c., that the great inconvenience occasioned by the accumulation of mud near the embankment of the new Houses of Parliament renders it necessary that some immediate step should be taken to obviate the same, and that the Navigation Committee consider that the annoyance can only be effectually removed by continuing the line of embankment. Under these circumstances the Navigation Committee are of opinion that a survey and plan should be made of the river Thames, for the purpose of ascertaining the most desirable line of embankment on both sides of the river from London-bridge to Vauxhall-bridge, and also the expenses of making the proposed embankment, and of excavating and deepening the bed of the river where required; and that a bill should be brought into Parliament in the next session for embanking the river Thames, according to a plan to be agreed on; in which power should be given to the Commissioners of Woods, &c., to embank the bed and soil of the river opposite the crown property, and that power should be given to the corporation either to embank themselves, or to permit the owners of the wharfs and property on each side of the river to embank, under their directions, upon such terms as may, upon consideration, be thought desirable; half of the expense of the survey and of the act of Parliament to be borne by the Commissioners of her Majesty's Woods, &c.

"Alexander Mylne, Esq." (Signed) "Edward Tyrrell."

The Lords of the Treasury have agreed to the above propositions, and have appointed Mr. James Walker, of 23, Great George-street, Westminster, to make the necessary surveys and estimates. The Corporation have approved of the nomination of Mr. Walker, and have given him, as a colleague, Mr. Stephen Leach, the clerk of the works of the Thames Navigation.

Artesian Wells.—At a meeting of the St. Pancras vestry, a motion, proposed by Mr. Vigors, was carried, to the effect, that each member of the vestry should sign a declaration strongly approving of the plan of supplying the borough of Marylebone with water by means of Artesian wells.

Hastings.—The project of forming a harbour here has, after many weeks' agitation and excitement, been abandoned, so far at least as respects the idea of going to Parliament for a bill in the approaching session.—*Brighton Gazette.*

Mount's Bay Breakwater.—A very numerous and highly respectable meeting was held at the Town Hall, Penzance, on Tuesday, the 15th January, to take into consideration the propriety of memorialising her Majesty's government for the protection of life and property, and the promotion of important national objects, by the immediate construction of a breakwater in the Mount's Bay. It was stated that the breakwater would require 2,813,175 tons of stone, at 1s., being 140,658*l.* 15s., and for completing the slope, 1,108,529 tons at 1s. 3d., or 69,233*l.* 1s. 3d.—making the total cost, with ten per cent. for contingencies, 230,995*l.* 18s. 3d.

Menai Bridge.—So many contradictory reports have appeared relative to this noble structure, and particularly as to the degree of damage it has sustained in the late storm, that we are glad to avail ourselves of the communication of a friend, who visited the bridge on Thursday last. He writes:—"I have this moment returned from visiting the Menai Bridge, and have now the pleasure of acquainting you that the communication with Anglesea is again open; the mails, cars, and carriages, having passed over in perfect safety since Friday last. This applies, however, only to the division of roadway least injured by the hurricane—the other part is expected to be completed in a week or ten days. It is intended to strengthen, considerably, the vertical rods. The flooring, also, which was heretofore of common plank, four or five inches in thickness, will now be twelve and eighteen inches, and of Baltic timber. The broken vertical rods are being replaced, and part of the sunken flooring on the roadway, which suffered most, are completed. The main chains, which prove the stability of the suspension principle, have remained firm as the rocks in which they are embedded.—*Morning Chronicle.*

Portpatrick.—The late dreadful gale has considerably damaged the extensive works at Portpatrick, which our readers are aware have been carrying on for a considerable length of time at that place. In particular the pier-head, on which the harbour commissioners had erected a light-house, has been undermined; and the light-house is in such imminent danger, that the light-keeper narrowly escaped, and the light has since been transferred to the old tower, which is in a more sheltered position, in the interior of the harbour.

Scotch School of Engineering.—In the Scottish Naval and Military Academy is a professor of civil engineering and of the accessory branches.

Improvement of Leith Harbour.—Our readers will learn with much satisfaction, that the Lords of her Majesty's Treasury have been pleased to direct Messrs. Cubitt and Walker, jointly forthwith to proceed to Leith, regarding the projected improvement of the harbour; and we anxiously hope that the report of two engineers of such acknowledged ability and experience will put an end to all doubts and difficulties on the subject, in the minds of well-informed persons, and that after the report of these gentlemen is made, no farther obstacle from any quarter will be thrown in the way, that no partial interests or local prejudices will any longer be suffered to retard an immediate commencement of this long desired and necessary work for increasing the trade of the port of Leith, and promoting the prosperity, not only of the city and county of Edinburgh, but of a large portion of Scotland, that harbour being a great transit port. It is much to be wished that such energetic measures may be adopted by the engineers as will enable the commissioners to advertise in time for contractors, so that the work may be begun early in the spring. Not a day should be lost in securing the advantage of a low-water pier as near Leith as may be consistent with the general interests of trade and commerce.—*Edinburgh paper.*

Filtration of Water on a Great Scale.—In a recent number of the proceedings of the Institute of France, it is mentioned that a trial has been made of Fouvielli's filtering apparatus, working under the enormous pressure of 70 mitres, or nearly 230 feet of water. Four sets of apparatus, each about five feet high by three feet eight inches in diameter, have been set to work at Belleville and at La Villette. The water after passing through them possesses perfect limpidity, and it does not appear that this great pressure occasions any derangement of the filtering materials, whether the water be passing through them in the direction it takes in the process of filtration, or when the current is reversed during the time of cleansing, which occupies only a few minutes. The daily produce of the four filters is 177,408 gallons.

PUBLIC BUILDINGS AND IMPROVEMENTS.

Consecration of the New Church at Cheadle.—On Saturday last the new parish church at Cheadle was consecrated by the Lord Bishop of Hereford. It is a very splendid edifice, in the Gothic style, containing nave, side aisles, chancel and tower, at the west end, and will seat 1,500 persons. It is built by subscription.—*Staffordshire Gazette.*

The new staircase of *Buckingham Palace* is completed. It is more light and elegant than the former one, and gives access to the magnificent picture gallery. Some projected improvements have been deferred *sine die*, owing to the early return of the court to town.

Hyde Park.—A quadruple row of elms, forming three distinct malls, has just been planted, with much taste and judgment, at the eastern end of Hyde-park, and will, in a few years, add greatly to the beauty of that favourite resort.

St. Paul's Covent-garden.—The new school-house, erected in Hart-street, Covent-garden, cost nearly 2,000*l.*, towards which the Duke of Bedford has largely contributed. The school will comfortably accommodate, on three separate floors, 300 boys, 200 girls, and 200 infants, on week days; and 400 children are instructed by 35 gratuitous teachers, on Sundays.

The Late City of London Tavern.—The Wesleyan Methodists have purchased the City of London Tavern, Bishopsgate-street, for the sum of 15,000*l.* A part of the spacious building, which is freehold, is to be appropriated to meetings for business on their missionary and other benevolent undertakings; a portion being reserved for public worship.

The New National School of St. George the Martyr, Southwark.—The building is of Gothic architecture, consisting of a centre and two wings; the former comprises two school-rooms, one for the girls, and the other for the boys, calculated to hold upwards of 800 children. The wings will form residences for the masters and mistresses of the schools. The architect, Mr. White, spared no pains in making it a handsome and permanent building.

A New Road.—Application, it is said, will be made to Parliament, next session, of a bill for the purpose of forming a new road from Eaton-square to Kensington. The road is intended to cross Sloane-street, Alexander-square, and thence to the gardens of Gloucester Lodge, the residence of the late Mr. Canning; thence to the Addison-road; and to terminate at Kensington. The length will be two miles.

The Goldsmiths' Company, at their own expense, are about to erect a new church, adjoining their almshouses at East Acton, for the accommodation of the company's numerous tenants, and their aged poor in that establishment. The Bishop of London, as Lord of the Manor, presents them with a ring of bells and an organ.

Surrey Lunatic Asylum.—This building has been contracted for by Messrs. Baker at the sum of £39,370.—William Mozely, Esq., is the architect.

The equestrian statue of the Duke of Wellington, which excited so much attention at the Duke of Rutland's grand party at Belvoir Castle, was designed and modelled by Mr. Edmund Cotterill, and was manufactured by Messrs. Garrards.

Ascot Grand Stand.—The first stone of this building was laid on Wednesday last by Lord Errol, one of the trustees, in the presence of a large and distinguished company. The contract is taken by a Mr. Cuthill, who is under penalty to complete the structure by the 20th of May, so that the public may calculate on finding ample accommodation by the next meeting. The sum raised by 100*l.* shares is 10,000*l.*, part of which will be paid off yearly, until the stand is free, when it will become the property of the trustees for the benefit of the race fund.

Chester.—In consequence of the falling of a part of the buttresses from the tower of the venerable cathedral at Chester, the south transept was much injured, and the timbers burst through and broken to pieces.

Leeds.—A magnificent hall is to be erected in this town for the society of *New Odd Fellows*, from the designs of Messrs. Perkins and Backhouse, architects.

York Castle, the barracks, and the venerable cathedral, were injured by the late storm; in the latter, some of the valuable windows have been partially damaged, and such was the force of the wind that the lead roofing was driven a considerable distance from the building.

Birmingham, Storm.—The top of the Town-hall is roofed with lead, nearly three-fourths of which is torn off. A newly-erected chimney of the vitriol works, upwards, of 300 feet high, was partially blown down.

Dumfries, Storm.—Five stones have been displaced from the spire of St. Michael's and as it has long been off the plummet line, serious fears are entertained for its future safety. The same remark applies to the wooden top of the Mid-steeple, and all the churches on both sides of the river have been more or less damaged, not excepting St. Mary's.

Dublin, Storm.—The ball which surmounted the spire of St. Patrick's Cathedral was blown down, providentially without doing mischief. It had been out of perpendicular a considerable time, and fell within the railing in the North Close. About 27 years ago the former ball fell, carrying with it several feet of the spire.

Ireland.—The Earl of Dunraven is completing a magnificent mansion at Adare Abbey, upon which 40,000*l.* will have been expended. Lord Clarina is making an outlay of 10,000*l.* upon valuable improvements at the hereditary seat, Elm-park. William Mansell, Esq., has commenced large improvements at the ancient mansion and romantic demesne of Tervoe. General Lord Bloomfield, a beautiful mansion and villa near Newport. Sir Lucius O'Brien, Bart., still further embellishing the splendid residence of his ancestors, at Dromoland. Mr. Barrington building a mansion at Cannercullen.—*Limerick Chronicle.*

The Juvenile Prison at Parkhurst, Isle of Wight, being now finished, received its first fifty inmates in December, from the hulks at Portsmouth.

FOREIGN INTELLIGENCE.

Paris.—The commission which was appointed to examine and report upon the new fire-proof machinery (consisting of Col. Paulin, M. Rohault, M. Maynich, and M. Simonet) met on Friday, Jan. 11th. Their instructions are to furnish a report, with a view to the introduction of this *perfectionnement* in theatrical mechanism, as well into the proposed new theatres as into those already constructed.

The large paintings in the church of the Madeleine, by Messrs. Ziegler, Abel de Pujol, &c., are nearly finished; the sculpture, gilding, and incrustations in marble are almost completed; the altars, pulpit, baptistry, and *banc d'œuvre* are nearly placed; and the great bronze doors are rapidly approaching to completion. It is expected that the building will be inaugurated in the fêtes of next July.

New French Copyright Bill.—The author of a drawing, picture, a work of sculpture, architecture, or any other work of the same description, shall alone have the right of reproducing or authorising the reproducing of it, by engraving, or in any other way. This right shall last during the author's whole life. After his death, his widow, heirs, or representatives shall enjoy it, conformably to the provisions established in the first paragraph of this present law. The authors of the works just mentioned, or their representatives, may cede the right secured to them, retaining, nevertheless, the property of the work; but, in case the original work be sold, the exclusive right of authorising the reproducing of it by engraving or any other means shall be transferred to the purchaser, if no stipulation to the contrary exists.

Immense wooden galleries are now being erected in the square of the Champs Elysées, for the impending exhibition of the produce of French manufacture.

Naples.—According to letters from Palermo of the 24th Dec., referred to in *Le Commerce*, the King of Naples, previous to his departure from Sicily, published a variety of decrees relative to the establishment of cemeteries, without the precincts of towns, the opening of a number of roads, &c.

Napoleon Column.—The *Journal de la Corse* states, that the works on the column which is to be erected in honour of Napoleon, near the house in which he was born at Ajaccio, are going on with rapidity. The column will be formed of a single block of the granite of the country 50 feet long, and will be surmounted by a statue of the Emperor.

Dutch Dikes.—In the island of Beverland, which is only fifteen miles in length by seven in breadth, there are 200 miles of dikes or artificial embankments.—*Chambers' Edinburgh Journal.*

Steam Dock-yard in Holland.—About a mile above Rotterdam, on our right, we noticed Finjord, a considerable steam building station, where at present a large number of men are employed, many of them upon an iron steam-boat of great magnitude.—*Chambers' Edinburgh Journal.*

Bruges Road.—A new road is in the process of construction betwixt Bruges and Calais. It will be much shorter than any other now existing, and direct, except in one part, where, on account of the mobile nature of the gravelly soil, a circuit of three miles is rendered unavoidable.

Haarlem Lake.—It seems that there is a very great diversity of opinion in the sections of the two chambers respecting the project for draining the Lake of Haarlem.

Hamburgh.—A private letter states that during the late tremendous gale, the harbour of this place had been almost entirely destroyed, nearly every pile having been torn away; the whole town had been inundated.

In the dominions of the King of Wirtemberg a royal theatre is to be built at Stütgard, and a smaller theatre, to be completed next year, at Kanstadt, within a few miles of the former town. Professer Zaüht, who lately visited England, is the architect of the new theatres.

A grand theatre is about to be built at Dresden, at the public expense, for the performance of German and Italian operas.

The Statue of Goethe, executed at Milan, arrived a few days since at Frankfort.

The celebrated Bavarian painter, M. Cornelius, who has lately visited Paris, has been made a Knight of the Legion of Honour, and since elected Foreign Associate of the Royal Academy of the Fine Arts, in lieu of the late distinguished composer, Zingarelli.

Copenhagen, Jan. 5.—The King has removed the principal obstacles to the erection of the Thorwaldsen museum, by alloting to that purpose a building consisting of two wings, and another portion of the palace of Christianburg.

Greece.—An advantageous discovery for the state has been lately made in the mines of Kumi, a better sort of coal than that as yet worked having been found.

Road to the Red Sea.—We learn by letters from Alexandria, that 800 Europeans crossed the isthmus of Suez last year, on their passage to and from India; and that a regular coach conveyance will be soon established between the shores of the Levant and the nearest point for embarkation on the borders of the Red Sea.

Pennsylvania Public Works.—The amount expended in 1837, by the state of Pennsylvania, in public works, was, for canals and railways, 1,733,442 dollars, and for turnpikes, 118,160 dd., being about 400,000*l*. The receipts were, canal lotts, 415,681 dols., railway lotts, 335,827.

NEW PATENTS.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 24TH OF DECEMBER, 1838, AND THE 29TH OF JANUARY, 1839.

Samuel Clegg, of Sidmouth-street, Gray's Inn-road, Engineer, for "A new Improvement in Valves and the combination of them with Machinery."—3rd January; 6 months to specify.

Henry Robert Abraham, of Keppel-street, Russell-square, Architect, for "Improvements in Apparatus applicable to Steam-boilers."—3rd January; 6 months.

Thomas Nicholas Raper, of Greek-street, Soho, Gentleman, for "Improvements in rendering Fabrics and Leather Waterproof."—3rd January; 6 months.

Abel Morrall, of Studley, Needle Maker, for "Certain Improvements in the Making or Manufacturing of Needles, and in the Machinery or Apparatus employed therein."—3rd January; 6 months.

Louis Mathurin Busson du Maurier, of Lombard-street, Gentleman, for "Improvements in the construction of Springs for Carriages."—3rd January; 6 months.

Miles Berry, of Chancery-lane, for "Certain Improvements in Rotatory Engines to be worked by Steam or other Fluids.—4th January; 6 months.

William Hickling Burnett, of Wharton-street, Bagnigge Wells-road, Gentlemen, for "New and Improved Machinery for Sawing, Planing, Groving, and other preparing and working Wood for certain purposes."—8th January: 6 months.

Joseph Clisild Daniell, of Limphey Stoke, Wilts, for "An Improved Method of weaving Woollen Cloths and Cloths made of Wool together with other materials."—9th January; 6 months.

Moses Poole, of Lincoln's Inn, Gentleman, for "Certain Improvements in Clogs."—11th January: 6 months.

John Howarth, of Aldermanbury, Manufacturer, for "Certain Improvements in Machinery in Spinning, Roving, Doubling, and Twisting Cotton, and other fibrous materials."—11th January; 6 months.

John Ashton, of Manchester, Silk Manufacturer, for "An Improvement or Improvements in Manufacturing Plush of Silk or other fibrous materials."—11th January; 6 months.

John Swain Worth, of Manchester, Merchant, for "An Improved Machine for Preparing and Cleaning Wool for Manufacturing Purposes."—11th January; 6 months.

William Newton, of Chancery-lane, for "Certain Improvements in Machines for Drilling Land or Sowing Grain and Seeds of different descriptions."—11th January; 6 months.

Francis Brewin, of the Old Kent-road, Tanner, for "Certain Improvements in using Materials employed in Tanning, and preparing the same for other useful purposes."—11th January; 6 months.

Robert Logan, of Trafalgar-square, for "A new Cloth or Cloths constructed from Cocoa Nut Fibre, and for certain Improvements in preparing such fibrous materials for the same and other purposes."—11th January; 6 months.

William Ponsford, of Wangye-house, Essex, gentleman, for "Improvements in the Manufacture of Hats, and an Improved Description of Felt suitable for Hats and various other useful purposes, and Improvements in preparing the Material or Materials chiefly used in the Manufacture of such felt."—Jan. 12; six months.

Edwin Marten, of the village of Brasted, Kent, plumber, for "An Improved Method of Laying covering composed of Lead or other Metal on the Roofs of Houses or other Buildings, with Drains, whereby the part of the Water falling on such roof which would otherwise penetrate, is carried off, and rolls and seams are rendered unnecessary."—Jan. 12; six months.

Joseph Burch, of Bankside, Blackfriars, calico printer, for "Certain Improvements in printing Cotton, Woollen, Paper and other Fabrics and Materials."—Jan. 15; six months.

William Witham, of Huddersfield, machinist, for "Improvements in Engines to be worked by Steam-water or other fluids."—Jan. 15; six months.

Hugh Ford Bacon, of Fen Drayton, Cambridge, for "Improvement or Improvements in Apparatus for regulating the Flow or Supply of Gas through Pipes to Gas Burners, with a view to uniformity of supply."—Jan. 17; six months.

William Holme Heginbotham, of Stockport, gentleman, for "Certain Improvements in Machinery or Apparatus for propelling Boats or other Vessels, to be employed either for Marine or Inland Navigation, and to be worked by steam or other power."—Jan. 17; six months.

William Newton, of Chancery-lane, Civil Engineer, for "Certain Improvements in Engines, to be worked by Air or other Gases."—Jan. 17; six months.

Oglethorpe Wakelin Barratt, of Birmingham, Metal Gilder, for "Certain Improvements in the process of decomposing Muriate of Soda, for the Manufacture of Mineral Alkali and other valuable products."—Jan. 19; six months.

Joseph Garnett, of Haslingden, Dyer, for "Certain Improvements in Machinery or Apparatus for carding Cotton, Flax, Wool, or any other fibrous substances."—Jan. 19; six months.

Richard Dugdale, of Paris, now residing at Manchester-street, Middlesex, Engineer, for "Method or Methods of increasing the security, tenacity and strength of Beams, Axles, Rods and other articles made of Iron and Steel."—Jan. 19; six months.

Caleb Bedells, of Leicester, Manufacturer, for "Improvements in Gloves, Stockings and other Articles of Hosiery."—Jan. 21; two months.

John Coope Haddan, of Baring-place, Waterloo-road, Surrey, Civil Engineer, for "Improvements in Machinery or apparatus for propelling Vessels and Boats by Steam or other power."—Jan. 22; six months.

George Stevens, of Stowmarket, Brewer, for "Certain Improvements in Stoves."—Jan. 22; six months.

Thomas Dowling, of Chapel-place, Oxford-street, gentleman, for "Improvements in preparing Metals for the prevention of Oxidation."—Jan. 24; six months.

John Harrocks Ainsworth, of Halliwell, Lancaster, Bleacher, for "Certain Improvements in Machinery or Apparatus for Stretching, Drying and Finishing Woven Fabrics."—Jan. 24; six months.

Robert Copland, of Courland, Wandsworth-road, Surrey, Esquire, for "Improvements in Water-wheels."—24th January; 6 months.

Pierre Jean Isidore Verdure, of the Sabloniere Hotel, Leicester-square, Gentleman, for "Improvements in the Manufacture of Starch, and in the Machinery for preparing and in employing of the refuse matters obtained in such manufacture."—25th January; 6 months.

John Howard Kyan, of Cheltenham, Esquire, and William Hyatt, of Lower Fountain-place, City-road, Engineer, for "Improvements in Steam Engines."—29th January; 6 months.

John Hillard, of Bread-street, Cheapside, Merchant, for "Certain Improvements in Machinery and Apparatus for Making and Manufacturing Screws."—29th January; 6 months.

William Lukyn, of Lower Cowley House, Oxford, Dentist, for "Certain Improvements in applying and attaching Artificial and Natural Teeth."—29th January; 6 months.

TO CORRESPONDENTS.

We have received several communications on the subject of engineering education. We had conceived that we had gone into the subject at sufficient length, but as these communications call for a reopening of the question we intend to go into it at greater extent next month. We had commenced a reply this month, but on account of the pressure of matter we are obliged to defer it until the next number.

We regret that we are obliged to postpone Mr. Tait's communication on Improvements in Railways. Likewise several other communications. We will endeavour to make up the arrears in our next journal.

In reply to the inquiry of the Country Subscriber respecting the Oxford-street pavement, we must observe that each party has laid down his specimen at his own expense, and that the present experiment is not to try the expense but the durability and working of the different systems.

Subscribers are particularly requested to complete their sets of numbers for the first volume immediately.

We shall feel obliged to the profession if they will forward us accounts of works in progress, new inventions and discoveries; and particularly if our country subscribers will send us any newspaper containing any matter relative to the objects of our Journal.

Books for review must be sent early in the month; communications prior to the 20th; and advertisements before the 26th instant.

*** The first volume may be had bound in cloth, and lettered in gold, price 17s

PONT DU CARROUSEL, PARIS.

ENGINEER, M. POLONCEAU.

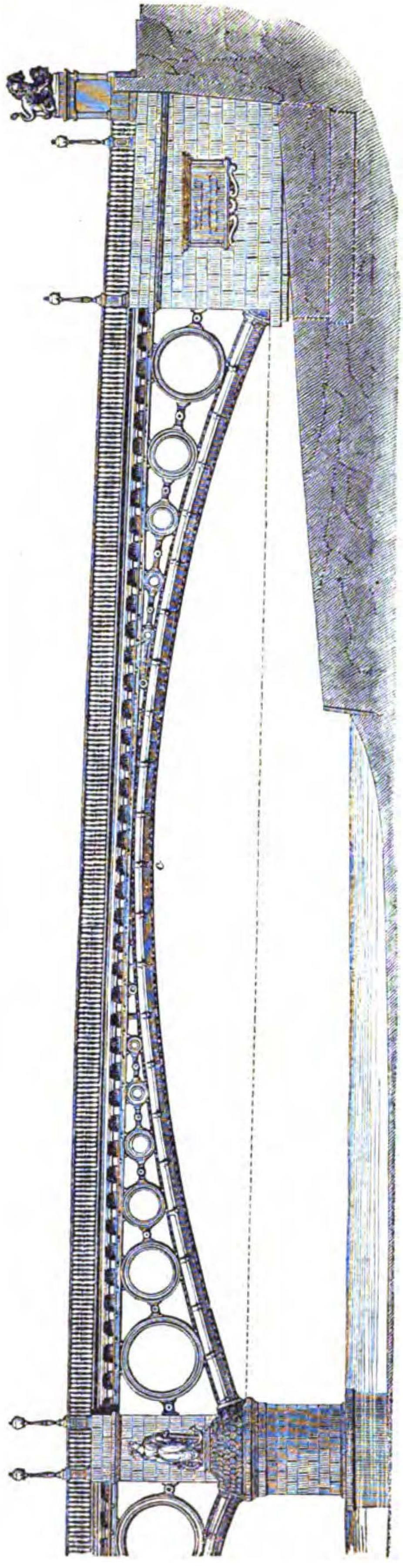


Fig. 1. Elevation of one of the Side Arches and Abutment.

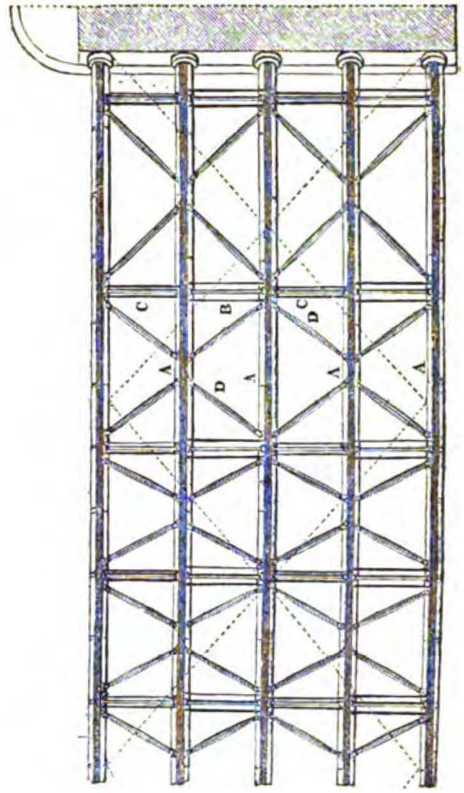


Fig. 3. Plan of Ribs below Roadway.

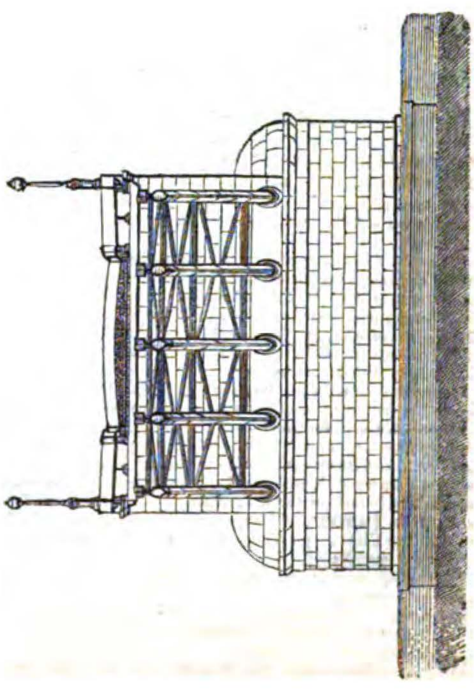


Fig. 2. Section of Arch and Elevation of Abutment.

Fig. 6. Section of Beam.

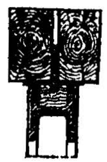


Fig. 5. Elevation of Cornice.

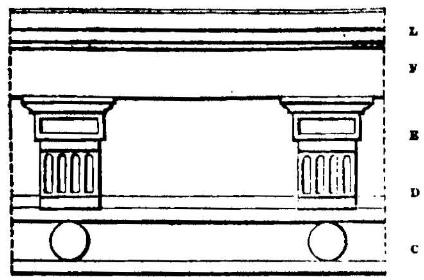


Fig. 4. Section of Road and Foot Path over Arch.

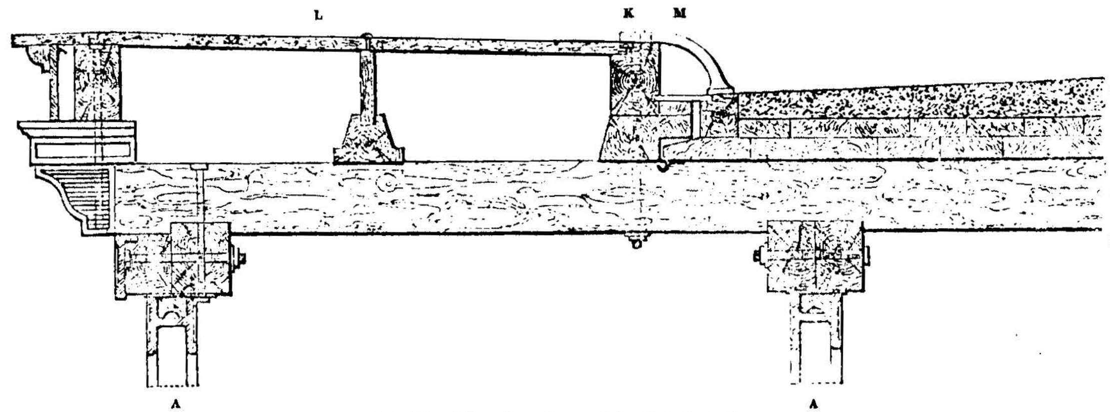
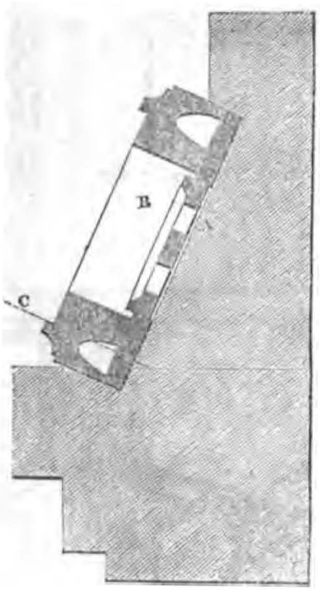


Fig. 7. Section of Abutment.



Figs. 8 and 9. Elevation and Section of back Abutment Plate.

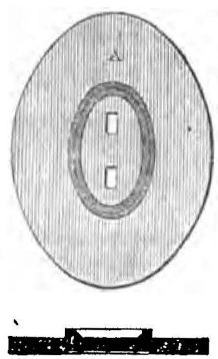
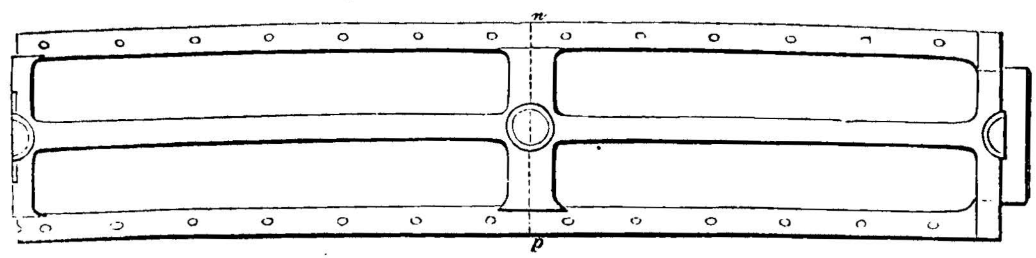


Fig. 16 Elevation of one of the Tubular Ribs.



Figs. 14 and 15. Elevation and Section of a Ring.

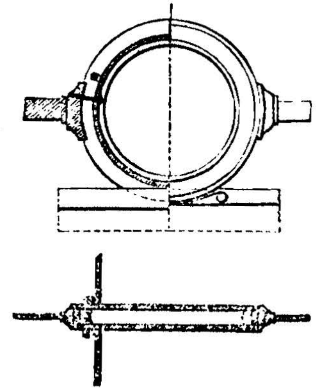


Fig. 17. Section of one of the Tubular Ribs.

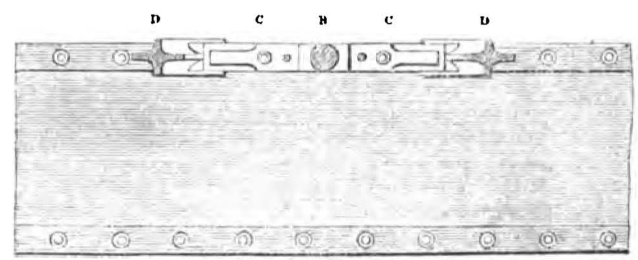


Fig. 10. Section of Rim to Abutment Plate.

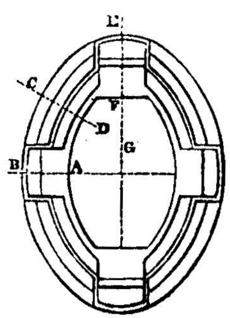


Fig. 11. Fig. 12. Fig. 13.

Scale of French Metres.

2 1 0 1

Scale of Feet, Fig. 4 to 18.

0 1 2 3 4 5 6 7 8 9 10

Fig 18. Plan of the Top of one of the Ribs, Cross Stays, Ties, and Diagonal Braces.

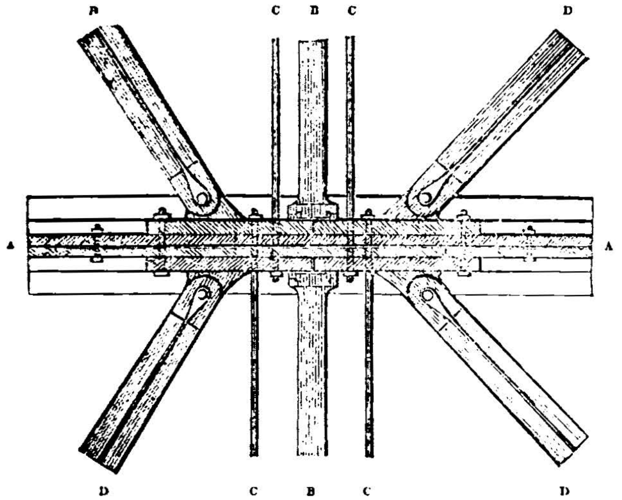
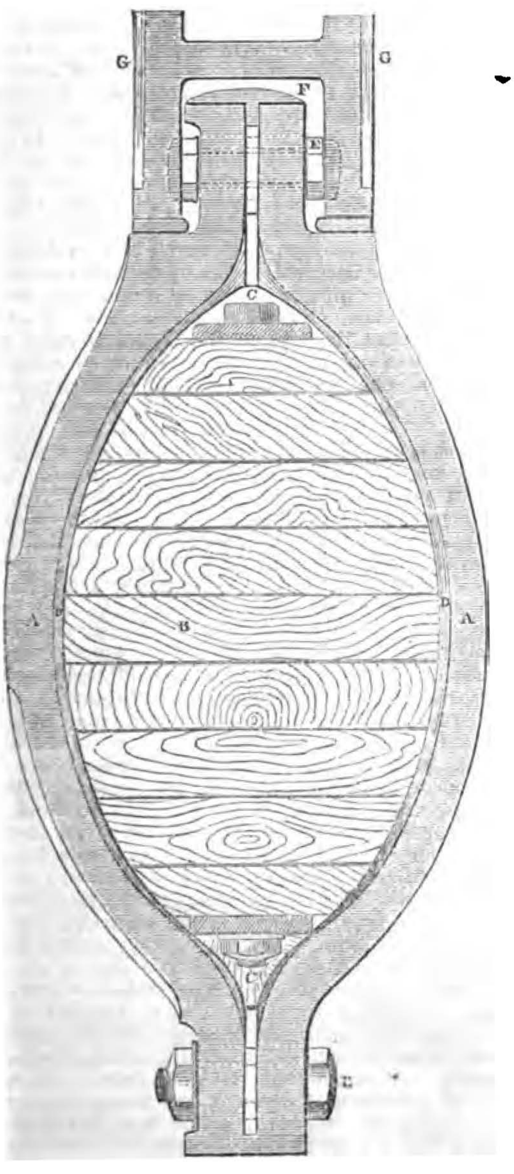


Fig. 19. Section of the Rib upon an enlarged Scale.



BRIDGE OF THE CARROUSEL AT PARIS.

REFERENCES TO THE DRAWINGS.

Fig. 1. Elevation of one of the *side* arches, span, 156 feet; rise, 15 feet 6 inches; and width of pier, 13 feet.

Fig. 2. Section of the arch, and elevation of pier, breadth of roadway, 17 feet, and two foot-paths, each 9 feet; total width, 35 feet.

Fig. 3. Plan of ribs of the arch, shown more at large in figure 18. Similar letters in figures 3, 17, and 18, refer to similar parts.

Fig. 4. Section of part of the roadway and footpath over the arch. A, the upper part of the cast-iron rings (figures 14 and 15).—B, two flitches of oak timber, 12 inches by 8 inches, forming the longitudinal bearers or girders; they are bolted together with nut and screw bolts.—C, external plates, the inner plate 10 by 12 inches, and the outer plate 8 by 10 inches, bolted together; on the face is a cast iron paneled fascia, forming part of the cornices.—D, transverse bearers or joists, 12 by 10 inches, placed 4 fee 4 inches apart from centre to centre; on the ends are cast-iron caps, forming a modillion to the cornice.—E, a cast-iron moulded capping to the modillion.—F, longitudinal plate, 8 by 12 inches, to carry the edge of foot-path and iron railing, with a fascia and moulding to form the cornice.—G, a block, 12 by 8 inches.—H, longitudinal bearer, 12½ by 2½ inches under centre of footpath, with a plate 12½ by 8 inches to carry curb of footpath, and rebated out to form an aperture for the water from the roadway to escape. K, curb, 8 by 12 inches.—L, planking of footpath, with a narrow slip of iron let in flush on the edge.—M, iron guards bolted down to curbs.—Curb to roadway, 6 by 7 inches, splayed on the top.—P, planking of oak 4 inches thick.—Q, planking of fir 3 inches thick.—R, road materials.

Fig. 5. Elevation of cornice, 3 feet 10 inches high; similar letters refer to similar parts, as in figure 4.

Fig. 6. Section of one of the longitudinal beams in the centre.

Fig. 7. Section of the abutment.—A, stone springer, the face cut to an angle of 66°.—B, iron abutment plate, with 2 mortice holes, as shown in fig. 89. C, rim of abutment plate, forming a socket; the section of this rim is shown in figs. 11, 12, and 13.

Figs. 8 & 9. Elevation and section of the back plate, with 2 mortice holes.

Fig. 10. Elevation of the front plate or rim, forming the socket.

Fig. 11. Section of rim round abutment plate, across A. to B.

Fig. 12. Ditto ... ... across C. to D.

Fig. 13. Ditto ... ... across E. to F.

Fig. 14. Elevation and section of one of the rings and connecting pieces or stays between the rings.

Fig. 15. Horizontal section and plan of ditto.

Fig. 16. Elevation of one of the external lengths of the tubular ribs of cast iron, 13 feet 9 inches long, and 2 feet 9 inches deep, including flanges.

Fig. 17. Elevation of the inside ribs, showing the section of the bolts and ribs.

Fig. 18. Plan of top of one of the ribs, showing the edge of the flanges and connexions.—A, iron tubular rib.—B, cast-iron hollow cylinders, 4½ inches diameter, forming stays between the ribs.—C, wrought-iron bolts or ties, 1¼ inches diameter, with nuts and screws.—D, cast-iron diagonal braces, with feathers, average 9 by 5½ inches, and a groove at the ends, fitting on, and bolted to the connecting pieces, screwed to both sides of the upper flange of the tubular ribs; similar letters refer to similar parts in figure 17.

Fig. 19. An enlarged section of rib, drawn to a scale of two inches to the foot. A, cast-iron casing.—B, nine thicknesses of timber, bent into a curvilinear form, and bolted together with nut and screw bolts, C C.—D, coating of asphalte.—E E, nut and screw bolts, connecting the two cheeks of the iron rib, with thin slips of wood between the flanges.—F, capping of asphalte.—G, lower part of one of the iron rings, which carries the longitudinal bearers, as shown in fig. 4.

This bridge was constructed under the direction of M. Polenceau, engineer. It was commenced in the year 1834, and completed in 1836. It forms a communication over the Seine, between the Place du Carrousel by the Quai du Louvre and the Quai Voltaire. The bridge presents some novel features in its construction, so as to merit the attention of the profession. It is constructed of timber and iron, with stone-cased piers and abutments. The bridge consists of three arches, forming portions of an ellipsis. One only is shown in the accompanying drawings. The centre arch is 187 feet span, and 16½ feet rise; and the two side arches 156 feet span, and 15½ feet rise. The total length of the bridge, including piers and abutments, is 558 feet, and the breadth of the roadway 35 feet. The whole length of the bridge in its design forms a flat arch. The chord line of the side arches is slightly removed from the horizontal, so that a line drawn from the springing at the pier to the springing at the abutment would make an angle of one degree with the horizon. The chord of the middle arch is horizontal.

The piers are cased with hewn sandstone, and filled in with concrete. They are also erected on a foundation of concrete, and protected with sheet piling. The cut-waters at each end of the piers are semi-circular, and are thus carried up to a level with the springing of the arch, and terminated with a hemispherical head. Above that level the piers are carried up square, and project about 1 foot 8 inches before the face of the arches. The abutments are also cased with stone, and founded on concrete. On account of the flatness of the bed of the river, they are projected forward on each side, so as to concentrate the stream in the centre of the river. By reference to the drawings it will be seen that the cornice of the abutments and piers follow the inclination of the roadway, which we consider an improvement in the architectural effect on the ordinary mode of making the cornice and parapet horizontal, as at London, Waterloo, and other bridges.

We will now proceed to describe the construction of the arches. It will be observed that at the springing of the ribs the abutments are splayed or inclined to an angle of 66 deg., and formed of solid masses of stone, on the face of which oval recesses are sunk to receive the abutment plates, and are made a little larger, to prevent the vibration of the bridge splitting the stone off the edges. The abutment plates are of cast-iron, in two pieces, as shown in figures 7 to 13, which were firmly bedded on to the stone with *Pouilly* cement. These plates form a socket for the reception of other plates bolted on to the ends of the ribs. They were firmly connected together, and the joints filled in with an iron cement, composed of 10 parts of cast-iron filings, 2·5 of sal ammoniac, 1·8 of sulphur, and 2·25 of metal dross. All these were in fine powders, carefully amalgamated, and mixed with only enough water to bring them to a good consistence. The weight of each under plate is about 850lbs., and of the upper plates 1220lbs.

In order to unite the firmness of iron with the elasticity of wood, and to insure both against the ravages of the weather, while lightness and cheapness of construction are equally consulted, M. Polenceau has adopted a peculiar form of rib, which has been called, from its shape, the "tubular rib." Each rib is formed in 22 lengths, and composed of two separate cheeks of cast iron, bolted together, with nine thicknesses of timber inside, as shown in figure 19. The interstices between the timber and iron are filled in with a composition of two parts of Seyssel asphalte, and one part of gas tar, which also forms a capping on the top of the ribs. In filling in the asphalte, the ribs were heated by means of portable furnaces, so that an opportunity was afforded of ascertaining the extreme expansion of the metal. The length of the ribs were of four kinds—outer and inner end pieces, and outer and inner middle pieces, varying in size, but were about 13 feet long on the average, and weighed about 2,800lbs. To insure their strength, each half rib was subjected to a double proof, first by suspending it by a fulcrum at each end, and then laying on it 40 tons; and again, by dropping a ton and a half on the middle, from a height of 1, 2, 4, and 6 yards: these lengths fit into each other, and are fastened together by screw-bolts and iron keys, as shown in figures 16 and 17.

Each arch is composed of five ribs, connected together by means of cross ties, bolts, and braces, as shown in figures 2 and 3, and more at large at figures 17 and 18: upon these ribs are placed the rings which carry the superstructure; they vary in size and weight, according to their position. Some of the larger are 10 feet diameter, and a ton and a half in weight; they are united to each other by bolts at their circumferences, as shown in figures 14 and 15. By reference to figure 19, it will be seen how the lower part of the ring rests upon the ribs; and, by figure 4, how the upper part carries the longitudinal bearers: these rings are again connected transversely, by means of bolts across the arch. They required considerable care in setting them, on account of the difference in the size of the arches. Some of them were found too large, and others too small.

The longitudinal bearers or girders consist of two flitches of oak, bolted together, as shown in figure 4: upon these are laid the transverse bearers or joists of oak, which are notched or calked, and bolted down; upon the joists are laid two thicknesses of planks, breaking joints over each other. The lower planks are of oak, and the upper of deal; over these are laid the road materials, and on the sides are flitches of timber, forming a curb and gutter to the roadway; the footpath is also formed of oak plants, raised on longitudinal bearers, as shown in figure 4, with a slip of iron let in flush, the whole length, and iron guards at distances, as shown in figure 4. The exterior of the footpath is converted into a cornice, an iron sunk fascia, being laid over the face of the lower longitudinal bearer, and on the ends of the joists, an iron capping, forming a modillion, with a moulded capping also of cast iron, and the upper part formed into a fascia with a bed molding under the edge of the footpath, the whole having a pleasing effect, as shown in figures 4 and 5. The plankings of the roadway were well rubbed over with tar, and all the joints carefully filled up with sand, and then rubbed with a mixture of equal parts of vegetable and gas tar. The material of the road is composed of white chalk stones and pebbles, the size of walnuts, and the whole surface of the roadway and footpaths finished with asphalte. On each side of the bridge, to protect the footpath, is an iron railing, with bars 7 inches apart. All the iron work of the bridge is painted with an iron grey colour, of M. Polenceau's invention.

We have endeavoured to explain the construction of this bridge in the best manner we are able, and for the better understanding of its details, we refer the reader to the drawings and references which will be found to contain the dimensions of most of the timber.

We are principally indebted for the drawings to our foreign contemporary, the "Algemeine Bauzeitung." We wish the editor of that publication would be as generous in acknowledging the numerous articles that have been copied by him from this journal.

GLENARM HARBOUR.

"The chief ruler or statesman that will be able to form asylum-harbours on the unsheltered and dangerous parts of the coast, and will also cause to be marked or beaconed, by the erection of granite towers, the dangerous rocks, the shoals, and the reefs which surround the shores of these kingdoms, thereby giving safety and security to the mariner in time of tempest and storm; also safety to the floating wealth of these realms, and the colonies thereunto belonging; also lessening the wail of the widow and the orphan throughout this maritime land—will not only receive the blessings of future generations for the erection of these works of mercy, tending so much to the preservation of life and property, but will also increase, to a great extent, the wealth, the power, and prosperity of the whole empire."—*Bald's Evidence on Harbours—Public Works—Ireland.*

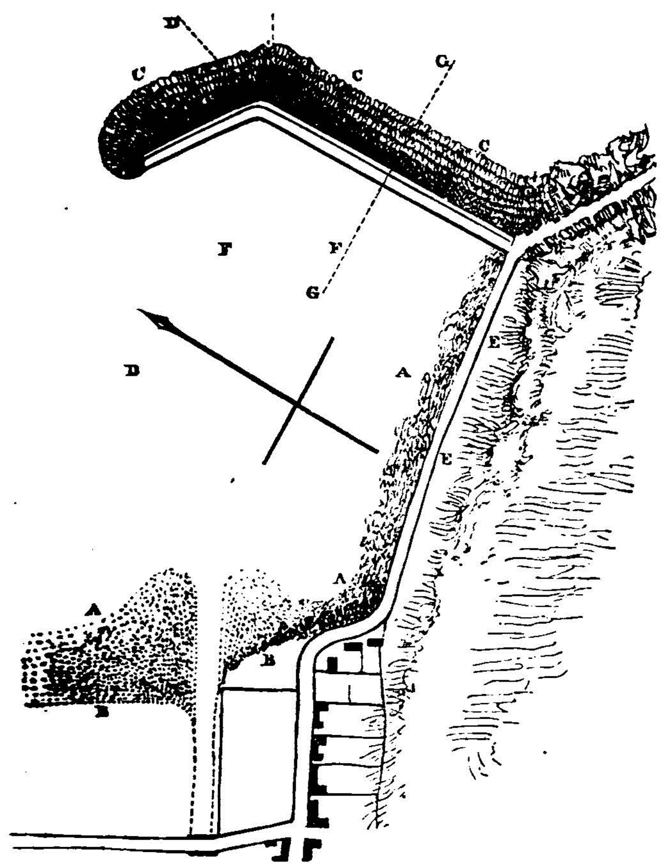
Report of WILLIAM BALD, Civil Engineer, F.R.S.E. & M.R.I.A., &c., *on the erection of a Pier, and formation of a Harbour in Glenarm Bay, in the County of Antrim, Ireland.*

The Bay of Glenarm, where the proposed Pier is intended to be erected, is situated on the north-east coast of the county of Antrim, bordering the North Channel. The bay is about half a mile in length, and three furlongs in breadth; containing an area of about 120 acres, and possessing a very considerable depth of water: four, five, and six fathoms. The bottom consists of clay, and is well known to be excellent holding-ground to all classes of ships. At the head of Glenarm Bay is situated the town of Glenarm, and the land surrounding the bay rises to a considerable elevation, and protects it from the prevailing southerly and westerly gales. This bay is, however, open to the channel sea from the north, north-east, east, and south-east; but the greatest run of sea into it is from the north and north-east. The Bay of Glenarm lies nearly opposite the entrance to the Clyde, offering very great facilities to commercial intercourse with all the towns situated on the west of Scotland; viz., Glasgow, Ayr, Greenock, &c. &c. It is distant from Larne 10 miles, and from Portrush nearly 50 miles; so that, in an extent of 60 miles of coast, there is no harbour, either artificial or natural, to afford protection to foreign traders, coasting vessels, or even to the smallest description of fishing craft. These reasons alone are sufficient to prove the great utility that would be derived from the erection of a harbour in Glenarm Bay; and it would, also, give shelter and security to a great portion of the floating wealth belonging to the Clyde, the port of Liverpool, the colonies of North America, and the West Indies, which would pass through the Irish Northern Channel. Besides affording an asylum for vessels overtaken by storm, it would give a port to the whole of the central portion of the county of Antrim, consisting of large districts of country highly cultivated, and producing great quantities of grain, and cattle of all kinds, and which could be cheaply exported, by means of a harbour at Glenarm; and, also, the valuable facility of importing into the country all the necessary articles of merchandize. Glenarm harbour would become the port to an extent of country containing not less than 400 square miles, also to the whole of the fertile interior country adjacent to the large and populous town of Ballymena, distant only 12 miles; and it would offer a ready means of direct commercial intercourse with the manufacturing and maritime districts of the Clyde in Scotland, both by steam and sailing vessels; and which would, in a very short period, create and augment the trade of the country to a very great extent. The Portrush and Derry steamers to Liverpool, touching at Glenarm, would establish a trade of vital importance to the merchants of Ballymena, particularly those engaged in the export of pork, butter, provisions, and linen cloth. The exportation of limestone from Glenarm to Scotland, and the importation of coal in return, would form a very lucrative and highly beneficial branch of trade between the countries. At present there is not more than about 6,000 tons of limestone exported, and only 1,000 tons of coal imported. There can be no doubt but the importation of coal would greatly increase, both for burning lime, and working the steam-engines and machinery in progress of erection at Ballymena and Broughshane, when the facility of procuring this necessary article from Britain is attained, by the construction of a harbour at Glenarm.

The port of Belfast is distant from Ballymena about 24 miles, and Glenarm is only 12 miles; and independent of the saving of land-carriage, it offers a greater facility to direct intercourse with Scotland, being nearer, and in a more direct line; besides, the depth of water within the proposed pier at Glenarm would enable vessels drawing even more than 20 feet of water to enter and depart at all times of tide. With these eminent and peculiar advantages, which no artificial harbour in Ireland possesses except two, there can be no doubt but a very considerable trade would arise, fully sufficient to repay any moderate expenditure which might be made in erecting a pier at Glenarm Bay.

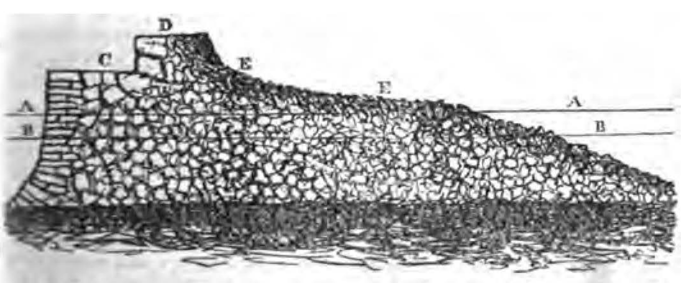
Design for a Harbour at Glenarm on the Coast of the County of Antrim, Ireland. Drawn to a scale of 800 feet to 1½ inch. By William Bald, F.R.S.E., M.R.I.A., and Civil Engineer.

Fig. 1. Plan of Harbour.



(The dotted line D)—N. by E ½ to the Mull of Cantire—(the other dotted line)—NE by E ½ E, to Craig of Ailsa—AAA, Low-water—BB, High-water—CCC, Proposed Pier or Breakwater—DD, Glenarm Bay—EE, Road-way—FF, Harbour—GG, Line of Transverse Section—H, Town of Glenarm.

Fig. 2. Transverse Section at GG, 190 feet broad at base; drawn to a scale of 55 feet to the inch.



AA, High-water—BB, Low-water—C, Top of Quay, 18 feet wide—D, Parapet at top, or Storm Pavement—EE, Breakwater Glacis, or Storm Pavement.

The Construction.—It is proposed to run out a rough pier, or breakwater, from Paixe's Point to a distance of 825 feet, then with a cant of 380 feet in length, as laid down, drawn and described in the chart containing the proposed design and sections of the breakwater, deposited with the clerk of the peace. This work would effectually protect and cover about 20 acres of the Bay of Glenarm, and give security and shelter to trading ships of all kinds. The depth of water within the mole would be from 22 to 30 feet at high water ordinary spring tides. There is an abundance of limestone, in extremely thick beds, lying close to the proposed site of the breakwater, easily wrought, and which will afford an abundance of very heavy and large material, at a remarkably cheap rate, to construct the breakwater with. It is proposed, simply to lay down an abundance of stone blocks, and then to permit the ocean, for some time during storms, to shape down the slopes of the sea-side of the mole to the angles of inclination which the momentum of that element would assign to such materials. And for the purposes of landing and shipping of goods, it is intended to construct a timber wharf within the pier or breakwater, leaving to some future period, when the trade would afford the means, the facing up of the inside of the pier with squared masonry. Even the construction of only 300 or 400 feet in length of the breakwater, would enable vessels to discharge and take in cargoes, so that an *immediate* traffic would be the result of even a very small portion of this work being done.

I have drawn out two estimates: one for an extension of 1,205 feet in length—amount, £17,312 16*s.* 8*d.*; the second estimate is for an extension of, in length, 825 feet—amount, £11,217 2*s.* 5*d.*

William Bald, *Civil Engineer.*

RALPH REDIVIVUS.—No. XIV.

THE LOWTHER ARCADE.

What advantages its more successful rival may possess in regard to its shops, I am not prepared to say, neither is it a question of any importance to my present purpose, but I may assert, almost without fear of contradiction from any one, that the Lowther as far surpasses the Burlington Arcade in its architectural appearance, as it falls short of it in the degree of favour and patronage it receives from the public. In itself this is but very indifferent praise, since it might be greatly superior to the other, and yet scarcely worthy of notice for any architectural merit. In fact, as a design, this piece of architecture displays both originality and taste, greatly more so than many things which it is the fashion to talk of, merely, it would seem, because they happen to have been cried up in books, and their praises have been repeated and handed down from one book-maker to another, without further examination or inquiry.

Before, however, I touch upon the merits of this arcade, I must be allowed to say something in regard to the class of buildings so denominated in this country. As far as public convenience is concerned, most assuredly nothing could be devised more suitable to such a climate as ours—that is, supposing it to deserve one tithe of the ill-natured, splenetic grumbling it provokes,—than a covered street, which bids defiance to the humours of the atmosphere, and where one may lounge and look at the shop-windows, though the rain should come down in torrents, or though an August sun should broil people as they walk along in the open streets. Here there is no disagreeable, perhaps I should say, delightful variety of mud, ankle-deep at one time, and hovering, but, alas! not golden, clouds of dust at another. On the contrary, there is a monotonous constancy of uniform, dry, and level pavement, where a lady might walk without soiling a white satin slipper. It is this monotony, I presume, that prejudices the public against such *galleries*, as they may very fairly be styled, more especially the one here under notice.

I say, "prejudices the public against them," because there is some reason to presume they have no attraction, or else by this time we should have many more erections of the same kind, if no where else, in those places at least that seem expressly intended for them, and unfit for anything else; for instance, the two squeezed-up alleys called the "Turnstiles," leading into Lincoln's-Inn fields; Middle-row, Holborn; Cranbourne-alley, and several others of the same description in Cornhill and its neighbourhood, all of them very greatly frequented thoroughfares, and more particularly disagreeable to pass through in wet weather. Were these widened, and covered in, and converted into galleries lined with the shops, they would, I think, be so many improvements; spots which one would be more inclined to visit than to avoid. It will, perhaps, be said that merely widening them would in many cases not be sufficient, some of these alleys being, if not absolutely crooked, full of windings and turnings. To which it may be replied, *tant mieux*, since, so far from presenting any obstacle, such deviations from an uninterrupted straight line would suggest many new ideas and combinations to an architect, that is, to an architect of any *nous* and taste. Indeed, much as I admire the Lowther Arcade, I by no means wish to behold any repetitions of the same subject, where there is so much scope for novelty and variety—far more, I will undertake to assert, than in almost any other class of buildings that can be mentioned. Styles that would be far too *outré* and fanciful for ordinary street architecture—decoration that can hardly be applied in exposed situations, might be employed here. Every variety of Gothic, from Norman to the latest Tudor—if I may be allowed to say so without getting a rap over the knuckles for apparently confounding Norman with Gothic—the Byzantine, Lombardic, Moorish, Italian, in all its most picturesque and peregrine fancies, or Pompeian, with its arabesque vagaries, or pure Greek, arrayed in all the pomp of its polychrome embellishment, might be resorted to at will. What displays of perspective might be obtained! what pictures! what painter-like effects! what magic witchery of light and shade! what—but this is raving—the very coinage and ecstacy of the brain. I am soaring on Pegasus—no, I have got astride on Astolfo's hippogriff, and have got nearly half way to the moon.

These harum-scarum flights do not do for sober company; my worthy progenitor, I am sure, never gave way to any thing of the kind. He never soared higher than a flying-fish, never frisked nor curvetted at all—at least, not more than a horse does in a mill. Therefore, let me endeavour to talk soberly; and, in sober seriousness, I would rather have a subject of this kind to work out according to my own i eas, than one of those grand affairs which seem to be of more mark and likelihood—at least, of far greater importance; yet which, after all, generally turn out to be very little better than common-place, magnified and displayed upon a more than common scale.

Highly satisfactory as the Lowther Arcade is in itself, it goes very little way towards showing what might be made of a gallery of this kind, by throwing greater play and variety into the plan, by increased loftiness in particular parts, by a sudden expansion in one place, and consequently the effect of contraction in another. A central rotunda, octagon, or hexagon, from which different vistas radiated, would even, were it in itself but of moderate size, give a piquant complexity to the design, and provide a point where some statue or other ornamental object would produce a striking effect. Though not exactly in the very best taste, the rotunda of the Passage Colbert, Paris, is a scenic, architectural bit, which shows what might be accomplished in that way. An upper aisle of shops on each side over those below might occasionally be adopted, and would certainly aid very much in varying the character of the particular design. In short, a place of this description is one that affords the utmost scope for invention, contrivance, and taste, and also for bringing together the features and characteristics of both external and internal architecture. There is hardly any kind of embellishment that might not be applied; and since the introduction of asphalt for that purpose, the very pavement might be made to assume a decorative character, and be variegated with ornamental patterns.

But how are such things to be done? Who is to pay for all this splendour? Taste is an exceedingly expensive and costly thing; such, at least, seems to be John Bull's opinion, although John is generally ready enough to suffer himself to be humbugged out of his money in paying double what he ought to do for many things that have no pretensions to taste at all. However, as I myself happen to have no taste whatever for the L. S. D. part of the business in such matters, I leave that consideration to other heads; merely remarking, that so far from there being any symptoms of lack of money among our shopkeepers to prevent their encouraging any architectural enterprise of the kind here mentioned, numbers of them seem to be contriving how to squander away as much as possible of that commodity, without any return to them for it in the shape of taste, for after all the extravagant expense they incur, they seldom, if ever, produce more than what is a little bedizened-out patch in a street or row of houses.

Perhaps I have been somewhat indiscreet—a rather blundering tactician in indulging my fancy as to what might be done, before I speak of what actually has been done. *N'importe:* the Lowther Arcade has sufficient merit of its own to satisfy as a very excellent specimen in itself: as a piece of design, it is in admirable keeping throughout; unostentatious, it is true, in its embellishments, but perfectly free from any alloy of that meanness which too frequently gives a strangely poverty-stricken air to buildings that, upon the whole, affect grandeur. Here nothing more appears to have been aimed at than what has been actually accomplished, which, as matters are generally managed, is certainly no little praise. There is none of that trumpery pomposity which may captivate the vulgar, yet disgusts the informed. And by vulgar I do not mean the vulgar in rank, but the vulgar in taste, let their rank be what it may. Neither are there any of those crude whims and whimsies that are occasionally palmed upon us as fancy and invention, I suppose, as for instance, that compound of heterogeneous absurdities and contradictions the front of the British Insurance-office. In the Lowther Arcade, on the contrary, the whole is made to appear perfectly of a piece, and the different parts so skilfully reconciled together, and harmonised one with the other, that what is Greek does not put us out of conceit with what is Italian, nor *vice versa*, does what is Italian shock us by the side of what is Greek. Without being in the least degree crowded, the whole design is well filled up. In regard to the mode in which this *passage* is covered over, I greatly question if there be in all the country a more beautiful ceiling vista than that here produced by the series of small pendentive domes, upon which the effect of the whole, as an architectural picture, so greatly depends. It is true, the sides consist merely of shops; but how much taste is shown in the design of the front contained within each compartment, more especially if compared with the insufferably dowdy office-windows, and those above them, that are thrust into the *grand* Ionic hall of the Post-office!—though, I suppose, it must still be allowed to pass as extremely classical, because it has no admixture whatever of Italian or any other style—save the genuine John Bull cockney. I have heard, upon what I consider very sufficient authority, that the designs for the Lowther Arcade were furnished by *a* Mr. Turner. Who the same Mr. Turner is, I know not, but I am sure he has no occasion to be ashamed of his name, at least not as far as this specimen of his talents is concerned with it.

CANDIDUS'S NOTE-BOOK.

FASCICULUS II.

"I must have liberty
Withal, as large a charter as the winds
To blow on whom I please."

I. Very few architects, I am sorry to say, appear at all to perceive the policy of diffusing a taste for, and some knowledge of, their art among the public. On the contrary, many have endeavoured, as far as in them lay, to deter non-professional persons from attempting to take it up as an agreeable study, by involving it in as much mystery as possible, and representing it as one that demands nothing less than a thorough acquaintance with the practical as well as the theoretical branch of it. This is not only decidedly foolish, but also untrue, and at variance with the common-sense course adopted in all analogous cases. You may allow a man to be an excellent judge of cookery, although you entertain so poor an opinion of his actual skill in it, that you would not trust him to dress a beef-steak. He may be a profound connoisseur in music, although unable to compose a single bar; a supreme authority in matters of painting, though he never put a palette upon his thumb; an oracle in matters of sculpture, though utterly ignorant of the processes of it; yet, if he ventures to meddle with architecture, to pretend to have an opinion of his own in regard to it, the chance is that he is scouted at once as a mere amateur, a conceited gentleman just capable of drawing out pretty-looking things on paper, and perhaps hardly capable of that. If, indeed, destitute of all practical knowledge, such a one assumes to himself the power of doing more, he very justly deserves to be treated as a shallow pretender, but surely not else. Did architects clearly see their own interests—I do not mean their own individual interest, because in many cases that may be best served by the greatest quantum of ignorance on the part of their employers, but the interest of their art—so far from discouraging amateurship, they would endeavour to render the whole public amateurs; because, unless there be something very peculiar and anomalous in regard to architecture, it should follow that the greater interest people in general take in it the greater relish they have for it, and the better they comprehend it, all the more likely are they to encourage it, and to encourage it with a proper feeling. As a body, therefore, the profession ought to do everything in their power to create and foster such taste; not only not to check it, but to encourage it with the utmost solicitude. At any rate, if they do not care to do so, they have no right to reproach the public with that ignorance, and consequent indifference in regard to architecture, which they themselves may be said to keep up, because they do nothing towards removing it. After all, of what are they afraid? Are they really apprehensive that the public would find out how very little talent, or original ability of any kind, is to be found in many buildings which, though they rank high as edifices, are entirely the work of the hands, not of the mind; in fact, do not require more, if even so much, contrivance and intelligence as is exhibited in many manufactures, which, nevertheless, are held to be purely mechanical?

II. Among those whimsical absurdities to which custom reconciles us is that of inscribing the name of the architect and the date of a building, not where they can be seen, and convey such information at a single glance, but where they must remain unseen for ever, namely, on the foundation-stone. Surely this practice must have been of Irish origin, since a more blundering one, and one more contrary to the plainest common-sense, can hardly be conceived. It is all very well to bury under ground the names of lord mayors, or other official worthies and dignitaries who *assist* at the ceremony of laying the first stone, because it matters not how soon they and everything relating to the childish *silver trowel part* of the business are forgotten; but that there should ever be any mystery, or room for doubt, as to who was really the architect of a building, when all uncertainty might be obviated by a mere name and date, is quite preposterous. Besides which, it is very likely to happen, and often does happen, that a structure is either rebuilt, or nearly, on its old foundations, and in such cases what becomes of the veracity of the inscription on the foundation-stone, should it ever come to light at all! Of this we have two notable instances in the Custom-house and the College of Surgeons, one of which has been, though only partially, altered so greatly for the worse from its original design, bad as that design was; and the other so metamorphosed from its original ugliness, as to be no longer the same buildings they first were. Had architects invariably made it the practice to affix their names to their works, we should now be at no loss to know who we are indebted to for those noble fabrics of olden time, which are the admiration of all. Why it should not be done I do not understand, when every engraver put his name to the plates he executes. Neither would there be any occasion that the architect's name should be ostentatiously displayed; for were it cut merely on the lintel or architrave of a door, the plat-band above a basement, or some member of that kind, it would not obtrude itself on the eye, nor discover itself till sought for.

III. It looks somewhat like inconsistency, that at the very time they wish architecture should be ranked as one of the fine arts, professional men should lay so much stress as they do, not merely upon the practical but upon the mere business-like part of it. Should you happen to express your surprise that Mr. Such-a-one obtains so much employment, when he has on no single occasion shown any talent, perhaps the reply will be, "Oh, but he is a most excellent man of business;" the plain English of which is, that let architects fancy themselves what they may, the public consider them in no other light than tradesmen; and in nine cases out of ten the public may be perfectly right. By no means do I assert that talent never finds employment, but it will, I believe, generally be found that it is the very last thing that recommends a man to it.

IV. That the Elizabethan style possesses historical interest I do not dispute, but that it offers any beauties or advantages to recommend it as a mode of architecture is what I must be allowed most flatly to deny. Its only principle is the disregard of all architectural principles, and of all artistic feeling. Very seldom do we meet with anything in it that can be termed really good, even estimated according to what may considered the leading taste of the examples themselves; or if there happen to be some particular feature that satisfies the eye, it is a mere solitary bit in the composition—although it is rather an abuse of term so to employ it—without anything to harmonise with it. Besides which, notwithstanding their licentiousness of design, the examples of this style betray great dearth of ideas and poverty of imagination; for, be it observed, there is a most wide difference between whimsies and fancies and fancy itself. I have met with some people who, in aiming at being amusingly lively, have only been impertinently frisky: nor is it a small degree of awkward friskiness that characterises the style in question, and causes it to appear even more dull than it else might. It is no more than right that we should know what it really was; but its examples ought to be held *in terrorem*, certainly not for imitation, except it be that species of imitation which enables an artist to appropriate what is available for better purposes, rejecting all the dross. Yet those who have of late served up this style to us have generally taken care to give us garbage and all. Certainly no one has hitherto attempted to discriminate between its best and worst qualities, or to point out what it offers for adaptation to our present purposes; since, leaving taste entirely out of the question, it has nothing whatever to recommend it as a mode of building adapted to our present habits and tastes; certainly nothing on the score of comfort and convenience, on that of economy perhaps even less, since it is only lavish profusion of decoration that can conceal its native ugliness. I may be told that it is a truly national style, that of our ancestors: national nonsense! So were trunk-hose and cumbersome ruffs at one time our national dress, yet what man—I do not say of sense, but in his senses—would wear them now, unless determined to establish for himself, at all hazards, a character for singularity? We do nothing else like our ancestors; then why, in the name of common sense, should we put ourselves into their most grotesque and unseemly architectural fashions? I have been led to these remarks by looking over the first number of Richardson's "Architectural Remains;" which work professes to give only the choicest specimens of the Elizabethan period; and is therefore likely to effect good, by exposing the unmitigated deformity that prevails even in what we must presume to be comparatively pure in taste, and happy in invention. It is a pity Mr. Richardson, who, of course, thinks very highly of John Thorpe's architectural taste, should not think sufficiently well of John Britton's literary taste as to take that learned sexagenarian's dedication to the queen as a model for his own. In regard, however, to the style—I do not mean of sexagenarian's dedications, but of Elizabethan architecture—I conceive it would be a far nobler object of ambition in the profession to aim at forming what might hereafter be distinguished as the *Victorian*, than to content themselves with aping what is called the Elizabethan.

V. Gwynn's "London and Westminster Improved" is pretty well known to every one by name, but it is not, perhaps, so generally known that that writer is apt to be occasionally rather satiric. The following remarks, for instance, are somewhat in the spirit of Boz. "The powers of inventive genius are at this time so very little attended to, and the examples of Greece and Rome so firmly established, that nothing more is required to model a youth of moderate parts into a complete architect, than to put him apprentice to a bricklayer, mason, or carpenter, under whose tuition he will acquire the great art of scoring straight lines, and setting off their proportions by scale and compasses. His servitude being ended, thus accomplished and furnished with the rudiments of architecture, he may be sent to Rome, and after he has spent the usual time for traversing that city, he may cause it to be inserted in the London papers, that Mr. Trowel, the *celebrated architect*, on account of his vast abilities, has had prodigious honours conferred upon him, and that he shortly intends to revisit his native country, to which he will no doubt do infinite honour." This, it must be allowed, is tolerably *Bozzish*, and convinces us that quackery was understood before our own time. "But to be serious," he continues, "where is the necessity for this parade of going to Rome? Is there a building, or even a fragment of a building in Greece, or Italy, of which we have not accurate draughts and measures? and is it not from these resources that *every modern building is compiled*, without variation, and without the least attempt at novelty or invention? It is very much to be questioned, if such an attempt was to be made, whether a thorough-bred connoisseur would vouchsafe to bestow a second look upon such a design." That Gwynn must have been a brave fellow! And yet, he might as well have "whistled to the winds," as attempt to correct the inveterate pedantry of "thorough-bred connoisseurs," and the servile commonplace routine of architects. What inconceivable magnitude of talent it must require to be able to follow a pattern, and make an exact copy of columns, and things of that sort! Is not that exactly your opinion "My Public"? Aye, to be sure it is.

PLAN FOR A HARBOUR AT HASTINGS.

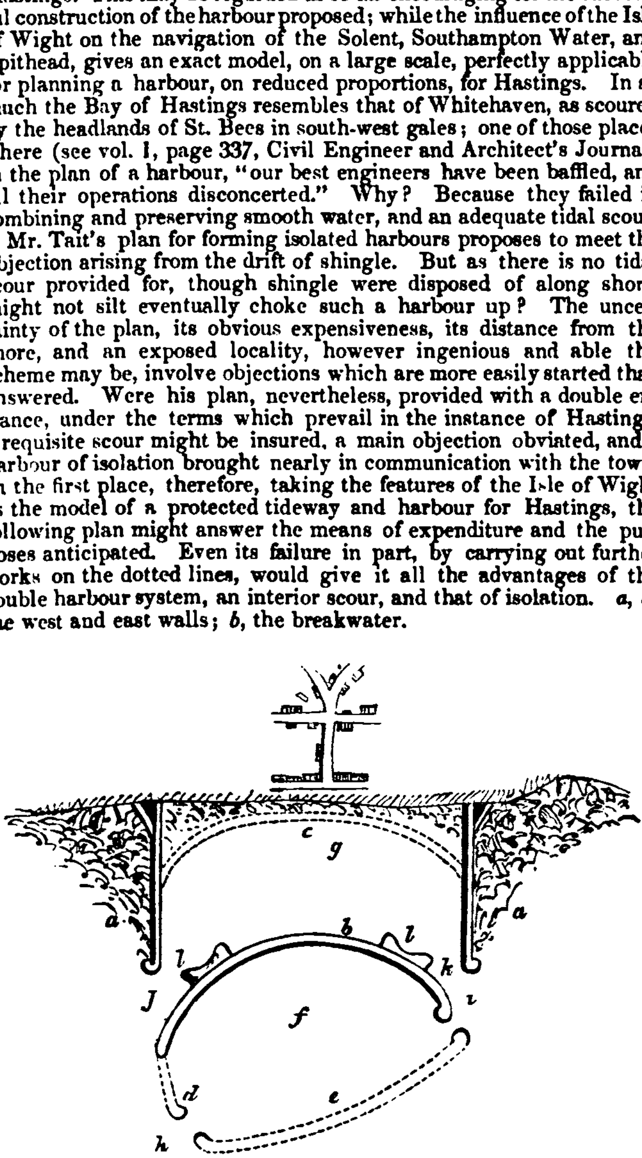
BY A SERIES OF PROGRESSIVE IMPROVEMENTS.

By John Rooke, Esq., Author of "Geology as a Science," &c. &c. Applied to Engineering.

The plan of a harbour for Hastings, noticed in "The Civil Engineer and Architect's Journal," vol. 1, page 338, being closely associated with the course of the tides in the British Channel, so must the tideway be first considered; as upon the influence of these tides, and the projections of land upon the line of shore, depends the success or failure of artificial works for the shelter of sea vessels. To the deeps of the Atlantic Ocean, the origin of tides in the British Channel may be distinctly traced; the line of tidal current is, therefore, from the westward, terminating in the strait of Dover, and there meeting the opposing balance of a tidewave from the North Sea. In the western section of the British Channel, the force of flood tides propelled eastward by a powerful pressure from the Atlantic Ocean, as a result of fluid action, drives beds of shingle forwards, which are necessarily deposited in the eastern section thereof, since the force of the reflux tides is less than that of the flux tides. As Hastings is situated in the eastern section of the British Channel, and not far distant from the terminus of a tidewave, which has a general course parallel to the trending of the shore, so shingle has a decided tendency to drive eastward, and convert harbours lying in its course into what have been designated "shingle traps." The cause of this result is plain. If the North Irish Channel, where the tidewave is continuous, be compared to the eastern section of the British Channel, where the tidewave terminates, we observe a marked difference. In the one, drift is propelled onwards, and deep water preserved, because a continuous scour prevails; while, in the other case, the scour terminates, and the drift is deposited. It is by observing these results, that in planning a harbour for Hastings, we ascertain the general laws by which the engineer must be guided.

We may now restrict our observations to the localities of the English coast, along the British Channel, and, passing from Land's End up to the Isle of Portland, we see that the Chesil Bank is the first decided accumulation of drifted shingle. The projection of this isle, however, forcing the tidewave southward, causes it to run northward, again, with great force, and scour out the Bay of Weymouth. We next observe the Isle of Wight taking the position and form of a geological deposit, projected from the headlands of St. Alban's and Durlestone; and opposite the great fresh-water drain of Southampton Water. In Swanage, Studland, Tollande, and Colwell Bays; and in the Solent, Southampton Water, and Spithead, a deflection of the tideway on shore, and, according to an angle of incidence, operating in conjunction with the Isle of Wight, has preserved deep water, and a continuous navigation. Between Selsey Bill and Beechey Head, we observe another of those undulations seaward, and deflections on the line of shore again, which have more or less preserved continuously deep water. Beechey Head having driven the tideway southward, necessarily causes it to run on shore again, according to the angle of incidence on which it has been pressed seaward, whence we are able to assign a distinct cause for the prevalence of permanently deep water in Pevensey Bay, and up to Hastings. This may be regarded as so far encouraging for the successful construction of the harbour proposed; while the influence of the Isle of Wight on the navigation of the Solent, Southampton Water, and Spithead, gives an exact model, on a large scale, perfectly applicable for planning a harbour, on reduced proportions, for Hastings. In so much the Bay of Hastings resembles that of Whitehaven, as scoured by the headlands of St. Bees in south-west gales; one of those places where (see vol. I, page 337, Civil Engineer and Architect's Journal) in the plan of a harbour, "our best engineers have been baffled, and all their operations disconcerted." Why? Because they failed in combining and preserving smooth water, and an adequate tidal scour.

Mr. Tait's plan for forming isolated harbours proposes to meet the objection arising from the drift of shingle. But as there is no tidal scour provided for, though shingle were disposed of along shore, might not silt eventually choke such a harbour up? The uncertainty of the plan, its obvious expensiveness, its distance from the shore, and an exposed locality, however ingenious and able the scheme may be, involve objections which are more easily started than answered. Were his plan, nevertheless, provided with a double entrance, under the terms which prevail in the instance of Hastings, a requisite scour might be insured, a main objection obviated, and a harbour of isolation brought nearly in communication with the town. In the first place, therefore, taking the features of the Isle of Wight as the model of a protected tideway and harbour for Hastings, the following plan might answer the means of expenditure and the purposes anticipated. Even its failure in part, by carrying out further works on the dotted lines, would give it all the advantages of the double harbour system, an interior scour, and that of isolation. *a, a*, the west and east walls; *b*, the breakwater.



In the foregoing outline, it is proposed that each succeeding step of the plan shall be determined or varied according to the practical results previously shown. In the first place, the breakwater *b* would be constructed when a scour would commence, of which the extent and direction should be closely watched. Next the west and east walls might be commenced and carried out according to the operations exhibited by the progress of the work. These finished, the interior scour of the harbour, if insufficient, would suggest the extension of the breakwater still further along the dotted line *d*, until the scour within the harbour should be sufficiently powerful, by which the plan of the harbour would bear a resemblance to the Isle of Wight pressing upon the waters of Southampton, the Solent, and Spithead. The scour thus established would then determine the position and figure of a quay on the side of the dotted line *c*; and if these various works, when combined as a whole, should fail in affording a harbour of refuge, then the dotted line, *e*, might be built in addition, and thus give an inner harbour, *g*, and an outer harbour, *f*, or partly an isolated harbour. Thus vessels taking refuge in the one, could be subsequently towed into the other by a steam-tug, if required; and docks might then be added as a security and convenience to the whole. On the plan here detailed, the entire works would be determined by practical results, errors would be corrected, and no step in the process need be regretted or retraced.

What has been here sketched out must, however, be considered merely as a free outline, subject to remodification in its details, rather than as an absolute or invariable plan. The convexity of the curved line, *b*, is intended to scour and preserve deep water along the line of the concave curve opposite thereto, marked *c*; and if the run of water along these curved walls were too powerful, such defect might be mitigated by adding undulating jetties at the dotted points, *l, l*. Ever keeping experimental results in view, the spaces of the entrances, *j* and *k*, and those of *h* and *i*, if called for, might be in some measure determined by such a rule.

Though the harbour, *g*, might appear somewhat exposed to either eastern or western gales of wind, from having double entrances, yet the smoothness of regulated water flowing in continuous lines obviates its rebound, and more than compensates the security which a single entrance affords. The breadth of water within the harbour, *g*, exceeding the space of the entrances, *j* and *k*, smooth water and an accumulation of silt would be a more likely objection than the excessive force of a passing and onward current. A material advantage in disposing the lines of walls in curves and diagonally, in place of at right angles to the course of the tideway, would be that of smoothing the water, easing the various works, cheapening their construction, and augmenting their security, besides directing the force of the tidewave on those points mainly where a scour might be desirable, and giving the greatest depth of water along the proposed line of wharf.

SCHOOL OF CIVIL AND PRACTICAL ENGINEERING,

AT THE SCOTCH NAVAL AND MILITARY ACADEMY, EDINBURGH.

We had prepared last month an account of the Engineering School at Edinburgh; but the pressure of other matter compelled its delay. We are now, however, by the kindness of T. Compton, Esq. (formerly of Woolwich), the Professor of Civil Engineering in the Academy, enabled to give a better description than would otherwise have been in our power. The class of civil engineering has been in activity since November, 1835, and consists of the departments of mapping and plan-drawing, construction, practical surveying, and administration, or the mode of making out specifications and estimates. The class is actively employed in summer in surveying the most interesting localities in the neighbourhood of Edinburgh; and its success under its able conductor has been such as to lead the directors to form a class for practical engineers. This is to be divided into the sections of drawing, pattern-making, moulding, and casting; millwright-work, theory and construction of steam-engines, miscellaneous machinery, boiler-making, and locomotive machinery. The course of instruction in this latter department is intended to be three or four years; and the terms thirty-two guineas the first year, twenty-four guineas the second, twelve guineas the third; and, if a fourth, six guineas; the fees payable quarterly, in advance. These terms are high; but, altogether, the institution, proceeding on a practical basis, is calculated to effect much good. We should wish, however, that it was in the power of the directors to place the institution within the reach of mechanics; as, with great liberality, they have thrown the school open to amateurs at three guineas per quarter. We think that it is well worthy of the attention of the directors to make instruction in the steam-engine a part of the course of their naval pupils, and also to afford facilities for the instruction of steam-boat engineers, which would be a more efficient measure for preventing accidents, than any quack laws and jobbing superintendents.

OBSERVATIONS ON THE IRISH RAILWAY COMMISSIONERS' REPORT.

With no unfriendly feeling either to the Irish Railway Commissioners, or to those professionally connected with them, we again make further observations on the Irish Railway Report, as a public document executed at the expense of the people.

Does not the following suggested distribution of railroads through Ireland exhibit a spirit of favouritism and partiality, when, for the southern division of Ireland, the Railway Commissioners have laid out 359 miles of railway, estimate 5,317,884*l*., and for the northern 152 miles, estimate 2,336,258*l*.; while no railway has been laid out for the centre of Ireland, nor for the whole province of Connaught?

In the September number of this Journal we took a general view of the Report; we showed that the general system of railways laid out through Ireland by the Commissioners was wrong; we also showed in correct detail numerous errors, both in the maps, plans, sections, and gradients, such as were sufficient not only to destroy the reputation of the work, as to its accuracy, but even affecting the very characters of the individuals who had incautiously compiled and published so erroneous a document. Those numerous and serious errors were laid before the public through the columns of our Journal six months ago, and have not been questioned or replied to in any published works to our knowledge, by any of the commissioners or their friends, no, nor even by the grandson of Charles Hutton, nor the *eleve* of Telford, deeply and seriously as it affects both of them, the Railway Commissioners, and even the Government, after an expenditure of nearly twenty thousand pounds, and a loss of more than two years' time.

We ask, what will the engineers of France and of America say in examining such an inaccurate production? Will they not justly exclaim, Behold, the people in the country of Newton, of Napier, and Maclaurin, are now so reduced in scientific acquirement, that they are not able to work accurately the simple operations of decimal arithmetic? Is it not humiliating to think that among the rulers of this great empire that so few individuals of scientific acquirement are to be found? Sir Davies Gilbert and Lord Oxmantown are men of science; the former has now nearly reached the maximum age allotted to man, while we regret that political influence has swept the latter from that position in the councils of the sovereign and the country which his talents and acquirements so pre-eminently entitled him to occupy, for to aid the advancement and the progress of those interests connected with the works of science and improvement, which so few could comprehend and understand so well among the representatives of the country. We are happy to have an opportunity of testifying our great regard and esteem for Lord Oxmantown, not only as a cultivator of science in its highest branches, but also of his devotion to the prosecution of practical mechanics. Has not one of the most distinguished *savans* of the empire declared—"That the sciences and the arts of England are in a wretched state of depression, and that their decline is mainly owing to the ignorance and supineness of the Government, to the injudicious organization of our scientific boards and institutions, to the indirect persecution of scientific and literary men, by their exclusion from all the honours of the state." And has it not been truly said that—"The young diplomacy of the American States was raised into distinction when Franklin took upon himself the functions of her ambassador, and France was at the zenith of her glory when the Marquis La Place was President of her Conservative Senate, Lagrange a Peer of France, and Carnot her Minister of War."

A few leading articles have appeared from time to time in the ministerial papers, praising the Irish Railway Report, but the acquirements of the editors of newspapers are such as to exclude them from being able to review such a work, and to those who understand such subjects, those leading articles must appear to have been put forward by the commissioners and their friends, to support their very objectionable system of Irish railway projects. It is remarkable that the government of the country found it necessary to employ a gentleman to travel through Ireland for the express purpose of praising this railway report, at various public meetings which had been held in that country —and this was actually acknowledged publicly by the individual so employed.

The "Quarterly Review" for January, 1839, contains an article on the Report of the Irish Railway Commissioners; but it contains nothing that had not been previously published or well known before, and it is only remarkable for introducing a vast variety of subjects totally irrelevant to the one it professes to discuss. We beg to observe, that Mr. David Stevenson never was at New Orleans, and that the information regarding the steamers at New Orleans, which the "Quarterly Review" quotes at page 6, is from the pen of Captain Basil Hall, who had visited New Orleans, and not from that of Mr. Stevenson, who had not been there; the statement of the "Quarterly" is, therefore, not correct. The observations made on the democratic institutions of the North American Republic at page 25, are not only quite unworthy of the intelligence of the age, but they are, in our opinion, unfounded and untrue. The property of the people of the United States of America is just as secure as that of the people of any other country. The laws which govern the free and independent states of the North American Republic are more likely to spread through the great American continent than those of the arbitrary and despotic governments of Europe; in all likelihood those principles of freedom which have been spreading so widely for the last 50 years, will yet be extended much more, and ameliorate the condition of the human race in the most remote and distant regions of the earth. Matters of a political kind we do not profess to discuss, and we regret to do so in any manner; but our excuse is, that for the American people of the United States we entertain the highest respect, and we therefore do not like to see them and their institutions calumniated in pages which profess and avow to be consecrated to the discussion of a scientific subject, and which our avocations oblige us to notice, and more particularly as an attempt will be made to convert the Irish railway monopoly into a political state job; it therefore becomes a sacred duty with us to expose it to the fullest public animadversion.

"We conceive the principal question in this inquiry to be—Does the report emanate from persons possessing, in the opinion of Europe, the requisite qualifications? We have, accordingly, taken some pains to inform ourselves upon this subject."—Quarterly Review, December, 1838.

The account given by the "Quarterly Review" on this very important matter, has established, in the clearest manner possible, that none of the Irish Railway Commissioners had ever executed any kind of railway works; and it therefore cannot fail to appear to those possessed of practical knowledge in railway engineering, that the nomination of such a railway board was a very extraordinary proceeding on the part of the executive; to depute such men to legislate on matters they never had been previously acquainted with, was certainly, to say the least of it, not an arrangement either consonant to reason, nor creditable to the wisdom of the government of this country. When the legislature had deemed such a commission necessary to lay out a system of railways for Ireland, why were not individuals of the highest practical skill in railway engineering, totally unconnected with Ireland, selected for such a purpose? And this service, we affirm, could have been accomplished in four months, and the reports, sections, plans, &c., might have been with ease delivered in less than eight months, while these Railway Commissioners required nearly two years, involving in its consequences a loss of *three years to Ireland* in the progress and extension of railways, inflicting a deep and lasting injury upon her prosperity, and the unemployed population of that country.

We are advocates that great works of national utility should originate with the people—we are inimical, in the highest degree, to legislative interference with anything, from the making of a steam-engine to that of the smallest article; we conceive it is the duty of a wise and a paternal Government to aid and assist public companies in their exertions and endeavours to execute works of public utility: but, on the other hand, if a Government once assumes the mantle of general manufacturer of steam-engines, engineer-general of railroads, &c., under an act of the legislature, then the rights and interests of all the industrious classes are directly invaded, a monopoly set up, and the spirit of enterprise, of invention, and improvement ceases, and all those vigorous trading impulses which have so eminently contributed to the wealth and to the prosperity of all free and enlightened countries, but particularly the great advantages which would result to Ireland by the introduction of English capitalists. We deny the right of the British Government to step in at the eleventh hour and interfere, except so far as the public interests may require, with either the English railway companies, or even those of Ireland, which have been formed, by men who have, in England, Scotland, and Ireland, congregated together, subscribed and risked capital, called into existence a new power, executed the most stupendous works with the most triumphant success, and all without the aid of a Royal commission. Will not the Government of this country read a lesson of wisdom from past events? Has not steam navigation across the Atlantic Ocean been achieved in the most satisfactory manner by private enterprise? Have not the river navigations, and also the whole of the canals of England, been executed by companies? Are not all the steam-vessels which cover, not only the British seas, but also those of Europe, entirely due to the successful enterprise of companies? And have not the noblest engineering works in the world been accomplished by private companies? Look at the bridges of Waterloo and Southwark; they will prove that the people are quite capable of executing works as stupendous and monumental as the pyramids of Egypt, but of a much more useful and noble kind. We are thoroughly convinced that wherever works of a public nature have been executed by the Government, they have not only been inferior to those now named, but they have also been attended with much more expense than if undertaken by private enterprise. If we look at the imperfect execution, *and unfinished state*, of the Caledonian Canal, after an expenditure of one million sterling, and thirty-five years of time, it is really not calculated to inspire people with confidence in the executive of the country, as either being the best or most competent authority to execute public works. Or, again, at the suspension-bridge erected over the straits of the Menai, a structure strongly characterised by its inferiority of strength and durability, as compared to those bridge-works erected either in ancient or modern times. This fragile and perishable work was constructed under Royal authority, and which the passing breeze not only dismantles and renders impassable, but is also fast consuming its strength by the vibratory motions to which it is constantly exposed, as well as the never-ceasing oxidation of the material which forms the main and imposing feature of that structure. The expense of the Holyhead-road and bridges is stated in the appendix, p. 366, of Sir Henry Parnell's book on roads, at £759,710. 6s. 11d. sterling, and the expense of the execution per mile of the road is from £4,000 to £5,000 sterling, and the tolls upon that road are much higher than upon any other road in England. We are not aware that Government toll-roads or Government steam-boats are cheaper to travel on, and voyage in, than those of private companies. For example, the fare from Dublin to Liverpool, in her Majesty's steam-vessels, is from five to ten shillings more than what is charged by the Dublin Company's steamers from the quays of Dublin; so much for Government cheapness.

It is not only painful to contemplate the odious monopoly of government in the post-office department, but it is really extremely injurious to this great commercial country that the postage of letters should be overwhelmed with so high a rate of duty. What insanity then to talk of the government of this country becoming constructors of railroads and carriers of passengers. "Legislation is not health but human welfare;" and the government of Great Britain has quite enough to do in legislating for this great empire and the colonies thereunto belonging, without interfering with projects which should be left entirely to the enterprise of the people under proper legislative restrictions for the good of the public.

Looking at France, one of the most powerful nations in Europe, and where by arbitrary authority the public works of that country had been placed under the controul of the state; are those works, we ask, more substantially executed, or kept in a better state of repair than those of Great Britain? Is it not allowed by every person who has travelled through England and France, that the roads of the former country are much better than those of the latter, and that the superiority in the velocity of travelling in Great Britain is well known and admitted to surpass that of any other country. It is also remarkable that our bridges, docks, harbours, canals, aye and also our railways, are, we venture to lay with pride, the most substantially executed, and the grandest works of the kind that the people of any nation in the world has yet executed. These noble engineering works astonish all travellers who have visited Great Britain; they announce the genius and enterprise of not only a great, but that of a free people, whose unparalleled activity and intelligence have not been fettered and withered by legislative enactments in the promotion of commerce, the increase of our national wealth, and the consequent greatness of this empire: and this may be justly attributed to perfect freedom being allowed to every kind of private enterprise under parliamentary regulation.

Let us examine how far the Railway Commissioners have been able to lay out a judicious system of railroads for the southern division of Ireland, and whether they have been able to do so upon better levels, and at a less expenditure of mileage than private companies.

First, to connect the cities of Dublin, Kilkenny, and Limerick, the following will show the extent of mileage and the gradients.

Length of mileage by the Railway Commissioners' lines.	M.	F.	Length of mileage by the Companies' lines.	M.	F.
Dublin to, Limerick chateristic gradient $\frac{1}{180}$	128	4	Dublin to Limerick, chateristic gradient $\frac{1}{330}$	111	0
Branch to Kilkenny, chateristic gradient $\frac{1}{300}$	26	4	Branch to Kilkenny $\frac{1}{200}$	28	0
	155	0		139	0
			Difference in favour of the Companies' lines	16	0

Hence it appears by these facts that the system of railways proposed by the Companies to connect Dublin, Kilkenny, and Limerick, would be sixteen miles shorter than the length of those railways proposed and recommended by the Railway Commissioners.

Again, taking Dublin, Kilkenny, Limerick, and Cork, and comparing the number of miles of Railways which will be required to connect them, first, by the system proposed by the Railway Commissioners, and secondly, by the Companies' system.

By the Railway Commissioners' system.	M.	F.	By the Companies' system.	M.	F.
Dublin to Limerick	128	4	Dublin to Limerick	111	0
Kilkenny branch	26	4	Kilkenny branch	28	0
Cork branch	76	7	Cork branch	68	4
Small Southern branch at Donahill	13	0			
	244	4		207	4
			Difference in favour of the Companies' lines	37	3

Here again, in comparing the Companies' lines of proposed railways with those laid out by the Railway Commissioners, there would be a saving of 37 miles 3 furlongs by adopting the Companies' system, which is very serious, viewed both as to the first expense of construction, and afterwards in working those lines of railroads.

We shall now exhibit the distances to be travelled in going from Dublin by Limerick to Cork, from Dublin to Kilkenny, and from Limerick to Cork, &c., by the Commissioners' lines and also by those proposed by the Companies.

By the Railway Commissioners' lines	M.	F.	By the Companies' lines	M.	F.	Diff. in favour of Companies' lines. M.	F.
Dublin to Limerick	128	4	Dublin to Limerick	111	0	17	4
Limerick to Cork	98	2½	Limerick to Cork	68	4	29	6½
Dublin to Kilkenny	82	0	Dublin to Kilkenny	75	0	7	0
Dublin to Limerick & Cork	226	6½	Dublin to Limerick and Cork	179	4	47	2½
Dublin to Waterford	144	2	Dublin to Waterford	103	0	41	2

The direct distance from Dublin to Cork by the Commissioners' line not passing through Limerick, would be 169 miles 5 furlongs; by the Company's line, passing through Limerick to Cork, would be 179 miles 4 furlongs; difference in favour of the Commissioners' line 9 miles 7 furlongs. Looking attentively at the above table, and also at the map of Ireland, it will appear that the Companies' lines possess many and great advantages over the Railway Commissioners' system of railways as laid out in the south of Ireland.

It appears by the Railway Commissioners' maps that a railway has been delineated on the map from Clonmel to Waterford, but in examining the estimates, it does not appear that any item of expense is to be found for constructing the continuation of the railroad from Clonmel to Waterford, distance 26½ miles, which, at 10,000*l.* per mile, would be 262,500*l.*, which is a serious error committed by the Railway Commissioners; for it is not possible to think that they ever thought of excluding the city of Waterford from the benefit of railway communication. In the Railway Report, appendix A, No. 1, page 11, it is there stated that no survey was made of the Limerick and Waterford line for the Commissioners further than Clonmel. This is certainly an extraordinary admission as regards the city of Waterford, containing 30,000 inhabitants, having an excellent port, an immense shipping of both sailing and steam vessels, and an export trade of more than two millions sterling.

In looking over the Railway Report we find it stated at page 41, that the distance from

Dublin to Cork	is 166	miles 5	furlongs
... to Limerick	125	4	
... to Waterford	141	2	
... to Kilkenny	79	0	

These distances are all incorrect, for in looking over the sections, the zero of mileage is placed *three miles* from the Dublin Post Office; and therefore three miles should be added to each of the above distances; for example Cork is 169 miles 5 furlongs from Dublin according to the figured sections given by the Railway Commissioners, and not 166 miles 5 furlongs, &c., &c.

At pages 104 and 105 of the Irish Railway Report, the powers of four locomotive engines are given. The diameter of the cylinders, the length of stroke of the pistons, diameter of the wheels, and the weight of the engines and tenders have also been stated.

"Now the whole power of these several engines is found by multiplying the area of their respective pistons by the pressure (64.7lbs.,) and then reducing this product to the circumference of the wheel."

"In this way it will be found that the whole power is:—Class first.

3755lbs.; class second, 2488lbs.; class third, 2337lbs.; class fourth, 2090lbs."

We have examined those calculations but have not found one of them correct.

CLASS 1.

$3\cdot1416 \times 54 = 169.64$, circumference of wheel,
$14^2 \times \cdot7854 \times 2 = 307\cdot876$, area of 2 pistons,
$2 \times 16 = 32$ inches, length of double stroke,
$307\cdot876 \times 64\cdot7 = 19919\cdot62896$, force applied on the pistons,
$\frac{169\cdot64}{32} = 5\cdot301$, ratio of the velocity of wheel and piston,
$\frac{19919\cdot62896}{5\cdot301} = 3757\cdot71$lbs. power applied to make the engine advance.

CLASS 2.

$12^2 \times \cdot7854 \times 2 = 226\cdot195$, area of 2 pistons,
$226\cdot195 \times 64\cdot7 = 14634\cdot816$, force applied on the pistons,
$\frac{3\cdot1416 \times 60}{2 \times 16} = 5\cdot890$, ratio of the velocity of the wheel and piston,
$\frac{14634\cdot816}{5\cdot890} = 2484$lbs. power applied to make the engine advance.

CLASS 3.

$11^2 \times \cdot7854 \times 2 = 190\cdot0668$, area of 2 pistons,
$190\cdot0668 \times 64\cdot7 = 12297\cdot32196$, force applied on the pistons,
$\frac{3\cdot1416 \times 60}{2 \times 18} = 5\cdot236$, ratio of the velocity of wheel and piston,
$\frac{12297\cdot32196}{5\cdot236} = 2348$lbs. power applied to make the engine advance

CLASS 4.

$11^2 \times \cdot7854 \times 2 = 190\cdot0668$, area of 2 pistons,
$190\cdot0668 \times 64\cdot7 = 12297\cdot32196$, force applied on the pistons,
$\frac{3\cdot1416 \times 60}{2 \times 16} = 5\cdot890$, ratio of the velocity of wheel and piston,
$\frac{12297\cdot32196}{5\cdot890} = 2087$lbs. power applied to make the engine advance.

"The gradients also, on the regulation of which so much depends, both in respect to the original cost and the ultimate value of the railway to the country, have been carefully gone over by one of the commissioners, in conjunction with the engineer, and in consequence several material alterations were made, which have much lessened the amount of the original estimate, without affecting; in an important manner, either the rapidity of intercourse or the commercial advantage."—Page 37, Railway Report.

In the September number of our journal for 1838, we printed a list of sixty-five errors found in the gradients, and upon a more full examination there will be found at least from forty to sixty more; this clearly shows that very little care or attention was bestowed by the commissioner and engineer who had examined and gone over the gradients; indeed, the very numerous errors found in the gradients are destructive to the character and accuracy of the Railway Report and Sections, although

"My Lords had full confidence, from the character of the gentlemen appointed to form the commission, that their inquiries would be conducted in a satisfactory manner."

We consider an alteration in gradients from one in 330, to one in 180, as most important, both as to rapidity of intercourse, and also as to commercial advantage, although the railway commissioners do not think so.

The same force of traction which is required to draw 100 tons up a rise of one in 330, would draw on the level 195 tons.

	tons.	lbs.	lbs.
	$100 \times 8 =$		800
	$\frac{100 \times 2240}{330} =$		679
Engine	$\frac{12 \times 2240}{330} =$		81
			1560 Total resistance not including the friction of the engine.

$\left(\frac{1560}{8} = 195 \text{ tons.}\right)$

The same force of traction which is required to draw 100 tons up a rise of one in 180 would draw on the level 274 tons.

		LBS.
100×8lbs. $= 800$lbs. friction at 8lbs. per ton.	. .	800
$\frac{100 \times 2240}{180} = 1244$lbs. gravity of the 100 tons (reduced to lbs.) on a plane inclined in the ratio of $\frac{1}{180}$		1244
$\frac{122 \times 2240}{180} = 149$lbs. gravity of the engine on the same plane		149
Total resistance not including the friction of the engine		2193

$\left(\frac{2193}{8} = 274 \text{ tons.}\right)$

This shows the difference between the rise of one in 330 and one in 180.

The load, tender, and engine, taken at 100 tons, and running at the rate of 20 miles per hour on the level plane, will, on ascending a slope of one in 330, run only at a rate of 14.20 miles per hour, and ascending a slope of one in 180, will run at a rate of 11·43 miles per hour.

An engine capable of evaporating 48 cubic feet of water per hour wil draw on the level plane 88·32 tons, at the rate of 20 miles per hour

up, 1 in 500 — 51·96 tons,		......
... 400 — 46·49 tons,		......
... 300 — 39·09 tons,		......
... 200 — 28·44 tons,		......
... 100 — 11·97 tons.		......

Woods on Railways. Page 578.

Looking at the levels which the surface of Ireland presents, we differ entirely with the Irish Railway Commissioners, as to adopting 1 in 180 as the characteristic gradient for the main trunk lines proposed to be laid out through that country; and we object still more so to 1 in a 100 for the great main line of railway laid out from Dublin to Cork, which appears by the Railway Commissioners' sections to be the characteristic gradient of that line, because an engine running up such a slope can only draw about one-eighth of the load that it can on the level plane; and running up 1 in 180 less than one third of the load it can draw on the horizontal plane. We are, therefore, thoroughly convinced that the Irish Railway Commissioners have not sufficiently studied this most important element in railway engineering; or has their limited knowledge of such a subject precluded them from being able to comprehend the vital advantages arising from the adoption of good gradients, even although attended with some expense in cutting and embanking?

In our journal for last September, we forcibly alluded to the very great injustice of not giving railway communication to the centre of Ireland, and also to the fertile province of Connaught; we stated our reasons why that province ought to participate in railway intercommunication, as well as the other provinces of Ireland. In the same number of the journal we stated our reasons fully against the line of railway projected by the commissioners from Dublin to Armagh, and we particularly observed that it ran parallel with the coast railway for nearly one hundred miles, and that it could not be possible that two such lines could exist, as one or other of tnem would be a total failure. Having with some attention sudied the commissioners' inland lines of railway from Dublin to Armagh and Enniskillen, we think that those projects recommended by them are extremely injudiciously planned; because, if an inland main trunk line was to be laid out from Dublin to Armagh, with a branch line to Enniskillen, and were it determined upon that the important trading town of Drogheda should be exclnded from railway communication with the capital, then lines of railway might have been chosen which would have united Dublin to Armagh and Enniskillen, with a saving of twenty-six miles of railway, which would be a great advantage as regards economy, not only in the first construction of these lines, but also in the working of them afterwards.

The system of main lines of railway, which have been proposed to be carried into effect by the various companies through the south of Ireland, possess superior advantages in connecting the various large cities together, than those recommended by the Irish Railway Commissioners. The lines proposed by the companies being much more expensive, and laying open a wider, a more populous, and a richer extent of Ireland's surface, with less mileage and better levels than the Irish railway commissioners' main lines appear to do. This fact has been established by the calculations already given; and by examining the Irish commissioners' index map of the proposed railways, there is to be seen a small triangular portion of country lying between Cahir and Hollycross which is completely encompassed by railways, amounting to more than 40 miles ln length, and which cannot fail to strike every engineer, who will take the trouble to examine the proposed system of Irish railways laid out by the commissioners, to be an extremely defective and objectionable one, as to the distribution of this intercommunication by railways through the southern division of Ireland, as far as regards the connecting of the cities of Dublin, Kilkenny, Limerick, and Cork; although the royal commissioners had before them a very sensible and also an ably written paper by a gentleman of the name of Sinclair, who seems to have studied the subject of railways with deep attention. He states in his letter addressed to Peter Barlow, printed in the Railway Report Appendix, A. No. 12, page 83, in which the following paragraph is to be found:—

"In laying out great or general lines of railway through a country, my experience of the system generally leads me to think, that it would be extremely desirable to carry such main lines so near to considerable towns as to *supersede the necessity of branches.*"

Let us hear what the royal commissioners say on this subject:— "It is not by selecting a line to some large town, and conferring upon it the imposing title of a grand trunk line, that the object for which we are contending is to be accomplished." Then, was it wrong to have connected Liverpool, Birmingham, and London together by one main line? Was it wrong to have connected Bristol and London by one direct main line, and titled it the Great Western? Nothing, in our opinion, is better than to have large cities at the termini of railways.

The system of railways which have been proposed in the south of Ireland by the Irish Railway Commissioners, has evidently been copied from a small map of Ireland, containing a proposed project for making a main line of railway between the harbours of Kingstown and Valentia; the map is dated London, May, 1835, and carries the signature of the person then engineer to the Dublin and Kingstown Railway Company; and to the activity of some of the members of that company has fame assigned so great an influence in the councils of the late Irish Railway Commission, not only in the drawing up of parts of the report itself, but also in the selection of the railway lines, as will appear by the small map alluded to; and so highly injurious did this appear to some of the individuals in high authority, that part of the report which had appeared in the first numbers printed, was altogether suppressed in those which subsequently appeared, and this gave rise to a discussion in the House of Commons, to which the Chancellor of the Exchequer was not able to give a satisfactory reply. This transaction alone is strong presumptive evidence of the partiality and favouritism which has characterized the proceedings of the Royal Irish Railway Commission.

We have been not a little surprised to find that one of the engineers who had advocated and laid out the line of railway from Dublin to Belfast, by Newry, along the sea shore, called the coast line of railway, appears also as the engineer and advocate for the railway commissioners' inland line extending from Dublin to Armagh and Belfast. The inland line of railway is well known to be the avowed and open opponent of the coast line of railway: we conceive this proceeding to be certainly an anomaly in the jurisprudence of civil engineering. It is beyond our comprehension how a professional man could conscientiously reconcile to himself such a proceeding, or continue to possess that respect due to the integrity of his character, in becoming the professional advocate of a competing line, destructive we should think to the interests of the Coast Line Company, by whom he was originally employed. On this subject we have already, in a very forcible manner, expressed our opinion that no engineer in the employment of any of the Irish railway companies should have been employed by the commissioners in laying out railways in Ireland, that they should have been careful to have kept themselves free from any hereafter observations which might be made as to such a proceeding; but, this fair and straightforward course could not be done in Ireland, no, not even by a royal railway commission; their proceedings could not be conducted without an open exhibition of partiality and favouritism by the employment both in the south and also in the north of the engineers of various competing and rival railway companies in Ireland.

It appears that two systems of railways have been laid out through the south of Ireland by the professional engineers employed by the commissioners; one to please the Royal Irish Railway Commissioners, the oth r to please the companies—those systems being at utter variance with each other; we ask would it not be proper to have those important differences first examined and investigated, and then decided by an impartial tribunal, composed of the highest engineering authority which could be found, totally unconnected with either the Royal Irish railway proceedings, or those of any existing Irish railway companies in Ireland.

It is remarkable that although Mr. Nimmo, Mr. Telford, Mr. Bald, Mr. Stephenson, and other eminent engineers who were professionally employed in Ireland, to report on railroads, and that their reports state, that an income profit would be derived from them of ten, twelve, and thirteen per cent.; yet, the Irish Railway Commissioners have not noticed those statements and valuable reports. Further it appears by a printed report of Mr. Griffiths (one of the railway commissioners) on the proposed Limerick and Cork railway, that it would pay a profit of $11\frac{1}{2}$ per cent., while on the other hand it deserves notice that the Irish Railway Commissioners state that the suggested railways in Ireland will only pay from $3\frac{1}{4}$ to 4 per cent.

"And through whose agency do the railway commissioners arrive at this conclusion? Why they employ Mr. Stanley, of the Stamp-office, to make their calculations; a person well qualified to close bankrupt books, and give the balance whichever way the parties pleased."—*Mr. O'Connell's Speech; House of Commons, 30th July*, 1838. And who has since been promoted to be Secretary to the Irish Poor Law Commissioners through the influence of the Chairman of the Grand Canal Company.

A cry has been set up by the jobbers in public money that Ireland is not able to maintain railroads. It may be observed that it has not yet been shown by any kind of well grounded facts, that such is the case. Because, the Kingstown Railway has been finished by private enterprise, aided by a loan from the state. The Ulster and Drogheda Railways are in progress of execution, and so would the Dublin and Kilkenny Railway, if it had not been checked in its course by the unfortunate publication of the Irish Railway Report, and also the Dublin and Limerick Railway. In all of which British capitalists had joined with the Irish companies, being perfectly satisfied, from accurate calculations, of a profitable result. Scotland has already made five railways, and there are five or six more in progress of execution in that country. And really we think that Ireland ought to be as well able to make her own railways by private enterprise, aided by British capital, as Scotland, if the public companies who have projected those works be not interfered with by the state.

Have not all the Steam Navigation Companies in Ireland been eminently successful? and are there not fleets of steamers sailing constantly from Cork, Waterford, Wexford, Dublin, Drogheda, Dundalk, Newry, Belfast, and Londonderry to the ports of Great Britain? Has not the Dublin Steam Packet Company alone raised five hundred thousand pounds sterling? And is not that company as well as all the others in a prosperous condition; these well attested facts speak volumes as to what private enterprise could effect in Ireland, *if it be not shackled by state monopoly*, but aided and assisted by judicious loans from the Government, or as recommended by a Select Committee of the House of Commons in 1835.

As a high authority of the value of private enterprise applied to public undertakings, we beg to quote the following observations of Dr. Bowring:—

"Dr. Bowring observed, there appeared to him to be a unanimous feeling in favour of the communication by the Red Sea. At present it was most imperfectly carried on; but by the formation of such a company as that proposed, it would be greatly improved. An objection had been offered to the proposed plan of its being left to a private company, but that it should be taken up by the Government. He had always thought that English commerce had spread to the extent that it had owing to its being *left to private enterprise*, and that it was desirable that it should be as independent of the Government as possible. It was in this spirit that the French merchants replied to the great minister of the day, when he asked what he could do for their advantage, when they said, 'Leave us alone.' (Hear, hear. hear.)"—*Steam Communication with India. Public Meeting held at the London Tavern, Bishopsgate-street, Jan. 18th*, 1839.

Looking at the total exclusion of central Ireland, and the whole province of Connaught, from railway intercommunication by the commissioners, and at the imperfect and objectional system of railways laid out by them, both in the south and in the north of Ireland—again, at the numerous errors existing in the commissioners' maps, sections, levels, and gradients—fully authorises us in declaring that they present a mass of inaccuracies unequalled in any work that has yet been published under executive authority by any state in Europe. The Report is deficient as an exposition of Ireland's manufacturing industry; of her internal traffic; the amount of her agricultural produce; her mineral wealth; her lake and river water power; the extent of her improvable wastes and sea lands; the value of her sea, river, and lake fisheries; the number of her steam-boats, &c.; the extent of her coal and peat fuel; her lake and river navigations; the revenue of her chief towns, &c. Nor does it appear that any correct geological survey has been made of any one of the Irish counties; although a coloured map has been published by the railway commissioners, as if it really had been the result of an examination of the whole of the Irish strata, but this document is incorrect.

The effect of the Railway Commissioners' Report, clothed as it is with an official garb, has been to engender doubts in the minds of British capitalists as to the returns which they had previously expected from the money which they had subscribed towards Irish railway undertakings, in consequence of which they have hesitated to proceed with the works. This renders it imperative on the Government to repair the deep injuries they have inflicted on Ireland by the Railway Commission, and to come forward promptly to reanimate that spirit of vigorous enterprise which has been thus so unfortunately checked by reasonable and judicious loans to such railway undertakings as have been sanctioned by Parliament.

Railroads are being extended through France, Germany, Russia, Belgium, England, Scotland, and the United States of America; but, unfortunately, in Ireland the Royal Railway Commission has paralysed the progress of these works of civilization, and has sealed their doom for years to come, unless the British Executive assumes the mantle of *Engineer-General of Railways for Ireland*, and constructs them at the public expense. This Royal Commission has by its acts and writings, for more than two years past, been contriving the most unfair practices to railway companies, the deepest injury to the existing rights of private enterprise, and the total subversion in Ireland of all the freedom of the pursuits of both the Irish and British people, as conn cted with the promotion of those works of improvement, the offspring of human invention, and which are shedding such a lustre upon the annals of the nineteenth century.

It is very remarkable that a distinguished public character, exercising great influence in Ireland, and a strenuous supporter of the present government has lately appeared in public as a prominent supporter and advocate for the commissioners' report, and the plan of the execution of railways by the government, on their own responsibility, to the exclusion of private enterprise. It may be useful to refer to the recorded opinions of the same honourable gentleman as delivered in the House of Commons on the first appearance of the Commissioners' Report, and which appears more accurately to describe the injurious effects of that document than a more lengthened essay, for which we have shown there was ample grounds.

" Mr. O'Connell said he was one of those who was dissatisfied with the report. The commissioners had not contented themselves with reporting proper lines for railroads hereafter to be undertaken, but they take upon themselves to stigmatise those already in progress. They tell us, moreover, that no railroad in Ireland can yield more than 3½ per cent. profit. And through whose agency do they arrive at this conclusion? Why they employ Mr. Stanley, of the Stamp-office, to make their calculations—a person well qualified to close bankrupt books, and give the balance which ever way the party pleased. Really the result of this commission was a melancholy one for Ireland. These commissioners having decided that 3½ per cent. profit is the most the speculations could yield, it is now impossible to go to the Stock Exchange and get money to forward these works. The result on the whole is, that it would be useless to make railroads in Ireland. If we had not this report, works would be undertaken, and employment given to the people; and yet the Chancellor of the Exchequer comes forward to praise these commissioners—and praise more undeserved was never, in his (Mr. O'Connell's) opinion bestowed upon any men. The thing is done—Ireland is stamped—there is the report. He rose to perform a melancholy duty; he could not approve of the report, and he had only now to express his regret at the inevitable consequences which must follow from it."—*Mr. O'Connell's Speech; House of Commons, Monday, 30th July*, 1838.

STEAM BOAT INSPECTORS.

It is with great regret we learn that the Government has given way to the clamours of a few idle twaddlers, and is on the point of proposing measures in Parliament calculated to be in the highest degree injurious to all parties interested in steam navigation. These measures are said to be based on the plan of appointing inspectors to examine all machinery, and to decide upon its safety and applicability. This is a course which will certainly not only defeat the objects of its promoters, but strike a deadly blow at this important branch of public enterprise, while, at the same time, it will inflict great injustice on a particular class.

This is a measure totally uncalled for, as it is a question not to be decided by the clamour of fools, but by the evidence of facts; and to these we confidently appeal, to prove that instead of there being any degree of danger, further than is incident to all human proceedings, there is a less amount of loss of life than is to be found in any other department of foreign, or domestic communication. Let figures speak for themselves, and then we shall see the thousands of lives which are yearly lost in the merchant marine of all nations, and the numbers who daily perish on land, by accidents from coaches and other vehicles. While, if we look to other countries, and particularly to the United States, we shall find that the accidents in steam vessels far outnumber those with us. It must be remembered, also, that where accidents with steam boats have occurred, that where they have not proceeded from maritime causes, often so far from being the fault of the manufacturer, they have arisen from avarice of the owners, or the ignorance of the engineers on board. Thus, not only is there no possible reason for such arbitrary proceedings, but there is no reason for singling out for oppression a means of intercourse which has carried so many millions of persons with such an incredibly small number of casualties.

Why have not the shipowners been singled out? They count sacrifices of life by thousands where we lose tens, yet none think of attacking an interest which is powerful enough to defend itself. Neither are there inspectors of coaches to decide whether a rotten axle should run another journey or be laid aside; while, because the rights of steam boat owners are supposed to have no powerful protection, they are to be selected as a peace-offering at the shrine of vulgar prejudice and administrative ignorance.

While this novel legislation is thus uncalled for, we may see, by anticipating its results, that it has no argument on which to base its future utility. For by the introduction of inspectors, the whole talent of the manufacturers will be left at the mercy of men who, however competent in other respects, cannot fail to be guided by prejudices injurious to the cause of science, and to the interests of the parties concerned. A stop will be put to all improvement, and all experiments annihilated; and in the hands of two or three men will be left the control of all this important department. What manufacturer will run the hazard of incurring the veto of this despot, or what owner will expose himself to the loss of capital in experiments? That this will be the result, it needs but little reflection to demonstrate; for, in a science which is not yet fixed, but is ever progressive, which must be left to the decision of time, which would be rejected by the prejudices of men. Let us remember the opposition of Watt to the high-pressure engine, and the conflict of opinion which still exists on the subject. Let us imagine Watt a steam-boat inspector, and say where would now be the locomotive and the Peruvian mine engine. Let us recall the contest about the powers of the Cornish engines, or suppose Dr. Lardner deciding on the question of Atlantic steam navigation; and we may be assured that if this plan had been in activity thirty years ago, we should have been far behind; and that if it is carried on now, we shall be as victims before the power of those nations who have the sense to leave science unshackled.

Except to produce this mischief, the operations of these *obstructors* must ever be a nullity; for they must be more dispersed than poor law commissioners, or as numerous as excisemen, if they have time and power to make such an examination as shall ensure a remedy against the evils which they are intended to prevent. Their superintendence must be indeed vigilant if they can climb every chimney and poke themselves into every fire grate, while their occupation will be no sinecure when they will afford such admirable opportunities for diminishing the responsibility of the engineers, and thrusting it all on the devoted obstructors. The effect will be a check to the progress of science, no guarantee against accidents, and a less available responsibility than at present exists; while the unfortunate employers will have the benefit of all the odium of the class over whom they are spies, and the certain blame of every mischance.

If there be even a shadow of a fault, and we have shown that there is scarcely that, the proposed measure, instead of remedying the evil, by attacking wrong parties, perpetuates it and creates a greater. It is not the manufacturers who are in fault, but the cupidity of the owners or the want of instruction in the working engineers. These are the sources of the evil, if any exist; and it is to these that the measures of the American government are chiefly directed. The skill of the manufacturer no inspectional ability can regulate; but, by making the responsibility of owners and captains more direct, a more efficient remedy will be provided, and the error, if any, corrected.

In conclusion, we deprecate this proceeding as mischievous and unjust; and we call upon the manufacturers and steam-boat owners to unite and oppose this measure by all the means in their power. It was by such combination that the railway proprietors last year defeated the government in a similar invasion on their rights and property; and in this case, even should not the entire proceeding be annulled, at any rate many of its ill effects may be removed, while the legislature may be brought to entertain sounder opinions on the question. This association of persons interested in steam-boat traffic has now become imperative; for not only in this instance, but in others, measures are contemplated for inflicting severe injury on it. The question of tolls on passengers is of paramount importance, while the proposal of inspectors equally calls for resistance, and the steam-boat proprietors may feel assured that it is only by union and prompt measures that these present evils can be avoided and future safety insured.

ON THE GENERAL THEORY OF THE STEAM ENGINE.

Notwithstanding the number of years which have elapsed since the invention of the Steam Engine, and the immense extent to which it is now employed, as well as the great importance at present attached (particularly in some of its applications) to the perfection and economy of its working: yet our knowledge of the general theory of its action is still but very limited. We were led to investigate this subject more fully on the perusal of a pamphlet which appeared in the course of last year, entitled, "A New Theory of the Steam Engine," by the Chevaler G. de Pambour, and purporting to be an analysis of a memoir by the same author, which was read at the Institute Royale of France, during the year 1837. The author, after shewing the inaccuracy of the ordinary mode of calculation used to determine the effects and proportions of steam-engines, exposes what he calls his new theory, by means of which he undertakes to solve all problems relating to those effects and proportions. M. de Pambour's theory consists essentially in the following laws:—

1. That the pressure in the cylinder is strictly regulated by the resistance on the piston and by nothing else.
2. That the velocity of an engine is determined by the quantity of water which can be evaporated in the boiler in a given time, and
3. That the pressure in the boiler is indifferent, provided it be at least equal to the pressure in the cylinder.

The last of these laws is of very little consequence, since it can have no effect on any of the calculations; but the two former serve to solve all the problems relating to steam-engines; for, having ascertained the quantity of steam generated in the boiler, and transmitted to the cylinder, as well as the velocity of the piston, which gives the volume occupied by that steam, we find its density and elastic force, and consequently the resistance on the piston. Inversely, either of the two other quantities might be determined, the rest being given. The principal difference between M. de Pambour's and the ordinary mode of calculation is that, according to the former, the effect of an engine is measured by the quantity of steam generated in the boiler; and according to the latter, by the quantity used in the cylinder: both which quantities must be equal, if correctly measured; unless, of course, there be any discharge through the safety valve, in which case M. de Pambour's method would fail, if he had not the means of measuring or estimating the quantity so lost; in place of which he assumes (for locomotive engines) an average loss of one fourth of the whole of the steam generated, and therefore considers the effective evaporating power of a boiler to be three fourths of its total evaporating power. Now this clearly cannot be true for all locomotive engines, nor even for one engine on all occasions; the safety valve will be more or less open, according to the load of the engine and the pressure in the boiler; and the discharge of steam through the valve, when open to the same degree, will depend on the pressure in the boiler. The latter circumstance would, however, have but an imperceptible influence if the difference of pressure were not very considerable, the velocity of efflux being directly as the effective pressure, and inversely as the density of the steam.

The manner in which M. de Pambour arrived at the average loss of steam through the valve, shows that it is seldom, if ever, correct. He first ascertained what rise of the valve was necessary for the discharge of all the steam generated, which corresponds to different numbers of degrees of the spring balance for different boilers, and then observed the actual rise in a certain number of experiments made with different engines; he then compared the sum of all those rises with the sum of all the rises necessary to give egress to all the steam generated in the various boilers, taken once for each experiment. In eleven experiments, the sum of actual rises was 12 degrees of the various spring balances, and the sum of rises necessary to give egress to all the steam, in each case 46·5 degrees: namely, five experiments, with engines requiring 5 degrees, give 25; three experiments, with one requiring 4, give 12; two experiments, with one requiring 3, give 6; and one experiment, with an engine requiring 3·5, gives 3·5; which numbers, when added together, will be found to make up 46·5. The ratio of 12 to 46·5 being very near one-fourth, this has been taken as the average rise of the valve, and consequently as the average loss of steam.

Thus we see that we can make no use of the constant coefficient 0·75 in determining the effective evaporating power of a boiler; for it might very well happen that only one-eighth should escape through the valve, in which case we should find the effect one-seventh too little; and if in any case there should be a loss of one-half of the steam, then we should arrive at a result 50 per cent. too great.

But, setting aside the error we should commit by taking the average rise of the valve, how are the following facts to be accounted for? In the table of experiments at page 229 of M. de Pambour's "Treatise on Locomotive Engines," we see that the Fury ascended the Sutton inclined plane, with a load equivalent to 188 tons on a level, at a speed of 13·33 miles an hour, the rise of the valve being 5 degrees of the spring balance, which is sufficient (see the table at page 175) to allow of the escape of all the steam generated in the boiler. We also find (page 232) that the Vesta ascended the same inclined plane, with a load equivalent to the former, at a velocity of 3·25 miles an hour, when the rise of the valve was equal to 3·5 degrees of the spring balance, or sufficient, according to the above-mentioned table, to give issue to all the steam. Also, (see page 234), the Vulcan is stated to have ascended the same inclined plane, with a load equivalent to 188 tons on a level, at a velocity of 11·42 miles an hour, the safety-valve being sufficiently open to allow of the escape of all the steam; and, in the same page, the same engine is stated to have ascended the Whiston inclined plane on another occasion, with a load equivalent to 186 tons on a level, at a speed of 18·75 miles an hour, the safety-valve being open to the same degree as in the preceding case.

Supposing the observations to have been correctly made, we can only account for these apparent anomalies by supposing the evaporation to have been more rapid in the cases quoted than during the experiments which had been made, with the view of determining the rise of the valve necessary for the discharge of all the steam generated; for it is the absolute quantity discharged, and not the proportion, which is determined by the size of the aperture. It is, therefore, exceedingly difficult to deduce the power developed by an engine from the evaporating power of the boiler, whenever there is any escape through the safety-valve.

Before leaving the subject of these experiments, we must observe that, from their nature, they were not susceptible of that precision which is necessary to allow of their results being made the basis of accurate calculation: for, on account of the irregularities of the road, the circumstances were continually varying, and the momentum of the trains rendered the effect of those variations less perceptible than it ought to have been.

It is an essential part of the Chevalier de Pambour's theory, that the pressure in the cylinder is independent of the pressure in the boiler, and depends solely on the resistance to be overcome. This is, to a certain extent, true; but we cannot allow that the pressure in the boiler is altogether independent of the pressure in the cylinder, for it cannot be denied that the law of the flowing of elastic fluids must obtain in this, as well as in all other cases. The pressure of the steam in the cylinder being, therefore, equal to the resistance on the opposite side of the piston, and the velocity of the piston being determined by the *effective evaporating power* of the boiler, which we readily allow, the pressure in the boiler will necessarily be such as to cause a corresponding efflux of steam from the boiler into the steam pipe, and through that into the cylinder. If at any moment this were not the case, the pressure would immediately begin to adjust itself, and would finally remain fixed as soon as it had arrived at that point: suppose, for example, that the pressure in the boiler is too low to cause an efflux at a sufficient velocity to supply the cylinder; the pressure will instantly rise until it be sufficient to cause an efflux at the velocity which will then be required, which is less than before, as the density is greater. This circumstance has been entirely overlooked, or rather neglected, by M. de Pambour, as well as the effect of velocity on the resistance of the air to the trains, which must considerably affect the results of his experiments.

Before entering upon the general discussion of the theory, when we shall have occasion to revert to M. de Pambour's works, we shall briefly advert to a paper *on the application of steam as a moving power*, which was published in the second volume of the "Transactions of the Institution of Civil Engineers." We should not have stopped to notice this paper, but for the medium through which it has been brought before the public, which naturally gives a certain degree of importance to everything therein published, as it must first obtain the sanction of a body of men, who, from their profession, and the eminence which some of its members have attained in that profession, have necessarily considerable influence over the opinions of those who are personally unacquainted with mechanics.

The author of the paper in question appears to have had less in view the advancement of science, as the title seems to promise, than to create a doubt in the public mind as to the correctness of the official reports of the duty performed by the Cornish engines; and he appears to have persuaded himself that he has demonstrated, on scientific principles, that those engines *could not* have performed anything like what they are reported *to have done*, and, consequently, that the reports are erroneous; but we hope to be able to show, satisfactorily, that he is labouring under a delusion.

We will, for the sake of argument, allow that the combustion of 7lbs. of coal is required to convert one cubic foot of water into steam, and consequently that the quantity of steam generated by the combustion of 84lbs. of coal under a pressure of 15lbs on the square inch, and recondensed without having been allowed to expand, will raise 44,467,500lbs. one foot high and no more. This we will allow to be the greatest effect that can be accomplished by atmospheric steam, and yet we assert the possibility of raising not only 70,000,000 but double that quantity, one foot high, by the combustion of the same quantity of coal, by making the steam in a condensing engine perform a part of the stroke at a high pressure, and then causing it to expand through the rest, though it should be reduced at the end of the stroke even to a lower pressure than that of the atmosphere. But Mr. Palmer attempts to demonstrate that "high pressure steam, when applied expansively, cannot produce so great an effect as atmospheric steam, thereby meaning to infer that no high-pressure engine can perform the same amount of duty as a condensing engine, both consuming equal quantities of fuel." He professes to draw his arguments from the established laws of nature, and adduces the following theorems; to prove which he very unnecessarily occupies seven pages, and then never makes any use of them; indeed, if he had, they would rather have shown an advantage, both in the use of high-pressure steam and in expanding it.

1. The sum of sensible and latent heat in steam is a constant quantity, viz., about 1172 deg. F.

2. All matter (steam, of course, included), whether solid, liquid, or gaseous, from the most dense and refractory to the least ponderable, evolves caloric on compression, or increase of specific gravity, and absorbs caloric on dilatation, or when its specific gravity is diminished.

3. To convert equal quantities of water of any assignable temperature, and under like pressure into steam of given temperature and elasticity, requires equal weights of fuel to be expended; but, although equal weights of water must absorb equal increments of caloric, when atmospheric steam is generated, it does not follow that all the caloric absorbed in high-pressure steam is exclusively supplied by the fuel expended. The law maintained is simply this, that the same causes produce the same effects.

4. Steam of two, three, or more atmospheres elasticity, is not composed of two, three, or the like number of volumes of water contained in an equal volume of atmospheric steam, when generated under the same barometrical pressure, but contains proportionably less water as the pressure under which the steam is generated increases.

From the first of these theorems we conclude that whatever be the pressure of steam before expansion (so that it be in that state called saturated, that is, as dense as it is possible for it to be at its temperature), if its density be reduced by expansion to that of steam generated under any given pressure, it will assume the latter pressure and the corresponding temperature, and will therefore be still in the saturated state; so that if steam enter the cylinder of a steam-engine at a pressure of three atmospheres, and, after having performed a little more than one third of the stroke, be made to expand through the rest, so that its density shall be reduced at the end of the stroke to that of steam generated under the pressure of the atmosphere; then the cylinder will be filled with steam in every respect the same as atmospheric steam, and, by the third of the above propositions, generated at the same expense of fuel as that quantity of atmospheric steam; and yet the effect will be about double what it would have been if the steam had been worked at the pressure of the atmosphere throughout the stroke, for the mean pressure is somewhere near two atmospheres. The fourth proposition shows that the economy of fuel is greater, the greater the pressure is at the commencement of the stroke, for the consumption of fuel is in proportion to the density, which, by the last named proposition, does not increase so rapidly as the pressure. The steam will thus, at a higher pressure, be required to work at full pressure during a greater portion of the stroke than if its density increased uniformly with its pressure, in order to fill the cylinder with steam of a given density, which shows that the mean pressure, and consequently the effect, will be greater, the higher the pressure at the beginning of the stroke.

The almost incredible advantages to be derived from the expansion of steam becoming every day more generally known, from the experience of the Cornish pumping engines, and the adoption of this principle constantly extending itself in consequence, as every body is desirous of availing himself of those advantages, it becomes absolutely necessary that the action of the steam, during that portion of the stroke of the piston through which it expands, should be better understood than it is at present, in order that we may be enabled to make a more exact calculation of the power exerted under such circumstances.

The present rule for calculating the mean pressure on the piston, when the steam is used expansively is extremely defective; it supposes the steam to lose none of its temperature during its expansion, while (neglecting that lost by radiation, which is a comparatively trifling quantity) the caloric absorbed by the steam itself in consequence of its dilatation, which no clothing of the cylinder can prevent, amounts to many degrees, particularly if, in order to obtain the greatest advantage possible from the principle of expansion, the steam be cut off after the piston has performed but a small portion of the stroke. In this case, the application of the law, that the pressure and density increase in the same ratio, would make the mean pressure appear much more considerable than it really is. We shall attempt, in a future paper, to bring this branch of the theory—we will not say to perfection, for that were presumption, but as near that limit as can be required for practical purposes.

MEMOIR OF RICHARD TREVITHICK.

While the biography of literary men has received full attention, although rarely presenting any object of interest, the lives of men of science, deeply enwoven as they are with the history of the pursuits in which they are engaged, have frequently remained unknown, or too often neglected. Nothing, however, can be more interesting to the student, or better calculated to animate him in his career, than the perusal of those efforts of application and genius, which have overcome impediments apparently unconquerable, or created a giant work from the rudest and most incongruous material. It is here that we find the most practical lessons of perseverance, and the most effective stimuli to our exertions: the slow and arduous path to fame is thrown open to our view, and we are taught not to be daunted at the most protracted labours, and not to neglect the slightest effort for success. When, too, our own countryman is the theme, we warm as we take pride from the halo shining on our native land, and we feel the exalted nature of that genuine fame which is not restricted to selfish enjoyment, but brightens the whole human race.

It is not unaccountable that oblivion should often encloud the memory of the greatest practical geniuses, for their early labours are hidden in the obscurity of the study or the workshop, and then, after battling against the efforts of the malignant, or the immoveable resistance of stolidity, the inventor is long dead before the contest is ended, or his works are successfully established. In the meanwhile, the progress has been so slow and so gradual, that, like a plant, casts off all semblance of the seed, so the name of the author has ceased to keep company with his labours. Often, too, where a name survives, we are led to distrust, when, like that of an Arkwright, it has supplanted the rightful owner.

One of the neglected benefactors of the human race is the subject of the present notice, whose memory, except in his native mines, is among his fellow-countrymen almost consigned to oblivion. At the present period, therefore, when we are beginning to enjoy the benefits of steam locomotion, we have thought that it would be acceptable to present some account of the engineer to whom our country is so much indebted for his efforts in promoting this improvement. We can only regret that this task had not fallen to the lot of others possessed of more ample materials for doing justice to the subject. Although we knew Trevithick during a most active portion of his career, yet the lapse of years soon renders the memory of incidents vague and imperfect. We know no one, indeed, who could better have fulfilled this task than a late President of the Royal Society, Trevithick's fellow-countryman and friend. Many errors of omission must therefore be excused, and many misrepresentations palliated; and it must be remembered that we are not so much to blame in committing faults, as that we merit protection for attempting what has not been done before.

Richard Trevithick originally moved in that class of society called in Cornwall the Captains of Mines, for which profession he was educated in the mine counting-house as clerk, having as one of his colleagues at that period Richard Griffiths, now the Chief Government Engineer in Ireland. Cornwall, at that period, was something different from what it is now, the mail road not extending beyond Exeter, the Cornish language just extinct, and the great influx of London capital not having commenced. This state of affairs, consequently, did not allow of any superior education; and although belonging to the mining aristocracy, Trevithick had little but the routine of practice to qualify him for the profession in which he was destined from his birth to move. Of his early years, therefore, it is unnecessary to say more, than that his career was distinguished by the introduction of many improvements into the operations in which he was engaged, and by a promise of distinction which his future exertions did not belie.

The mine captains, from their inter-marriages, were nearly all related, and among Trevithick's nearer cousins were the Vivians. Andrew Vivian, one of these, was a man of greater worldly abilities than most of his class, and fertile enough in all those expedients which are useful in raising money. With him Trevithick engaged in several affairs, he finding work, and Vivian supplying money. It was in partnership with him that, in 1802, Trevithick, while at Camborne, took out his patent for the high-pressure steam engine.

About the year 1723, Leupold, a German philosopher, in his comments on Papin's apparatus in the Theatrum Machinarum, had given the first idea of the application of steam on the high-pressure principle, but his suggestions remained without any practical results. Watt indeed had made some allusion to this principle in his attempts to obtain a locomotive power, but at any rate was not able to avail himself of it, even if he understood its application, and to the last day of his life displayed an obstinate prejudice against it. It does not appear that Watt had then read the Theatrum Machinarum, and it is not likely that Trevithick in his Cornish seclusion ever saw it, so that he has the merit of invention as much as of application. The introduction of this improvement gave increased powers to steam, and it is of that importance, that Stuart, not likely from national sympathy to be over-prejudiced in favour of an Englishman, is even inclined to date the era of the steam engine from this invention. It is certain that independently of its merits, this application of steam power is already of paramount importance from its great extension. It affords the means of locomotion on all the railways in the world, propels the swarms of American steamers, and is greatly used in manufacturing operations.

In 1804, Trevithick had the opportunity of trying his engine on the Merthyr Tydvil tramroad as a motive power applied to a carriage. The engine had an eight inch cylinder, and the piston had a stroke of four feet six inches; it travelled at the rate of five miles an hour, and drew as many waggons as carried ten tons of iron, without requiring any water, for a distance of nine miles.* Stuart says that the great obstacle to its introduction at this time was the supposed want of adhesion, or hold of the wheels upon the rails, to effect the locomotion of the engine.

Trevithick and Vivian erected several of their high pressure engines in Wales and other places, and it was about this time, although we do not know whether before or after the experiment on the Merthyr Tydvil tramroad, that Trevithick put into operation the first locomotive engine in London. In the great metropolis Trevithick found ample support in his countryman, Davies Gilbert, the Earl of Stanhope, Mr. Isaac Rogers, Mr. Samuel Rehe, Mr. Henry Clarke, and others connected with his native county or the cause of science. The engine he used was about the size of an orchestra drum, and which he attached to a phaeton between the back wheels. With this carriage an experiment was made in Lord's cricket ground, at Marylebone, several men of science alternately steering it, and expressing their perfect satisfaction as to the ease with which it was directed. From hence it was steered down the New-road, and Gray's-inn-lane, to the coachbuilder's, whence the phaeton was obtained. Thus it passed over ground, since the site of Hancock's experiments, and perhaps ultimately destined to be witness of the final triumph of this branch of locomotion. The next day Trevithick took this same engine and exhibited it in a cutler's shop, working the machinery; which was one of his essays, to show its general applicability. Subsequently he had a temporary tramroad constructed within an enclosure on the ground now occupied by Euston-square. This road was of an elliptical form, and on it he ran his locomotive. It was opened to the public as an exhibition, and people crowded to see it, but the second day Trevithick, in one of his usual freaks, removed the engine, and, to the great disappointment of visitants, closed the ground. This he did under the impression that it was better to let the affair drop, until he saw the opportunity to avail himself of it advantageously.

Another occupation of his metropolitan career was the tunnel under the Thames, in which he owed it only to his own pertinacity that he disappointed both the public and himself. Ralph Dodd, an engineer of some note of the last century, was the first to commence operations for a tunnel under the Thames from Gravesend to Tilbury Fort. His plan was to avail himself of the chalk stratum which he supposed to run under the bed of the river, and he expected that the chalk quarried out would sufficiently pay the expenses of working, leaving its subsequent use as a viaduct to afford a handsome income. As was mentioned by a correspondent in one of our late numbers,† he obtained an Act of Parliament for his plan in 1799, with power to raise 30,000l., and to increase his capital in case of need to 50,000l., his estimate being only 15,000l. The work was commenced, and proceeded for about three years, but was ultimately stopped on account of the expense of drainage. He had gone on the assumption that the chalk would be in one solid stratum, and that he should not be embarrassed by water, having in his estimates allowed only 1780l. for this purpose, and treated the expense as merely contingent. He found, however, such great inconvenience from under-springs rising through fissures in the chalk, that as we have said, he was obliged to abandon the project.

* Historical and Descriptive Anecdotes of the Steam Engine, by R. Stuart, p. 460.—Nicholson's Operative Mechanic, p. 209.

† Vol. 1, p. 381.

This tended to throw a damp on such plans, and when Trevithick proposed a similar tunnel under the Thames at Rotherhithe, he found a natural reluctance to support any such undertaking. Several of his friends, however, raised a subscription to enable him to make an experiment on a small scale, and the result was anxiously awaited to justify an appeal to the public for carrying out the entire plan.

In 1809, therefore, Trevithick was employed in running a small driftway parallel to the bed of the Thames. The committee of subscribers justly felt every assurance of the success of the undertaking, for the operation was extremely simple, while they had entire confidence in his skill and ability, from the experience he had gained in similar underground mining works. We have tunnels four miles in length to some of our canals, and abundance of communications in the mining districts under the surface of the earth, and even beneath the sea; but notwithstanding the ease of such a work, extraneous causes have always hitherto prevented this kind of viaduct from being used under rivers. Trevithick, to save labour and expense, committed the usual fundamental error of not going deep enough below the bed of the river, the object in his case being a close-run endeavour to keep at the least possible distance from it. Had his experiment been concluded, this would have enabled him to give a plausible original estimate at any hazard of subsequent increased expense. This error, however, was not productive of much inconvenience to him, nor was it the immediate cause of the abandonment of the enterprise, for he carried his driftway to a greater extent without impediment than has been done in any other attempt. It was not until he had gone 930 feet* under the river, that he encountered any obstacle, when he got into a hole in the muddy bottom of the river, and at one time a piece of uncooked ship beef, which had fallen from one of the vessels, drifted into the works. Although the Corporation authorities refused to allow him any facilities, he managed to get this hole stopped, and again went on with vigor; he carried on the excavation at the rate of from four to ten feet per day, and soon completed a thousand feet, to the great joy of every one concerned. On arriving at this distance, according to his previous agreement with the committee, Trevithick was to receive a hundred guineas, which, after a verification of the work by a surveyor, were paid to him. This surveyor was appointed by the subscribers to check Trevithick, and in giving in his report, confirming the measurement, stated that the line had been run one foot out of the perpendicular. This statement Trevithick took in high dudgeon, and chose to consider it as a deep reflection on his engineering skill to have deviated one foot in a thousand. His Cornish blood was excited, and with his usual impetuosity, he set to work to disprove the assertion, without any regard to consulting his own interest, or embroiling himself with the committee. Of all possible contrivances for effecting this object, he adopted the most absurd, which was no less than to make a hole in the roof of the tunnel at low water, and to push through a series of jointed rods to be received by a party in a boat, and then observed from the shore. Even had he been successful in carrying out this process, it would have afforded no criterion of the precision of the work, as the set of the current would necessarily have swerved the rod. Trevithick was employed in the driftway in carrying out this contrivance, and as delays of course ensued in fitting together the rods, the gully consequent on the opening in the roof ultimately admitted so much water as to render a retreat necessary. With a moral courage innate to his character, and worthy of a better cause, he sent the men on before him, and very nearly fell a sacrifice to his devotion. It has been already observed that the driftway was parallel to the bed of the river, and consequently curved; it necessarily happened, therefore, that the entering water would lodge, syphon-like, in the bottom of the curve, at which part, on Trevithick's arrival, he found so much water as hardly to be able to escape, for as he ascended the slope on the other side, and climbed the ladders, the water rose to his neck. It is needless to say, that this act of rashness was the death-blow to the project, while it added the climax to the many acts of inconsistency with which Trevithick's erratic career was disturbed. On a subsequent occasion, being cross-examined as to this occurrence while witness on a trial, he admitted the fact of his ruining the works, and his determination in any similar circumstance to defend his own character at whatever sacrifice to other people. The work thus ended after having reached 1,011 feet, and remains within a hundred feet of its proposed terminus, a melancholy monument at once of his folly and his skill.

After these events Trevithick returned to Camborne, and we now approach another of those epochs of his life, in which his labours were again destined to be followed by the most extended results. Here we have an instance of the operation of those trains of finite causes, which, while they are sometimes productive of the most unexpected advantages, too often baffle all human expectations and arrangements.†

* Mechanics' Magazine, Vol. I.

† Transactions of the Cornwall Geological Society. Mr. Boase's Memoir.

Uvillé, a Spaniard, seeing the decline of the American mines, from the insufficient power of drainage in the old works, was desirous of adopting the English method of pumping by steam. For this purpose he came to London in 1811, but his efforts were baffled by the difficulty of transporting such cumbrous machinery over the mountain districts, and the diminution of power which the atmospheric engines would sustain when worked in the rarified atmosphere of the elevated mine countries. When on the point of departing from England, frustrated in his object, he chanced to see a finished working model of Trevithick's engine, exposed for sale in the shop of Mr. Roland, in a street near Fitzroy-square. This model Uvillé carried to Peru, and to his inexpressible joy he had the pleasure of seeing it work with success on the high ridges of Pasco. Again encouraged in his favourite plan, he entered into partnership with two rich merchants of Lima, and obtained from the Viceroy of Peru the privilege of working some of the neglected mines. He once more started for England, and while on his voyage, talking with Mr. Teague, a fellow-passenger, of his anxiety to discover the inventor of the model, he was most agreeably surprised to hear Mr. Teague reply, "that Trevithick was his near relation, and that he could bring them together within a few hours of their arrival at Falmouth."

Uvillé continued with Trevithick for some months at Camborne, profiting by his instructions; he then made a tour under his guidance in several of the mining districts, and afterwards went to Soho to consult Boulton and Watt. Whether, however, it was their jealousy of Trevithick, or their genuine want of resource on the subject, they gave Uvillé no encouragement as to the success of his enterprise. The great elevation of the mines, the difficulty of the precipitous roads, and the absence of means of transporting heavy masses of machinery, appeared to those engineers insurmountable obstacles, and disinclined them to engage in such a difficult undertaking. On the refusal of these capitalists to assist, Trevithick himself undertook to furnish the necessary engines; and in September, 1814, Uvillé embarked at Portsmouth for Lima, with three Cornish miners, and nine of Trevithick's engines.

Long before this period Trevithick had married a Miss Harvey, a lady of good connections; her brother subsequently acquiring a large fortune. By her Trevithick had several children, and it will prove at once the love he entertained for her, and his spirit of perseverance even in trifles, that during his long courtship he never missed walking every evening several miles to visit her. Dissensions had, however, arisen in his family, and he was more prepared to engage in that distant career to which he was now invited.

Uvillé was received at Lima with the greatest honours and rejoicings, and landed with his cargo under a royal salute. It was not until the middle of 1816 that he was able to surmount the local difficulties of transport, and place the first engine in operation. Trevithick, however, had nobly armed him against the antagonist obstacles, and all that his ingenuity could suggest had been put into practice. The machinery, simplified to its greatest extent, was so divided as to form adequate loads for the weakly llama, and the beams and boilers made in several pieces were transported over precipices, where a stone may be thrown for a league. The engine erected at Tauricocha, in the province of Tarma, was put into operation, and in the presence of the government deputies drained the first shaft of the mine of Santa Rosa, one of the Pasco district. The greatest anticipations were created, and amid the profusion of honours showered upon the projectors, nothing was wanted but the presence of the meritorious inventor himself.

Trevithick had in these latter years been fully as active in his contributions to the cause of science, as in any previous portion of his career. It was he who suggested the improvement on steam boats by propulsion at the stern, which is now the subject of experiments at London and at Liverpool. He considered that a spiral wheel revolving at the stern of a vessel was preferable to the use of side paddle wheels, and we believe that a vessel something on this principle is now about to make the trial voyage across the Atlantic.

Another contribution of his to steam locomotion was his revival of giving motion to the engines by means of the re-action of the steam made to spout against the atmosphere.

In 1815 he effected a great improvement in his high pressure engines, by forming the piston so that a ring of water should run all round it, and render the whole air-tight; as he found in practice that a very moderate degree of tightness in the packing produces this result.*

Trevithick was now actively engaged in England preparing for his departure. He had constructed several new engines, and an apparatus for the Peruvian Mint; and his attention was directed to an object of the greatest importance, to remedy the growing scarcity of quicksilver, by constructing furnaces for purifying the silver ore by fusion. At last, in October, 1817, Trevithick, Robinson Crusoe like, gave up all his property in England, and leaving it to his wife and children, set sail for Peru.

In February, 1817, he arrived at Lima, where his presence excited the utmost enthusiasm. He was received by the government and the people with the greatest honours, while the official announcement of his arrival in the Gazette created the highest expectations of the whole population. He had immediately an audience of the Viceroy, and the Lord Warden of the mines was directed to escort him with a guard of honour to the seat of his future labours. The principal men of the mining district came many days' journey to Lima to see and welcome him, and all exerted themselves to testify their esteem for the well-deserving Don Ricardo Trevithick. Never, perhaps, was European so well received in the New Indies; it was not Las Cases coming to rescue an injured population from oppression, but it was a man of science who had arrived to augment their old resources, and to create new mines of wealth. It was the first benefit which they had received from the Old World, and it is not surprising that an ardent people received Trevithick with as great enthusiasm as Columbus had once awoke in Spain.

The exertions of this great man were crowned with success, and he was equally rewarded by their profitable return, and the gratitude of the people. The produce of the mines augmented to an unexpected degree, and the coining machinery was increased six-fold; his companions united in expressing their obligations to him, and the authorities were not remiss in showing how they appreciated them. We understand that he was invested with the title of a marquis, and was created a grandee of the Spanish empire, while the Lord Warden of the mines even proposed to erect his statue in massy silver.

In these employments Trevithick was engaged for many years; but at last the political dissensions, and his own wandering disposition, induced him to wish to leave the country. This was no easy matter: for the veneration with which he was regarded as a benefactor sent from Heaven, made the people regard his absence as a public calamity, and take every measure to prevent his departure. At last he made his escape, through dangers which few, less adventurous than himself, could have encountered; and, after escaping the terrors of the mountain and the desert, and the arm of the wandering savage, he again arrived safely in England, where he was about the period of the great panic in 1827.

Here he endeavoured to raise capital to carry on some of his colossal projects, but with his usual ill-success—for those who knew his skill, feared the waywardness of his character; and those who did not, were repulsed by the giant nature of his enterprises. It was in vain he urged his own success, and represented the boundless resources of the Andean territory. He had the mortification to find his provision for his own fortune nullified by the ignorance and timidity of those with whom he sought to participate. While in America he had acquired large tracts of land, and on one estate had a mountain of copper ore, which, like the hill mines of Potosi or Montserrat, it would take centuries to exhaust. Here he proposed to construct railways, and, by the aid of capital and machinery, make the shores of the Pacific as great a mart for the produce of the earth, as those of his own native promontory.

Don Ricardo again returned to the New World, and resumed his labours for the benefit of the American people; for, it must be observed, that however he may have been remunerated, and how much so ever he may have desired to advance his own interests, yet the apathy of his countrymen ever prevented him from carrying out his own wishes, or being any other than the great regenerator of American riches. He died, indeed, comparatively poor, and left, we believe, little other inheritance to his family than the grandeur of his name and the glory of his works.

In his person and manners he seemed formed to sustain the arduous contests to which he was destined. The robustness of form, inured by years of toil and fatigue, was reflected by the innate self-confidence of his disposition. Blunt, but not rude, he maintained his opinions with honesty and power, and was only in fault that too frequent success made him adhere to them with pertinacity. In his moral character he maintained with propriety all the social duties. Kind to his family, he was ever ready to make any sacrifice, although the meddling of others may have created dissension in his domestic circle; while as a friend none, perhaps, could be more relied upon, for his feelings of confidence survived repeated disappointments and betrayals. His mental powers are best appreciated by the events of his life, for we may be assured that if no one be great without some divine assistance,* so few have done remarkable things without having in some degree participated in their greatness. His genius was of the highest order, while those difficulties which his invention could not dissolve were overcome by his perseverance. His self-education also allowed him to borrow little from

* Historical and Descriptive Anecdotes of the Steam Engine, by Stuart, p. 520.

* Nemo unquam magnus fuit sine aliquo afflatu divino.—*Cicero.*

others, but made him dependent on himself; and this confidence was rarely in vain, for his errors were always less those of judgment than consequent upon a hastiness of disposition, which, as it had met with but little sympathy from the world, was but too apt to despise it. His skill in providing for all occurrences was rarely baffled, and could not easily be surpassed, while his original and gigantic conceptions, however much beyond the progress of his age, were seldom beyond the bounds of ultimate practicability.

That his name is but slightly known, and his labours consequently little appreciated, is by no means a result of their unimportance, but the effect of concurrent circumstances, which, as they can elevate insignificance, too often obscure merit. When he had conceived a plan by the resources of his mind, and confirmed it by experiment, the very vastness of it surpassed his means of execution, and prevented it from being carried into effect. He was himself no financier, and the associations he formed with Vivian and others were either insufficient in their extent, or turned more to the profit of his colleagues than himself. It was true that he left no means unsought of obtaining the assistance of others, but those who had capital feared to engage in enterprises to which they were unaccustomed, while those used to business had no disposition to deviate from the track in which they were long practised and successful. It is the nature, indeed, of great monopolies, that their very success engenders want of activity, for none feel so little inclination to engage in new processes as those who are accumulating wealth by old ones. It is this that deadens the progress of the iron trade, of distilling, and many others; and the manufacturers, instead of supporting new inventions, spurn them as associates, and trample them down as rivals. It was the support of this influence which gave power to Watt, while it cramped the energies of Trevithick; for without the aid of Boulton, the former might have wasted his life in experiments, or, Hargrave-like, have been supplanted by another Arkwright. Trevithick wanted but this to compete with Watt in worldly prosperity, and he wants not this to equal him in the height of his genius, the greatness of his works, or the wide-extending influence of his inventions.

That the memory of Trevithick has not received the honours which have been conferred upon others, is a neglect which has been shown to many of our greatest names, and proceeds less from our want of veneration for men of genius than from our national character. We do not, like Frenchmen, dread a rival near the throne, nor are we, like Americans, fearful of others denying to us what we are scarcely known to possess. We are rich enough in illustrious names to consider their admission in our domestic habits and our thoughts as a sufficient sacrifice to fame, and it is only on the instigation of some provincial that we raise statues to those who live in our hearts. Our population in the north, however, less fertile in their contributions to the shrine of genius, and more remarkable for local preference than extended sympathies, give a greater share of admiration to the few of whom they dare to boast. The English, in acceding to their suggestions, while they commemorate inferior names, create mementos of their own neglect. While, therefore, there are three memorials of Walter Scott to one of Shakspeare, and to Milton none, we must not consider the many tributes to Watt as emblems of superiority, but as proofs of a better fate. It is to this that we must attribute that a statue is rising to Watt in Manchester, while Brindley's merit still relies upon the glorious memory of his canal. We may carry, however, this self-confidence too far, and where we meant only to show hospitality, may have brought in strangers to master our own children; when we see the generosity of the American Congress to the spurious claims of Fulton, and the gratitude of Peru for the labours of Trevithick, we are called upon to offer some honour to his name, and to show that we are as proud of the inventor of the high-pressure machinery as we are conscious of the benefits we derive from his railway locomotives. But, neglect him as we may, the name of Trevithick will live while his engines annihilate space in the Old World, and in the New control the current of the Mississippi, and disgorge the mountain riches of the Cordilleras.

MR. OLDHAM'S SYSTEM OF WARMING AND VENTILATING,

AS ADOPTED AT THE BANK OF ENGLAND AND BANK OF IRELAND.

Sir,—As the best mode of heating and ventilating apartments and buildings is still an undecided matter among scientific men, I avail myself of your journal to draw public attention to what appears to me to be the best among the various plans and patents of the present day.

At a late meeting of the Royal Institution, Professor Brande, in the course of his Lectures on Heat, and in considering its transmission and diffusion by means of currents, pointed out the advantage of aiding the operation of those currents by mechanical means.

In illustrating this mode of conveying heat where extensive apartments are to be acted on, and where either a large volume of air or a great quantity of heat may be required, the Professor described the operation and effect of an apparatus successfully adopted by Mr. Oldham, of the Bank of England, in which building it has been in use during two years, having previously been adopted by him in the Bank of Ireland, and where it has been in operation during sixteen years.

When heat is conveyed by means of natural currents, these are necessarily, and exclusively, due to the difference in the temperature and specific gravity of the column of air, when heated, relatively with that of the surrounding atmosphere; the force of these currents, and the body of heat they are enabled to transmit, are therefore necessarily languid, compared to what may be effected by artificial means.

That steam is the best medium for the transmission of heat is now too well known to require much illustration. Its superiority over water (independently of the greater facility with which steam is conveyed to a distance) is derived from the extraordinary quantity of heat which water contains when in the state of vapour—a cubic foot of water, in the form of vapour, having the power of giving out nearly eleven times more heat, than the same body of water could when in its liquid state.

The mode hitherto adopted in many establishments, and in the large cotton-factories, is that of conveying steam through a continuous series of cast-iron pipes, so arranged and extended, through the several apartments to be heated, that each shall be supplied with a given length and surface of pipe, proportioned to the dimensions of the apartments to be heated.

This is manifestly a mode attended with great inconvenience and expense in the conveyance of such pipes, in their liability to leak; and in the want of uniformity in the temperature of the several parts of the rooms in which those pipes are introduced. But there is yet another and more formidable evil attending this mode of heating, namely, that while it merely conveys heat to the already existing air in the chambers to be heated, it has no relation to the condition of that air, or the supply that may be required, or the changing and purifying the same. In a word, the system, by means of steam-pipes, has the power of heating, but not of ventilating. It has no relation to the purity or impurity of the air to which it imparts the heat; and it is a fact, that giving an additional supply of heat to an apartment may even be prejudicial, inasmuch as such apartment may require ventilation, that is, *change* of air, rather than heat.

Now the process of heating adopted by Mr. Oldham has this peculiar and distinguishing characteristic, which gives it a claim above all others, namely, that it both heats and ventilates at the same time, to any extent, and with any required rapidity.

As far as health and comfort are concerned, heating and ventilation should never be separated. Mr. Oldham's process and apparatus most effectually supplies this desideratum.

Doctor Ure, in his inquiry into the modes of warming and ventilating, observes, that "the great principle of ventilation is, never to present the same portion of air twice over to the human lungs, but to supply them at each fresh inspiration with pure aerial particles in a genial thermometric and hygrometric condition."

Where heating is alone attended to, as in the case of heat conveyed by steam in metal pipes, it becomes necessary to provide currents of cold air, to supply the required continued change in the apartments for the purposes of ventilation. It is manifest, then, that the best principle must be, first, to heat the required volume of fresh air, and then introduce it to the apartments to be heated and ventilated, instead of effecting this double object by two distinct processes. This is effectually accomplished by the plan of Mr. Oldham under consideration. The *modus operandi* is as follows:—A body of pure air, of any required volume, and passing at any required velocity, is forced by the aid of an air-condensing pump into a chamber or chest, where it is heated in an ingeniously-contrived, but extremely simple apparatus, by means of cross currents of steam. The peculiarity of this contrivance is, that an ascending body of air, on entering this chest, divides itself spontaneously into any required number of thin horizontal films, by which a very extended surface is exposed to corresponding steam-heated metal surfaces. Instead, therefore, of passing the steam through a series of pipes, along which, but in an opposite direction, the condensed water has to return, it is conveyed at once from the boiler into the chest or condenser, (which, in fact, it is,) where, on having parted with its heat to the air as above described, it is condensed, and returned directly to the boiler. The chest or condenser, in the apparatus at the Bank of England is but three feet square, yet the body of air to be heated, while passing over but 3 lineal feet, spreads itself over no less than 154 superficial feet, and coming in contact with a corresponding superficies, heated by the steam, it necessarily receives a very large supply of heat in a short space of time.

This apparatus in the Bank of England, independently of heating and ventilating several large apartments, is put to the severest test namely, that of evaporating the moisture from a series of 400 large mill-boards, with a surface of 1600 feet, and which moisture they have absorbed from the fresh-printed bank notes which are daily dried by this process.

With respect to the quantity of heat which this small apparatus is capable of imparting to the air, this is accurately tested by the quantity of water which is condensed, and which amounts hourly to twelve gallons. Now, as Professor Brande observed, when we consider what an enormous body of heat is contained in the steam generated from twelve gallons of water, we are enabled to appreciate the hourly effective heating powers of this apparatus.

As to the volumes of warm air that may be required, that will of course depend on the cubical contents of the buildings to be heated. This, however, may be stated, that there is scarcely any limit, either to the quantity of heat which may be thus given out, or the quantity of fresh air, so heated, that may be propelled by such a system. Of the mechanical means by which this artificial current of air is created, little need be said, these are within the reach of all.

Of the efficacy of an artifical current produced by means of a fan or cylinder, Dr. Ure observes, that "it has been ascertained that a power equivalent to one horse, in a steam engine, will drive at the rate of 80 feet per second a fan, the effective surfaces of whose vanes, and whose inhaling conduits have each an area of 18 inches square, equal to that of a large steam boiler chimney. The velocity of air in the chimney, produced by a consumption of fuel equivalent to the power of twenty horses, was no more than 35 feet per second; while that of the fan, as impelled by the power of one horse, was 66 feet per second. Hence it appears, that the economy of ventilation by the fan, is to that by the chimney draught, as 66 is to $\frac{35}{20}$ or, 38 to 1. It is obvious, therefore, that with one bushel of coals consumed in working a steam-impelled excentric fan, we can obtain as great a degree of ventilation, or we can displace as great a volume of air, as we could with 38 bushels of coals consumed in creating a chimney draft. Economy, cleanliness, and compactness of construction, are not, however, the sole advantages which the mechanical system of ventilation possesses over the physical. It is infallible, even under such vicissitudes of wind and weather, as would essentially obstruct any chimney draught ventilation; because it discharges the air with a momentum quite eddy proof; and it may be increased, diminished or stopped altogether, in the twinkling of an eye, by the mere shifting of a band from one pulley to another. No state of atmosphere without, no humidity of air within, can resist its power. It will impel the air of a crowded room, loaded with the vesicular vapours of perspiration, with equal certainty as the driest and most expansive."

After so clear and practical an exposition of the advantages of a current, mechanically created, nothing further need be said of natural currents arising from mere increase of temperature, excepting that by the adoption of the pump instead of the fan, a very considerable power is saved, and the operation performed much more effectively.

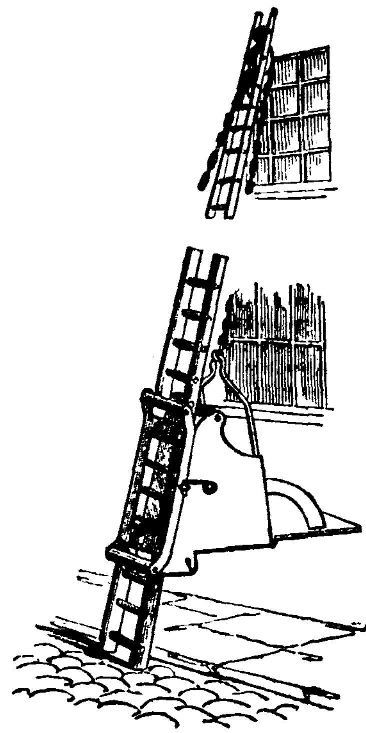
Another peculiarity of Mr. Oldham's apparatus here merits attention. The large volume of air heated and passed off to the required apartments is, previously to its being received into the heating chest, filtered and purified, by being deprived of all that noxious floating matter with which the atmosphere, particularly that of London, is at all times charged, and which, if heated and sent into the apartments with the air, would but increase that noxious character and render it still more injurious to the respiration of human beings. Not only indeed are these offensive impurities which are floating in the atmosphere effectually separated, but a power is given of charging it with aromatic or antiseptic matter, thus rendering it not only the medium of warmth and ventilation, but of purifying and healthful influences.

The peculiarities of Mr. Oldham's arrangements then, are, first, the adoption of mechanical means for the creation of a current of hot or cold air, and which may be augmented to any required extent or volume, instead of that comparatively feeble current which results from the difference of temperature alone; secondly, the causing this artificial current of air to be heated by a peculiar arrangement which separates its volume spontaneously into their horizontal films, thus making them pass in contact with a corresponding number of surfaces heated by steam, imparting a large volume of heat to a large volume of air in a small space and with great rapidity—and when so heated, of again uniting these films—to be passed up in a body in whatever direction or to whatever distance may be required; thirdly, the filtering the air before it is received into the heating apparatus, thus effectually excluding that offensive dust and black matter with which the atmosphere is charged. I am, Sir, &c. C. W. WILLIAMS.

[We will, in our next Journal, if possible, give the drawings of Mr. Oldham's apparatus.—EDITOR.]

MACHINE FOR CLEANING AND REPAIRING FRONTS OF HOUSES, &c., OR A FIRE ESCAPE.

SIR,—As the many melancholy instances of loss of life by fire have occasioned a very general interest in the invention of Fire Escapes, I beg the favour of your notice of one which I think has all the desiderata mentioned by Captain Manby, in his address to the Society for the Protection of Life from Fire, namely, simplicity, portability, and efficiency. I may add to these, economy in construction as being not a whit less important, seeing that the cheaper such machines can be made the greater will be the chance of their being kept in every part of the metropolis; the expense of mine will not exceed seven pounds; and in quantities, I have no doubt they may be made for a third less.



As I do not pretend to be more than an amateur in mechanics, I fear I shall very ill explain myself. By reference to the annexed sketch it will be seen that my invention consists of a car traversing up and down the inner or under side of a ladder, which it uses as a sort of inclined railway, and is suspended to the top round of the ladder by means of a chain passing over a pulley of a snatch block. The car may be adjusted to any sized ladder, which is admitted within the double framework of the machine between four rollers (two at the top and two at the bottom), each of which have occasionally a bearing on the ladder, but generally only the lowest inside and the upper outside rollers. The car weighs, including a single fall rope and block, about 90lbs, and I propose that every fire engine should carry one, which may be attached very ornamentally at the opposite end to the driving box.

By means of this car a fireman could be raised to the upper windows of a house without difficulty by three persons, and thus afford personal help to those in danger, who, nine times in ten, have not presence of mind to avail themselves of the aid thrown up from below.

As the car descends with the inclination of the ladder, it of course recedes from the front of the house; it is, however, enabled to put forth in case of need an additional projection or stage of four feet, as shown in the sketch, which I believe would be the utmost required. Such a machine will also be found very useful for builders, plasterers, painters, and others, for the purpose of repairing, cleaning, colouring, or painting fronts of buildings. If generally adopted for such purposes, hardly a street would be without one, which would form an additional certainty of the fire-escape being ready in case of need.

I need not be reminded that my invention is nothing without a ladder; but as fires very rarely happen without their being speedily procured in the neighbourhood, there cannot be any difficulty on that point.

Hoping to obtain, through your widely circulated publication, some practical opinion of the machine, I intrude this communication.

And remain, Sir, yours, &c.,

Nine Elms, December 31, 1838. A. F.

THE NATIONAL GALLERY.

SIR,—I had been for some time coveting a little leisure to submit a few opinions to you on this ill-fated building, when the "Supplement to the Public Buildings of London," by Mr. Leeds, informed me that my intentions were anticipated by one much more competent to speak upon the subject. The points to which I more immediately intended to advert, were for the most part those on which Mr. Leeds has so forcibly commented, viz., the absurdity of accusing the architect of having *diminished* the capacity of the building by the very measures which, on the contrary, *increased* it (see pages 62, 63); the inconsiderate outcry concerning its being "too low" see pages 67, 68); and the injustice of "censuring in the lump, without caring to hint at particular beauties in what upon the whole may be defective."

It is not for me to presume that anything emanating from so humble a correspondent as myself, will be allowed to add much weight to the criticism of Mr. Leeds; nor should I venture on these remarks, but that opinions—and very decided ones—have been expressed by so many persons, whose right to pass sentence is not more than mine.

The defects of the structure should have been criticised with a more candid reference to the imperative necessities which interfered with the full exercise of the architect's taste; and the merits of the portico (particularly as regards its plan) of the entrance hall, and of the general proportions of the several compartments of the façade, separately considered, should have been allowed. Granted, the central cupola is small, its tambour much too plain, and the two smaller cupolas or turrets unnecessary. The cornice of the portico, too, certainly lacks that prominence and richness which the Corinthian columns (particularly as they are fluted) require; but the portico otherwise, in regard to its low-pitched pediment (perhaps it may be too low) and the just approximation of its columns, is worthy of infinitely more admiration than the St. Martinians have yet bestowed upon it; and I cordially agree with the writer, whose minute analysis would render any further comments gratuitous, that the "façade, if erected some years earlier, would have been probably as much extolled as it has now been decried."

My chief purpose in now addressing you, is to suggest such remedial measures as I conceive to be—at a very little expense—practicable; and I therefore, with all deference (as to an unquestionable superior whom, in spite of the world, I delight to honour) submit to the architect the adjoined sketch, simply showing bow, by raising attic stories over the central and extreme compartments; by transposing the columns now in the centre of the wings, and by placing a pilaster attic order round the tambour of the dome, an altered effect would be produced, which the public might deem an improvement. The dome will still perhaps remain too small (the dotted line inclosing it being more accordant with my own notions of proportion), but it will certainly not be so objectionable on the score of plainness. If the dome could be entirely reconstructed, it might possibly be made at once available, for increased accommodation and effect; but I am speculating only on what may be gathered from the small engravings before me, and saw too little of the building when in London some time back, to venture on anything more than mere suggestions.

Your obedient servant,
GEORGE WIGHTWICK.

Plymouth, Feb., 1839.

[We regret that it is out of our power to comply with the request of our correspondent as to the insertion of a wood-cut, as it would form a precedent which would not fail in other cases of suggestions to entail on us great inconvenience and expense. We think his proposed alterations would be calculated to produce the effect he describes, but they would have a tendency to alter the character of the building from its present classicality.]—*Edit. Civ. Eng. & Arch. Journal.*

RAILWAY CURVES.

SIR,—Having been lately employed setting out railway curves, like your correspondent, "A Sub" (in your January number), I cannot help offering a few observations on his plan; although I fear I am not one of the "more experienced readers" that he expected would take it up. He says, he thinks "it would be an improvement upon the system of running directly from a straight line to a curve of $1\frac{1}{2}$, 2, or $2\frac{1}{2}$ miles radius, if a curve of 3, 4, or 5 miles radius, for a short distance, were made use of to connect them."

Now to me it appears that the true principle is this:—When you must change your line of direction in a railroad, do so with as *equable* a curvature as possible; for we know that if the curvature is not equable, some parts of it must be sharper than if the same radius were used all through. This, I think, would be a sufficient reason for rejecting his plan at the outset.

But even if without injury we could have a gradual increase of curvature—*Cui bono?* Is it to *accustom* the engines to a curvilinear path? Surely when an engine is at a point just entering on a curve, it is pretty clear that its *action* on that curve will not be affected by the nature of the path it was *previously* describing, since its tendency just then is in the direction of the tangent, which is quite independent of that path.

Again, your correspondent says, "that projectiles (where the resistance is equal) assume the parabolic curve," by which he proposes an approximation. Now the *resistance being constant* is not the cause of a projectile's describing a parabola, but because gravity, which acts upon it, is a constant *force*, producing a constantly *accelerated* velocity, so that the distances gone in a vertical direction are as the squares of those gone in a horizontal (counting from the highest point), which *is not* a very similar case to that of an engine moving along a railway. But even if we were to draw an inference from the motion of a projectile, I would do it thus:—We know that the curvature of its path is not constant, neither is its velocity—the latter being least when the former is greatest; now, the velocity of an engine *should* be constant, if possible—therefore, let the curvature of its path be so also.—I remain, Sir, your most obedient servant,

Feb. 19, 1839. R. W. T.

A METHOD FOR STRIKING GOTHIC ARCHES.

SIR,—I beg leave to make public, through the medium of your Journal, the following method, which I discovered some years ago, and which I believe to be original, for Striking Gothic Arches, more particularly that which has been termed the Tudor arch:—

Having determined the height and breadth of the arch, draw a horizontal line on a whitened wall; make the length of this line twice the height of the arch, and from the centre of the line, let fall a perpendicular, to which give one half the width of the arch. Let nails be driven at the two extremities of the horizontal line; to one of these fix an end of a chain somewhat heavy, but composed of short links, and, passing the other end over the other nail, draw up the chain till the bottom of the curve correspond with the extremity of the perpendicular, and when in that position make the chain fast to the nail over which it was passed. This done, trace upon the wall, with charcoal or otherwise, one half of the curve formed by the freely suspended chain. This curve, placed in such a manner as that the lower or more curved part may rest upon the impost, will form one half of the required Tudor arch, the other half being its counterpart—thus:—

Fig. 1.

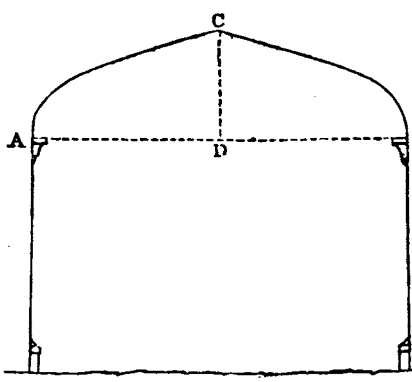
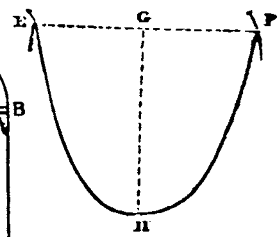


Fig. 2.



Let A B (in fig 1) be the breadth of the required arch, and C D its height. Set off on the wall (fig 2) E F=2 C D; from the centre G, of E F, let fall $G = H\frac{AB}{2}$. The chain being fastened at E, and then passed over F, and drawn up until the bottom of the curve correspond with H, make fast at F. Now the curve E H or F H placed so as that the more curved part fall on the impost; and the extreme E or F at the point C (fig 1), will be half of the required Tudor arch. By this bisection and arrangement of a Catenary, gothic arches of various agreeable curvature may be most easily and expeditiously traced.

I am, Sir, your most obedient,

13th Feb. 1839. J. R. JACKSON, Col.

[We have taken the liberty of altering our correspondent's arrangement of the figures, by making two answer the purpose of three, which we hope he will excuse, particularly as it does not interfere with the description of his ingenious and simple method of setting out the arch; a method which, we are sure, will be appreciated by the profession.—EDITOR.]

MONTROSE WET DOCK.

Report of James Walker, Esq., Civil Engineer.

THE SITE.—Having visited Montrose, in company with Mr. Leslie, early in December last, I surveyed the sites and plans of Docks proposed by that engineer, viz.,—the Horologe Hill site, and the other between Meridian Place and the patent Slip, or farther down the river than the Horologe Hill; and I have no hesitation in preferring the lower situation. It places the entrance in a wider and better part of the river, where the eddy-tide will render the entering of the ships very easy; it interferes less with the present wharfage; and (which I think very important) gives the opportunity of extending the Docks as occasion may require upon the links—a property which is uncovered and belongs to the town. I consider this site also, whether as respects approach from sea, entrance to the Dock, or the Dock itself, peculiarly eligible.

FIRST, AS TO THE APPROACH FROM SEA.—Having had reference to an apparently very accurate survey by Mr. Buchanan of Edinburgh, and having been favoured by Captain Beaufort with the Admiralty survey of the harbour, a copy of which is now before me, I find the depth between the Annat Sand and the Leads, at low water of spring-tides, from seventeen to eighteen feet, which was confirmed by the sounding I took: outside of this to deep water, there is nothing less than fifteen feet; inwards, the depth decreases gradually to less than half the above,* until opposite the Low Light, when it again increases to 13, 12, 14, 16, 10, and 11 feet, which last is in the Stell, opposite to, and not far from the entrance to the proposed lower Dock. Four feet may be added to all the above depths for the low water of neap-tides; thirteen feet for the high water of neap-tides; and eighteen feet for the high water of spring-tides. The length from the entrance to the harbour to that proposed for the Dock, is upwards of a mile, nearly straight, with rocky ground on the south bank, and sand on the north; but no rocks in the channel of the river: the bearing being N.W. by W. ½ W., and the width in the Stell, opposite to the proposed entrance to the Dock, about 300 yards. In this place, the direction of the flood-tide is thrown over towards the south side, so that for about a width of 100 yards from the shore, there is scarcely any current. The passage from sea, therefore, up to the Dock entrance, may be pronounced decidedly good.

Secondly, as to the Entrance.—Mr. Leslie has pointed the entrance down the river, which, had there been any current to interfere with ships entering, would have been objectionable; but in the present case, it is, for the reasons above stated, a matter of comparative indifference. This entrance is proposed to be fifty-five feet in width, and fifteen feet six inches in depth, at the high-water of neap-tides, which I think sufficient, and was so considered by the trustees when the subject was mentioned at the meeting. Mr. Leslie proposes one pair of gates at first, and shows by dotted lines upon the general plan, how this extension may be made at any future period into the river, so as to form the entrance into a lock with two pair of gates. This is the part of the design, the idea of which, for the reason I shall presently state, ought, I think, to be abandoned. The Dock is to be of the same depth as the entrance; the form a rectangular parallelogram, four hundred and fifty feet long, and three hundred feet broad,—giving an area of three acres, which, for a Dock, I consider decidedly too small; and that the plan would therefore be objectionable, were it not for the great facility of extension upon the links,—my opinion being that, in a very few years, the three acre Dock will not be too large for a tide basin, with one pair of gates into the river, to be opened before high-water; and that then the lock with the double gates should be at the upper end of the basin, to lock out of it, up to the inner Dock or Docks, properly so called, which may then be of a size thought expedient; for what would, in respect of size, be considered extravagant if recommended now, will not probably appear so when the first Dock, which will afterwards be the basin, shall be found insufficient. The sketch which accompanies this report will better explain my meaning. I would not recommend more being done at first towards the ulterior plan than simply returning the wing walls to form the future entrance, and making the front of the Dock or basin wall between these returns of timber piles or baulks to form a dam for future works within, and to be removed when these works shall be completed. With the above modification, I entirely approve of Mr. Leslie's plan, the execution of which does not appear to me to present any peculiar difficulty which Mr. Leslie has not provided for.

Water.—What was said to me of the apprehension that there would be great difficulty in keeping the works clear of water, led me to inquire particularly respecting the wells that had been dug in the neighbourhood, and the nature of the strata. On these points, I had information also from Charles Gordon, an experienced well-digger, as well as from Mr. Leslie, and other gentlemen. There will be water undoubtedly, as the ground is sand and gravel, with silth below: this will have to be pumped out, and the springs and wells round will be drained; but, after this is done, the water will diminish, and the quick-sand lose its quickness. I feel assured, from experience in similar cases, that a moderate-sized pumping engine will overcome the difficulty of water. The docks in the Thames are made in sand and gravel, under a clay surface: the Hull docks are all in silth. Mr. Leslie having furnished me with a copy of his working-plans, I have examined the same, and find that great pains have been taken with them: they are very particular and explanatory. I have also examined the estimate in detail, by taking out the quantities from the plans, and find that the same care has been extended to this. The sufficiency of the prices in some cases, particularly the masonry, may be tested by those who have local information. From the proximity to quarries, I think them sufficient; but that the prices of the dams and the excavation are close, considering the contingencies to which these works are liable. On the whole, I would recommend an addition of 3,000*l.* to the amount of 35,121*l.* upon the works detailed in the estimate. On examining the detail, I do not find the following particulars to be included, viz.:—The Dock-gates, mooring and warping buoys in the river, moorings or bollards in Dock, pumping (with the steam-engine) while the works are in progress. These will amount to 4,000*l.*, making an addition of 7,000*l.* to the estimate of 35,121*l.*†

* The Admiralty survey makes six feet only upon the Cross Dykes, the shoalest place, which must be a very low tide.

† Mr. Leslie prepared two estimates; the one being the parliamentary estimate, comprehending the whole work, and amounting to about 40,000*l.*; the other was got by the Trustees, in October, 1837, along with working plans and specifications for the work, exclusive of Dock gates, in four departments, and amounted to 35,000*l.* odds. This last estimate, Mr. Leslie has explained, did include the expense of pumping with the engine, but did not comprehend the Dock gates, stated in the parliamentary estimate at 2,000*l.* Mr. Leslie did not view moorings a part of the Dock, properly so called. The working plans, specifications, and estimate, got in October, 1837, were those submitted to Mr. Walker.

The Harbour.—The Harbour is intimately connected with the Docks; and, as my attention was called, and several questions asked, at your meeting, on the various points relative to the former, it cannot be considered irrelevant if I repeat what I then stated. I have already referred to the principal features of the entrance and river up to the Stell. The harbour is considered by you, and probably with reason, as the best between the Forth and Murray Firth: it is therefore very important in a public view, although certainly not a perfect harbour of refuge; for, with north-east winds, the Leads stone, and other rocks, are upon the lee, close to the entrance, and nearly dry at low water; and, with south-east gales, ships are stated to lie uneasy in the Stell; yet, with westerly, which are the prevailing winds, the harbour affords good refuge. The number of wind-bound vessels that entered the harbour last year was sixty-four; and it was stated to me that twenty to thirty were in the harbour at the same time. Considering the harbour thus, even in a public light, a good beacon should be placed at the entrance, upon the dangerous rock to which I have before alluded; and, judging from my experience in this quarter, I think it more than probable that, if a proper representation were made to the Commissioners of Northern Lights, they would either undertake the work, or assist in it.

The Basin.—As the harbour of Montrose may be considered the passage through which the sea-water finds its way into the Basin* when the tide is at flood, and out of it when the tide is at ebb, and as its depth and width are proportioned to the quantity of water that passes, so every thing that diminishes that quantity, or lessens the basin, has the direct effect of lessening the width and depth of the harbour. Therefore, the basin, to the extent that is covered by a spring tide, should be watched with jealousy, and every encroachment prevented. In the Admiralty survey, it is included as part of the harbour; it is part of the plan now before me, and every encroachment upon it may, by a special Act of Parliament, be the subject of prosecution; but your interests are more immediately concerned, and you have a better opportunity of guarding this, which may be considered the lungs of your harbour.

Harbour Trust.—A meeting of the trustees of the harbour took place in the Town-Hall, on Monday, 28th January last, Provost Crawford in the chair, when the clerk laid on the table the above report. The meeting were highly gratified with the tenor of the report, and concurred in a unanimous opinion, "that the authority of so eminent an engineer as Mr. Walker, in corroboration of Mr. Leslie's views, completely removes all objections to the plan, in regard to site, foundations, eligibility, or otherwise,—and also justifies the trustees in concluding that the works can be executed for a sum below the amount warranted by the rates leviable under the Act, which afford the most adequate security to lenders." The provost then stated that several gentlemen interested in the improvement had resolved to advance 15,000*l.* to the trustees, or to give their guarantee to that amount; and that he was appointed to announce this to the meeting. The trustees expressed their hearty approbation of the proposed loan or guarantee, and agreed to accept of the same, and to record their thanks to the gentlemen who had come so liberally forward to promote the undertaking. The meeting afterwards appointed committees for arranging and disposing of sundry matters preliminary to the commencement of the work, which will be contracted for without loss of time. We understand that the outer wall of the Dock, which is 600 feet in length, and will consequently be of some temporary service to the shipping, is to be first completed.—*Montrose Review.*

HISTORY OF PAPERHANGINGS.

Extracts from a paper by Mr. CRACE, read before the Royal Institute of British Architects.

Paperhangings are of comparatively modern origin, and although they are of such consequence both from the present extent of the manufacture, and as a vehicle for the diffusion of taste, I believe that there has never yet been written any detailed account of its rise and progress in this, or as far as I can discover, in any other country. I imagine them to have been originally manufactured as a cheap imitation of the rich stuffs and tapestries used by our ancestors to cover the stone walls and wainscoting of their apartments.

The English and Flemish were the first in Europe who excelled in tapestry, and are supposed to have brought the art from the Crusades; the workmen in France, from this cause, were called Sarozins.

The well known Bayeux tapestry, representing the invasion of this country by William the Conqueror, is supposed to be the oldest existing specimen. Turner, the historian, says, that our Anglo-Saxon ancestors had wall hangings, some silken, some with figures of golden birds in needlework, others woven, and some plain; and in various illuminated manuscripts dating from the 14th to the 16th centuries, I have found this material frequently introduced as a covering for the walls, and particularly as a canopy for thrones and chairs of state.

It is in the reign of Henry the Eighth that I have been first able to trace the distinct manufacture of the wove tapestry; and Dugdale, in his Warwickshire, affirms that it was *now first* introduced into England by William Sheldon, Esq., who brought over workmen from Flanders about 1540, and employed them in drawing hangings, of which I believe specimens still remain at Weston. Notwithstanding the authority of Dugdale, I think the art was merely then revived; for Lord Arundel, by his will in 1392, tempore Richard the Second, bequeaths to his wife Philippa the hangings of his hall *recently* made in London; and even ten years previously Richard

* In the Admiralty survey the Basin is called the Slake.

the Second granted a licence to Cosmo Gentilis of six pieces of tapestry, of a green ground, powdered with roses, which the king sent as a present to the Pope. However, the art seems in the reign of Henry the Eighth to have been brought to a perfection it had not before attained, and the great Holbein is supposed to have furnished various designs for it.

About this time the use of tapestries was not confined to the nobility, but it was not uncommon to see abundance of arras, rich hangings of tapestry, silver vessels, &c. in the houses of persons of much meaner quality.

In the reign of James the First, a very extensive manufactory of hose tapestry was established at Mortlake, in Surrey, by Sir Francis Crane, which was munificently patronised by that king and his son Charles the First, who granted an annuity of £2000 towards the maintenance of the undertaking. Francis Cleyn, a painter of considerable reputation in the service of the king of Denmark, recommended by Sir Henry Wotton, was employed in this manufactory, and gave designs in both history and grotesque. Indeed, the beautiful hangings which then adorned the British palaces were much admired by foreigners of distinction, who visited this country, and the manufacture was held in high repute abroad. The civil wars, however, ruined this large manufactory to which I have just alluded, and it does not appear to have been again carried on to any extent.

A Monsieur Pariport, in 1720, made a spirited attempt to compete with the celebrated Gobelins at Paris, and founded a considerable manufactory at Fulham, in which he was nobly encouraged by the then Duke of Cumberland, who assisted him with a gift of £6000, but this soon failed; and in 1759 a set of designs for tapestry, painted by Zucharelli, and executed by Paul Saunders for the Earl of Egremont, for a house he built in Piccadilly, were the last made in this country.

Connected with tapestry are the silk and satin damasks and the rich figured velvets; and another material much employed in this country for hangings and other purposes was the stamped and painted gilt leather, on which was represented sometimes in relief divers kinds of grotesques, relieved with gold and silver, vermilion and other colours. Many suppose it to have been invented by the Spaniards, and by them communicated to the Flemings, who excelled in it, and introduced here about the time of Henry the Eighth.

The writers in the French Encyclopedia confess, even in 1762, that though the stamped leather of France equalled that from Flanders and Holland, yet that that made in Venice and England was superior in both beauty of design and durability. This manufacture so much resembles that of paper-hangings, that I conclude it must have given the idea for the invention of, at any rate, one branch of the subject now under consideration.

Paper hangings may be divided into three separate branches; the flock, the metal, and the coloured; and each of these seems to have been invented at a different time, as an imitation of a distinct material—the flock to imitate the tapestries and figured velvets, the metal in imitation of the gilt leather, and the coloured as a cheap substitute for painted decorations. Professor Beckman says, that the former of these, the flock, was first manufactured in England, and invented by Jerome Langer, who carried on the art in London, in the reign of Charles the First, and obtained a patent for his discovery, dated May 1st, 1634. Various French and German authors give us the credit of this invention, yet it is disputed by a Frenchman, M. Tierce, who in the Journal Œconomique says, that a man named François carried on this art at Rouen so early as the year 1620 and 1630, and affirms that the wooden blocks employed are still preserved with the before-mentioned dates inscribed on them. François was succeeded by his son, who followed the business with success for fifty years, and died at Rouen in 1748 (?) M. Savary, in his Dictionnaire de Commerce, thus describes the manner in which the French manufactured their tonture de laine, or flock hangings:—The artist having prepared his design, drew on the cloth, with a fat oil or varnish, the subject intended to be represented; and then the flocker, from a tray containing the different tints of flocks, arranged in divisions, took the colours he required, and sprinkled them in a peculiar manner with his finger and thumb, so that the various shadow ands colours were properly blended, and an imitation of the wove tapestry produced.

Of the second branch, the metal papers, I do not find much mentioned by the older writers; and of the coloured papers, I almost despaired of finding any early account, till, in an old French dictionary of commerce, printed in 1723, under the head of Dominoterie, I discovered an account which seems to give the origin of the present system of paperstaining. Dominoterie is an ancient French name for marble paper, such as used by bookbinders; and the early French paperstainers were associated with the makers of that article, as a class called Dominotiers. The manufacture is thus described:—

The design having been drawn in outline, on paper pasted together of the size required, the paper was then divided into parts of a suitable size, and given to the carver or wood engraver, to cut the designs on blocks of pear tree, much in the same manner as at present. The outline thus cut was printed in ink with a press, resembling that then used by the letter-press printers, on separate sheets of paper. When dry, they were then painted and relieved with different colours in *distemper*, and afterwards joined together, so as to form the required design. The author then adds, that grotesques and panels in which are intermingled flowers, fruits, animals, and small figures, have up to this time succeeded better than imitations of landscapes, or other tapestry hangings, which are sometimes attempted, and refers to article 61 of the French laws in 1686, which confirms the statutes published in 1586, 1618, and 1649, in which rules are given as to what kind of presses, &c., are to be used by the dominotiers, and prohibiting them under heavy penalties from printing with types.

Recurring to the subject as connected with this country; in the year 1754, a Mr. Jackson, a manufacturer of paperhangings at Battersea, published a work on the invention of printing in Chiaro Oscuro, and the application of it to the making of paperhangings, illustrated with prints in proper colours. This book is a sort of advertisement of the kinds of papers made, and the mode of manufacture employed by him. He adopted a style of paper hangings executed with blocks in Chiaro Oscuro, in imitation of the most celebrated classic subjects.

To use his words, "The person who cannot purchase the statues themselves, may have these prints in their places, and thus effectually show his taste. 'Tis the choice and not the price which discovers the true taste of the possessor; and thus the Apollo Belvedere, the Medicean Venus, or the Dying Gladiator, may be disposed of in niches, or surrounded with a mosaic work in imitation of frames, or with festoons and garlands of flowers, with great taste and elegance; or, if preferred, landscapes after the most famous masters, may be introduced into the paper. That it need not be mentioned to any person of taste how much this way of finishing with colours, softening into one another with harmony and repose, exceeds every other kind of paperhanging hitherto known, though it has none of the gay, glaring colours in patches of red, green, yellow, and blue, &c. which are to pass for flowers and other objects in the common papers."

By the account of this gentleman we find that paperhangings were then in common use, and had reached a certain degree of perfection, for that even arabesques were executed; and I therefore conceive that the art discovered by Lanyer had been continued from his time to the present; particularly as in the year 1712, the 10th of Queen Anne, a duty of 1½d. per square yard is imposed on this manufacture. In the reign of that queen the Chinese paperhangings were very much employed, and have continued in fashion to the present day. These hangings, though parts of them may be executed by blocks or stencils, are almost wholly painted by hand. Cotemporary with Jackson, I have learned that a Mr. Taylor, the grandfather of one of our present most eminent manufacturers, carried on this business to a considerable extent, and accumulated a large fortune. He was succeeded by his son, who, I am informed, visited France, and was enabled to give the manufacturers there considerable information. He said, on his return, that he found the French paperhangings very inferior to our own, both as to execution and beauty of design. In those days we had an extensive export trade in this material to America and other foreign parts, but we are now driven out of this market by the French. The paperhangings at that date, about 1770, were manufactured nearly in the same manner as at present; I have indeed seen a flock paper of a large rich damask pattern, more than 100 years old, which resembles in every way the modern material; it is singular that this art of flocking was disused and almost lost during a period of twenty years, and revived only about forty years ago; a mode of decorating papers was also formerly employed, which is now never adopted. I have seen papers ornamented with a substance commonly called frost, a species of talc.

In the year 1786 there was established at Chelsea a manufactory for paperhangings of a superior description, conducted by Messrs. George and Frederick Echardts, gentlemen of considerable taste and spirit. The mode of manufacture was different to that in general use; for, besides the usual printing blocks, copper plates, on which were engraved designs of great finish and beauty, were likewise employed, and they not only printed on paper but also on silk and linen; and by an underground of silver or gold, they obtained very beautiful effects of colour.

Only part of the design was given by printing; it was finished by artists constantly retained by the manufacturers, men of considerable talent, who again were assisted in the inferior parts by young girls, of whom more than fifty were employed; and had this undertaking been supported by the government, it would, I do think, have been more available as a school for our rising artists, and of infinitely greater service than our present school of design, for it would have been a *working school*, and no other, I am convinced, will be of any use in forming a talented race of decorative artists in this country. There was also about this time another establishment similar to the former, conducted by Mr. Sheringham, in Marlborough-street.

From this time the French began to excel in this superior branch of the art, which with us had fallen on such barren ground. Their manufacturers were encouraged in every way by their government and the Emperor Napoleon, to attempt that perfection which they have now so successfully attained.

Having now slightly sketched the history of this art up to the present time, I propose on some future occasion, if agreeable to the society, to explain to the best of my power the different processes employed in the manufacture.

[The continuation of this interesting paper, which was read at a subsequent meeting, we shall publish in the next Journal.]

DESCRIPTION OF THE PATENT CEMENT OF MR. R. MARTIN, OF DERBY,

Read at the Royal Institute of British Architects, February 18, 1839.

The composition of my cement consists of a solution of pearlash and sulphuric acid, mixed to the exact point of neutralization with powder of gypsum, and the whole calcined together.

In calcination every particle of crystallized water and native acid is driven from the gypsum, and their place supplied with the alkali and acid made sulphate of potash as above described.

This change of solidifying substances creates properties altogether new and opposite in effect to all other water-mixed cements. There is neither heat nor expansion in solidification, nor subsequent swelling from absorption of the atmosphere or by immersion in water. It therefore results that the cement neither cracks nor creases, when used either as an in or out-door stucco. The mode of using the cement is very simple—similar to common lime plaster, but the purposes to which it is applicable are extremely varied. As it can be made of a variety of colours in manufacture, or colours introduced, it will supersede the necessity of paint or paper, where their use is objectionable; it is therefore particularly applicable for attics and basements.

For imitations of marble it must become the substitute of plaster of Paris, it being much more dense, and through its nonabsorptive quality withstanding all atmospheres, as has been already proved. As it does not expand in solidification, as above stated, solid figures may be cast with it if pressed into moulds. It combines readily with limes slaked or quick, and mixed with the latter it prevents its slaking, and with these, or by itself and sand, it forms an excessively hard and durable stucco. In its prepared state for use it does not receive the slightest injury from exposure to a damp atmosphere for any length of period, and will therefore carry without depreciation to any part of the globe—it is effective for every purpose for which the limes of this kingdom are used in its transatlantic possessions; and from being double their weight, will be nearly as economical in use, independent of its peculiar properties excluding all moisture and preventing the intrusion and ravages of insect and other vermin: considerations not only important to the resident, but to the government as conservators of the public stores.

For the joining together of stones, bricks, &c., it has not its equal, and can be used with the greatest advantage, where lime proves but an insufficient bond, and Roman cement from its expansive properties is improper; say for light-houses and other very elevated and much-exposed structures.

Applied as a stucco over common lime plaster a very smooth and hard surface is produced, and is so little absorbent that in painting two coats are sufficient. This application was made by Mr. Chadwick above three years since, on two halls at Adelaide-place, London Bridge, and who will verify the fact here stated.

In the summer of 1837 it was applied in castings and as a stucco, at 72, Cheapside (opposite the Atlas Insurance Office); the stucco has been since painted over, but not so the two coats of arms, which, as well as the stucco, have withstood the two last winters without the slightest injury.

Any further information respecting properties, &c., &c., may be obtained of Mr. Bernasconi, Alfred-place, Bedford-square, and who will also show specimens of its various applications.

PHOTOGENY;

OR, THE ART OF FIXING THE IMAGES OF VISUAL OBJECTS.

The means of obtaining a self-acting, permanent representation of visual objects, has long attracted the attention of philosophers, and in 1802 was the subject of experiments by Wedgewood and Sir Humphry Davy. Their efforts, further than recognising the sensibility of nitrate of silver, were, however, ineffective, as were those of a committee of the Academy of Sciences, composed of Laplace, Malus, and Arago, who were engaged in a similar manner investigation for ascertaining the power of moonlight. Chlorure of silver was also known to be easily acted upon by the rays of light; but it was not until the close of last year that any announcement was made of the progress of this art. Mr. Fox Talbot seems to have been first in the field; but M. Daguerre, the inventor of the diorama, made the first disclosure. As the two processes seem to be distinct in their results, we shall give a description of each separately, as derived from the "Compte Rendu" of the Academy of Sciences, and from the letters of Mr. Talbot. To commence with that of M. Daguerre, it is effected by placing a copper plate in a camera obscura, which copper plate being covered with a chemical preparation susceptible of the effects of light, produces a shaded drawing on the plate. These designs, when finished, may be exposed to the glare of the sun without changing, and will bear the scrutiny of a microscope. On reverting to the different powers of colours, it can be readily conceived that the several tints and shades will produce an effect corresponding to their intensity; the three primitive colours, as determined by Field, standing in the relation of three, five, and eight; the time required for the process varies with the quantity of light, and, consequently, with the season and time of day; in summer, at noon, eight or ten minutes is sufficient. This apparatus is at present incompetent to the representation of moving objects, and is imperfect even with regard to trees. A hackney-coach stopped during the drawing of one of the scenes, and one of the horses, turning his head during the process, is represented without one. A shoe-black, also engaged in his vocation, appears without arms; The Academy of Sciences expressed a unanimous opinion of the utility and importance of this invention, and application has been made to the French Government to remunerate the inventor. The announcement of this discovery led to the declaration of Mr. Fox Talbot, who has perfected another variety of the same process. He uses a prepared paper, and produces a representation in coloured tints, which, after the drawing is finished, is not affected by sunshine. Both processes possess peculiar advantages, and have a superiority over any chemical medium heretofore known. Chlorure of silver being white, is blackened by the light, and the white parts of the image become black, whilst the black parts remain white. Nitrate and muriate of silver obtain an impression in half a second, but none of these preparations produce a permanent effect. The importance of the new discoveries will open a new world to science, and even by the results already produced, the bounds of human investigation have been enlarged. The preparation of M. Daguerre is so sensible that it has obtained an image of the moon in twenty minutes, although the light of that body is 300,000 times less than that of the sun, and it produces no effect on any other chemical substance yet known. M. Daguerre is also said to have obtained an impression from the star Sirius, thus proving the fixed stars to be suns, and that light is homogeneous throughout the universe.

We copy the following very interesting account of the process of Mr. Talbot from our respectable contemporary, the "Athenæum":

1. In the spring of 1834 I began to put in practice a method which I had devised some time previously, for employing to purposes of utility the very curious property which has been long known to chemists to be possessed by the nitrate of silver; namely, its discolouration when exposed to the violet ray of light. This property appeared to me to be, perhaps, capable of useful application in the following manner:—

I proposed to spread on a sheet of paper a sufficient quantity of the nitrate of silver, and then to set the paper in the sunshine, having first placed before it some object casting a well-defined shadow. The light, acting on the rest of the paper, would naturally blacken it, while the parts in shadow would retain their whiteness. Thus I expected that a kind of image or picture would be produced, resembling to a certain degree the object from which it was derived. I expected, however, also, that it would be necessary to preserve such images in a portfolio, and to view them only by candle-light; because, if by day-light, the same natural process which formed the images would destroy them, by blackening the rest of the paper.

Such was my leading idea before it was enlarged and corrected by experience. It was not until some time after, and when I was in possession of several novel and curious results, that I thought of inquiring whether this process had been ever proposed or attempted before? I found that in fact it had; but apparently not followed up to any extent, or with much perseverance. The few notices that I have been able to meet with are vague and unsatisfactory, merely stating that such a method exists of obtaining the outline of an object, but going into no details respecting the best and most advantageous manner of proceeding.

The only definite account of the matter which I have been able to meet with, is contained in the first volume of the "Journal of the Royal Institution," page 170, from which it appears that the idea was originally started by Mr. Wedgwood, and a numerous series of experiments made both by him and Sir Humphry Davy, which, however, ended in failure. I will take the liberty of quoting a few passages from this memoir.

"The copy of a painting, immediately after being taken, must be kept in an obscure place. It may, indeed, be examined in the shade, but in this case the exposure should be only for a few minutes. No attempts that have been made to prevent the uncoloured parts from being acted upon by light have as yet been successful. They have been covered with a thin coating of fine varnish; but this has not destroyed their susceptibility of becoming coloured. When the solar rays are passed through a print, and thrown upon prepared paper, the unshaded parts are slowly copied; but the lights transmitted by the shaded parts are seldom so definite as to form a distinct resemblance of them by producing different intensities of colour.

"The images formed by means of a *camera obscura* have been found too faint to produce in any moderate time an effect upon the nitrate of silver. To copy these images was the first object of Mr. Wedgwood, but all his numerous experiments proved unsuccessful."

These are the observations of Sir Humphry Davy. I have been informed by a scientific friend that this unfavourable result of Mr. Wedgwood's and Sir Humphry Davy's experiments was the chief cause which discouraged him from following up with perseverance the idea which he had also entertained of fixing the beautiful images of the *camera obscura*. And, no doubt, when so distinguished an experimenter as Sir Humphry Davy announced "that all experiments had proved unsuccessful," such a statement was calculated materially to discourage further inquiry. The circumstance, also, announced by Davy, that the paper on which these images were depicted was liable to become entirely dark, and that nothing hitherto tried would prevent it, would perhaps have induced me to consider the attempt as hopeless, if I had not (fortunately), before I read it, already discovered a method of overcoming this difficulty, and of *fixing* the image in such a manner that it is no more liable to injury or destruction.

In the course of my experiments directed to that end, I have been astonished at the variety of effects which I have found produced by a very limited number of different processes when combined in various ways; and also at the length of time which sometimes elapses before the full effect of these manifests itself with certainty. For I have found that images formed in this manner, which have appeared in good preservation at the end of twelve months from their formation, have, nevertheless, somewhat altered during the second year. This circumstance, added to the fact that the first attempts which I made became indistinct in process of time (the paper growing wholly dark), induced me to watch the progress of the change during some considerable time, as I thought that perhaps *all* these images would *ultimately* be found to fade away. I found, however, to my satisfaction, that this was not the case; and, having now kept a number of these drawings during nearly five years without their suffering any deterioration, I think myself authorised to draw conclusions from my experiments with more certainty.

2. *Effect and Appearance of these Images.*—The images obtained in this manner are themselves white, but the ground upon which they display themselves is variously and pleasingly coloured.

Such is the variety of which the process is capable, that by merely varying the proportions, and some trifling details of manipulation, any of the following colours are readily attainable:—Sky-blue, yellow, rose-colour, brown of various shades, and black. Green alone is absent from the list, with the exception of a dark shade of it, approaching to black. The blue-coloured variety has a very pleasing effect, somewhat like that produced by the Wedgwood-ware, which has white figures on a blue ground. This variety also retains its colours perfectly if preserved in a portfolio, and not being subject to any spontaneous change requires no preserving process. These different shades of colour are, of course, so many different chemical compounds, which chemists have not hitherto distinctly noticed.

3. *First Applications of this Process.*—The first kind of objects which I attempted to copy by this process were flowers and leaves, either fresh, or selected from my herbarium. These it renders with the utmost truth and fidelity, exhibiting even the venation of the leaves, the minute hairs that clothe the plant, &c. &c.

It is so natural to associate the idea of *labour* with great complexity and elaborate detail of execution, that one is more struck at seeing the thousand florets of an *Agrostis* depicted with all its capillary branchlets (and so accurately that none of all this multitude shall want its little bivalve calyx, requiring to be examined through a lens), than one is by the picture of the large and simple leaf of an oak or a chesnut. But, in truth, the difficulty is in both cases the same. The one of these takes no more time to execute than the other; for the object which would take the most skilful artist days or weeks of labour to trace or to copy, is effected by the boundless powers of natural chemistry in the space of a few seconds.

To give an idea of the degree of accuracy with which some objects can be imitated by this process, I need only mention one instance. Upon one occasion, having made an image of a piece of lace of an elaborate pattern, I showed it to some persons at the distance of a few feet, with the inquiry whether it was a good representation? when the reply was, "That they were not so easily to be deceived, for that it was evidently no picture, but the piece of lace itself."

At the very commencement of my experiments upon this subject, when I saw how beautiful were the images which were thus produced by the action of light, I regretted the more that they were destined to have such a brief existence, and I resolved to attempt to point out, if possible, some method of preventing this, or retarding it as much as possible. The following considerations led me to conceive the possibility of discovering a preservative process:—

The nitrate of silver, which has become black by the action of light, is no longer the same chemical substance that it was before. Consequently, if a picture produced by solar light is subjected afterwards to any chemical process, the white and dark parts of it will be differently acted upon; and there is no evidence that, after this action has taken place, these white and dark parts will any longer be subject to a spontaneous change; or, if they are so, still it does not follow that that change will *now* tend to assimilate them to each other. In cases of their remaining *dissimilar* the picture will remain visible, and therefore our object will be accomplished.

If it should be asserted that exposure to sunshine would *necessarily* reduce the whole to one uniform tint, and destroy the picture, the *onus probandi* evidently lies on those who make the assertion. If we designate by the letter A the exposure to the solar light, and by B some indeterminate chemical process, my argument was this:—Since it cannot be shown, *à priori*, that the final result of the series of processes A B A will be the same with that denoted by B A, it will be, therefore, worth while to put the matter to the test of experiment, viz., by varying the process B until the right one be discovered, or until so many trials have been made as to preclude all reasonable hope of its existence.

My first trials were unsuccessful, as, indeed, I expected; but after some time I discovered a method which answers perfectly, and shortly afterwards another. On one of these more especially I have made numerous experiments; the other I have comparatively little used, because it appears to require more nicety in the management. It is, however, equal, if not superior, to the first in brilliancy of effect.

This chemical change, which I call the *preserving process*, is far more effectual than could have been anticipated. The paper, which had previously been so sensitive to light, becomes completely insensible to it, insomuch that I am able to show the society specimens which have been exposed for an hour to the full summer sun, and from which exposure the image has suffered nothing, but retains its perfect whiteness.

4. *On the Art of fixing a Shadow.*—The phenomenon which I have now briefly mentioned appears to me to partake of the character of the *marvellous*, almost as much as any fact which physical investigation has yet brought to our knowledge. The most transitory of things—a shadow, the most proverbial emblem of all that is fleeting and momentary—may be fettered by the spells of our "natural magic," and may be fixed for ever in the position which it seemed only destined for a single instant to occupy.

This remarkable phenomenon, of whatever value it may turn out in its application to the arts, will, at least, be accepted as a new proof of the value of the inductive methods of modern science, which by noticing the occurrence of unusual circumstances (which accident, perhaps, first manifests in some small degree), and by following them up with experiments, and varying the conditions of these until the true law of nature which they express is apprehended, conducts us at length to consequences altogether unexpected, remote from usual experience, and contrary to almost universal belief. Such is the fact, that we may receive on paper the fleeting shadow, arrest it there, and in the space of a single minute fix it there so firmly as to be no more capable of change, even if thrown back into the sunbeam from which it derived its origin.

5. Before going further I may, however, add, that it is not always necessary to use a preserving process. This I did not discover until after I had acquired considerable practice in this art, having supposed at first that all these pictures would ultimately become indistinct if not preserved in some way from the change. But experience has shown to me that there are at least two or three different ways in which the process may be conducted, so that the images shall possess a character of durability, provided they are kept from the action of direct sunshine. These ways have presented themselves to notice rather accidentally than otherwise; in some instances without any particular memoranda having been made at the time; so that I am not yet prepared to state accurately on what particular thing this sort of semi-durability depends, or what course is best to be followed in order to obtain it. But as I have found that certain of the images which have been subjected to no preserving process remain quite white and perfect after the lapse of a year or two, and, indeed, show no symptom whatever of changing, while others differently prepared (and left unpreserved) have grown quite dark in one tenth of that time, I think this singularity requires to be pointed out. Whether it will be of much value I do not know. Perhaps it will be thought better to incur at first the small additional trouble of employing the preserving process, especially as the drawings thus prepared will stand the sunshine; while the unpreserved ones, however well they last in a portfolio or in common daylight, should not be risked in a very strong light, as they would be liable to change thereby even years after their original formation. This very quality, however, admits of useful application. For this semi-durable paper, which retains its whiteness for years in the shade, and yet suffers a change whenever exposed to the solar light, is evidently well suited to the use of a naturalist travelling in a distant country, who may wish to keep some memorial of the plants he finds, without having the trouble of drying them and carrying them about with him. He would only have to take a sheet of this paper, throw the image upon it, and replace it in his portfolio. The defect of this particular paper is, that in general the *ground* is not even; but this is of no consequence where utility alone, and not beauty of effect, is consulted.

6. *Portraits.*—Another purpose for which I think my method will be found very convenient, is the making of outline portraits, or *silhouettes*. These are now often traced by the hand from shadows projected by a candle. But the hand is liable to err from the true outline, and a very small deviation causes a notable diminution in the resemblance. I believe this manual process cannot be compared with the truth and fidelity with which the portrait is given by means of solar light.

7. *Paintings on Glass.*—The shadow-pictures which are formed by exposing paintings on glass to solar light are very pleasing. The glass itself, around the painting, should be blackened; such, for instance, as are often employed for the magic lantern. The paintings on the glass should have no bright yellows or reds, for these stop the violet rays of light, which are the only effective ones. The pictures thus formed resemble the productions of the artist's pencil more, perhaps, than any of the others. Persons to whom I have shown them have generally mistaken them for such, at the same time observing that the *style* was new to them, and must be one rather difficult to acquire. It is in these pictures only that, as yet, I have observed indications of *colour*. I have not had time to pursue this branch of the inquiry further. It would be a great thing if by any means we could accomplish the delineation of objects in their natural colours. I am not very sanguine respecting the possibility of this; yet, as I have just now remarked, it appears possible to obtain at least some indication of variety of tint.

8. *Application to the Microscope.*—I now come to a branch of the subject which appears to me very important, and likely to prove extensively useful, the application of my method of delineating objects to the solar microscope.

The objects which the microscope unfolds to our view, curious and wonderful as they are, are often singularly complicated. The eye, indeed, may comprehend the whole which is presented to it in the field of view; but the powers of the pencil fail to express these minutiæ of nature in their innumerable details. What artist could have skill or patience enough to copy them? Or granting that he could do so, must it not be at the expense of much most valuable time, which might be more usefully employed?

Contemplating the beautiful picture which the solar microscope produces, the thought struck me whether it might not be possible to cause that image to impress itself upon the paper, and thus to let Nature substitute her own inimitable pencil for the imperfect, tedious and almost hopeless attempt of copying a subject so intricate?

My first attempt had no success. Although I chose a bright day, and formed a good image of my object upon prepared paper, on returning at the expiration of an hour I found that no effect had taken place. I was therefore half inclined to abandon this experiment, when it occurred to me that there was no reason to suppose that the common muriate of silver was the most sensitive substance that exists to the action of the chemical rays; and though such should eventually prove to be the fact, at any rate it was not to be assumed without proof. I therefore began a course of experiments in order to ascertain the influence of various modes of preparation, and I found these to be signally different in their results. I considered this matter chiefly in a practical point of view; for as to the theory, I confess that I cannot as yet understand the reason why the paper prepared in one way should be so much more sensitive than in another.

The result of these experiments was the discovery of a mode of preparation greatly superior in sensibility to what I had originally employed; and by means of this, all those effects which I had before only anticipated as theoretically possible were found to be capable of realization.

With a sheet of this, which I shall call "*Sensitive Paper,*" is placed in a dark chamber, and the magnified image of some object thrown on it by the solar microscope, after the lapse of perhaps a quarter of an hour, the picture is found to be completed. I have not as yet used high magnifying powers, on account of the consequent enfeeblement of the light. Of course with a more sensitive paper, greater magnifying power will become desirable.

On examining one of these pictures, which I made about three years and a half ago, I find, by actual measurement of the picture and the object, that the latter is magnified seventeen times in linear diameter, and in surface consequently 289 times. I have others which I believe are considerably more magnified; but I have lost the corresponding objects, so that I cannot here state the exact numbers.

Not only does this process save our time and trouble, but there are many objects, especially microscopic crystallizations, which alter so greatly in the course of three or four days (and it could hardly take any artist less to delineate them in all their details,) that they could never be drawn in the usual way.

I will now describe the *degree of sensitiveness* which this paper possesses, premising that I am far from supposing that I have reached the limit of which this quality is capable. On the contrary, considering the few experiments which I have made, (few, that is, in comparison with the number which it would be easy to imagine and propose) I think it most likely that other methods may be found, by which substances may be prepared, perhaps as much transcending in sensitiveness the one which I have employed, as that does the ordinary state of the nitrate of silver. But to confine myself to what I have actually accomplished in the preparation of a very sensitive paper.

When a sheet of paper is brought towards a window, not one through which the sun shines, but looking in the opposite direction, it immediately begins to discolour. For this reason, if the paper is prepared by daylight, it must by no means be left uncovered, but as soon as finished be shut up in a drawer or cupboard and there left to dry, or else dried at night by the warmth of a fire. Before using this paper for the delineation of any object, I generally approach it for a little time towards the light, thus intentionally giving it a slight shade of colour, for the purpose of seeing that the *ground is even.* If it appears so when thus tried to a small extent, it will generally be found to prove so in the final result. But if there are some places or spots in it which do not acquire the same tint as the rest, such a sheet of paper should be rejected; for there is a risk that, when employed, instead of presenting a ground uniformly dark, which is essential to the beauty of the drawing, it will have large white spots, places altogether insensible to the effect of light. This singular circumstance I shall revert to elsewhere; it is sufficient to mention it here.

The paper then, which is thus readily sensitive to the light of a common window, is of course much more so to the direct sunshine. Indeed, such is the velocity of the effect then produced, that the picture may be said to be ended almost as soon as it is begun.

To give some more definite idea of the rapidity of the process, I will state, that after various trials the nearest evaluation which I could make of the time necessary for obtaining the picture of an object, so as to have pretty distinct outlines, when I employed the full sunshine, was *half a second.*

9. *Architecture, Landscape, and External Nature.*—But perhaps the most curious application of this art is the one I am now about to relate. At least it is that which has appeared the most surprising to those who have examined my collection of pictures formed by solar light.

Every one is acquainted with the beautiful effects which are produced by a camera obscura, and has admired the vivid picture of external nature which it displays. It had often occurred to me, that if it were possible to retain upon the paper the lovely scene which thus illuminates it for a moment, or if we could but fix the outline of it, the lights and shadows divested of all *colour,* such a result could not fail to be most interesting. And however much I might be disposed at first to treat this notion as a scientific dream, yet when I had succeeded in fixing the images of the solar microscope by means of a peculiarly sensitive paper, there appeared no longer any doubt that an analogous process would succeed in copying the objects of external nature, although indeed they are much less illuminated.

Not having with me in the country a camera obscura of any considerable size, I constructed one out of a large box, the image being thrown upon one end of it by a good object glass fixed in the opposite end. This apparatus being armed with a sensitive paper was taken out in a summer afternoon and placed about one hundred yards from a building favourably illuminated by the sun. An hour or two afterwards I opened the box, and I found depicted upon the paper a very distinct representation of the building, with the exception of those parts of it which lay in the shade. A little experience in this branch of the art showed me that with smaller cameræ obscuræ the effect would be produced in a smaller time. Accordingly I had several small boxes made, in which I fixed lenses of shorter focus, and with these I obtained very perfect but extremely small pictures; such as without great stretch of imagination might be supposed to be the work of some Lilliputian artist. They require indeed examination with a lens to discover all their minutiæ.

In the summer of 1835 I made in this way a number of representations of my house in the country, which is well suited to the purpose, from its ancient and remarkable architecture. And this building I believe to be the first that was ever yet known *to have drawn its own picture.*

The method of proceeding was this; having first adjusted the paper to the proper focus in each of these little *cameræ,* I then took a number of them with me out of doors and placed them in different situations around the building. After the lapse of half an hour I gathered them all up, and brought them within doors to open them. When opened, there was found in each a miniature picture of the objects before which it had been placed.

To the traveller in distant lands who is ignorant, as too many unfortunately are, of the art of drawing, this little invention may prove of real service; and even to the artist himself, however skilful he may be. For although this natural process does not produce an effect much resembling the productions of his pencil, and therefore cannot be considered as capable of replacing them, yet it is to be recollected that he may often be so situated as to be able to devote only a single hour to the delineation of some very interesting locality. Now, since nothing prevents him from simultaneously disposing, in different positions, any number of these little *cameræ,* it is evident that their collective results when examined afterwards, may furnish him with a large body of interesting memorials, and with numerous details which he had not had himself time either to note down or to delineate.

10. *Delineations of Sculpture.*—Another use which I propose to make of my invention is for the copying of statues and bas reliefs. I place these in strong sunshine, and put before them at a proper distance, and in the requisite position, a small camera obscura containing the prepared paper. In this way I have obtained images of various statues, &c. I have not pursued this branch of the subject to any extent: but I expect interesting results from it, and that it may be usefully employed under many circumstances.

11. *Copying of Engravings.*—The invention may be employed with great facility for obtaining copies of drawings or engravings or facsimiles of MSS. For this purpose the engraving is pressed upon the prepared paper, with its engraved side in contact with the latter. The pressure must be as uniform as possible, that the contact may be perfect; for the least interval sensibly injures the result, by producing a kind of cloudiness in lieu of the sharp strokes of the original.

When placed in the sun, the solar light gradually traverses the paper, except in those places where it is prevented from doing so by the opaque lines of the engraving. It therefore of course makes an exact image or print of the design. This is one of the experiments which Davy and Wedgwood state that they tried, but failed, from want of sufficient sensibility in their paper.

The length of time requisite for effecting the copy depends on the thickness of the paper on which the engraving has been printed. At first I thought that it would not be possible to succeed with thick papers; but I found on trial that the success of the method was by no means so limited. It is enough for the purpose, if the paper allows any of the solar light to pass. When the paper is thick, I allow half an hour for the formation of a good copy. In this way I have copied very minute, complicated, and delicate engravings, crowded with figures of small size, which were rendered with great distinctness.

The effect of the copy, though of course unlike the original, (substituting as it does lights for shadows, and *vice versa*), yet is often very pleasing, and would, I think, suggest to artists useful ideas respecting light and shade.

It may be supposed that the engraving would be soiled or injured by being thus pressed against the prepared paper. There is not much danger of this, provided both are perfectly dry. It may be well to mention, however, that in case any stain should be perceived on the engraving, it may be readily removed by a chemical application which does no injury whatever to the paper.

In copying engravings, &c., by this method, the lights and shadows are reversed, consequently the effect is wholly altered. But if the picture so obtained is first *preserved* so as to bear sunshine, it may be afterwards itself employed as an object to be copied; and by means of this second process the lights and shadows are brought back to their original disposition. In this way we have indeed to contend with the imperfections arising from two processes instead of one; but I believe this will be found merely a difficulty of manipulation. I propose to employ this for the purpose more particularly of multiplying at small expense copies of such rare or unique engravings as it would not be worth while to re-engrave, from the limited demand for them.

I will now add a few remarks concerning the very singular circumstance, which I have before briefly mentioned, viz. that the paper sometimes, although intended to be prepared of the most sensitive quality, turns out on trial to be wholly insensible to light, and incapable of change. The most singular part of this is the very small difference in the mode of preparation which causes so wide a discrepancy in the result. For instance, a sheet of paper is all prepared at the same time, and with the intention of giving it as much uniformity as possible; and yet, when exposed to sunshine, this paper will exhibit large white spots of very definite outline, where the preparing process has failed: the rest of the paper, where it has succeeded, turning black as rapidly as possible. Sometimes the spots are of a pale tint of cœrulean blue, and are surrounded by exceedingly definite outlines of perfect whiteness, contrasting very much with the blackness of the part immediately succeeding. With regard to the theory of this, I am only prepared to state as my opinion at present, that it is a case of what is called "unstable equilibrium." The process followed is such as to produce one of two definite chemical compounds;

and when we happen to come near the limit which separates the two cases, it depends upon exceedingly small and often imperceptible circumstances, which of the two compounds shall be formed. That they are both definite compounds, is of course at present merely my conjecture; that they are signally different, is evident from their dissimilar properties.

I have thus endeavoured to give a brief outline of some of the peculiarities attending this new process, which I offer to the lovers of science and nature. That it is susceptible of great improvements I have no manner of doubt; but even in its present state I believe it will be found capable of many useful and important applications besides those of which I have here given a short account.

The subject (says Mr. Talbot) naturally divides itself into two heads—the preparation of the paper, and the means of fixing the design. In order to make what may be called ordinary photogenic paper, the author selects, in the first place, paper of a good firm quality, and smooth surface; and thinks that none answers better than superfine writing paper. He dips it into a weak solution of common salt, and wipes it dry, by which the salt is uniformly distributed throughout its substance. He then spreads a solution of nitrate of silver on one surface only, and dries it at the fire. The solution should not be saturated, but six or eight times diluted with water. When dry, the paper is fit for use. He has found, by experiment, that there is a certain proportion between the quantity of salt and that of the solution of silver which answers best, and gives the maximum effect. If the strength of the salt is augmented beyond this point, the effect diminishes, and, in certain cases, becomes exceedingly small. This paper, if properly made, is very useful for all ordinary photogenic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer sun. The light passing through tthe leaves delineates every ramification of their nerves. If a sheet of paper, thus prepared, be taken and washed with a saturated solution of salt, and then dried, it will be found (especially if the paper has been kept some weeks before the trial is made), that its sensibility is greatly diminished, and, in some cases, quite extinct. But if it be again washed with a liberal quantity of the solution of silver, it becomes again sensible to light, and even more so than it was at first. In this way, by alternately washing the paper with salt and silver, and drying it between times, Mr. Talbot has succeeded in increasing its sensibility to the degree that is requisite for receiving the images of the camera obscura. In conducting this operation, it will be found, that the results are sometimes more, and sometimes less satisfactory, in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver is disposed to darken of itself, without any exposure to the light—this shows, that the attempt to give it sensibility has been carried too far. The object is, to approach to this condition as near as possible, without reaching it; so that the substance may be in a state ready to yield to the slightest extraneous force, such as the feeble impact of the violet rays when much attenuated. Having, therefore, prepared a number of sheets of paper, slightly different from one another in the composition, let a piece be cut from each, and, having been duly marked or numbered, let them be placed side by side in a very weak diffused light, for about a quarter of an hour; then, if any one of them, as frequently happens, exhibits a marked advantage over its competitors, Mr. Talbot selects the paper which bears the corresponding number to be placed in the camera obscura.

With regard to the second object—that of fixing the images—Mr. Talbot observed, that, after having tried ammonia, and several other re-agents, with very imperfect success, the first which gave him a successful result, was the iodide of potassium, much diluted with water. If a photogenic picture is washed over with this liquid, an iodide of silver is formed, which is absolutely unalterable by sunshine. This process requires precaution; for, if the solution is too strong, it attacks the dark parts of the picture. It is requisite, therefore, to find, by trial, the proper proportions. The fixation of the pictures in this way, with proper management, is very beautiful and lasting. The specimen of lace, which Mr. Talbot exhibited to the society, and which was made five years ago, was preserved in this manner. But his usual method of fixing is different from this, and somewhat simpler—or, at least, requiring less nicety. It consists in immersing the picture in a strong solution of common salt, and then wiping off the superfluous moisture, and drying it. It is sufficiently singular that the same substance which is so useful in giving sensibility to the paper, should also be capable, under other circumstances, of destroying it; but such is, nevertheless, the fact. Now, if the picture which has been thus washed and dried, is placed in the sun, the white parts colour themselves of a pale lilac tint, after which they become insensible. Numerous experiments have shown the author that the depth of this lilac tint varies according to the quantity of salt used, relatively to the quantity of silver; but by properly adjusting these, the images may, if desired, be retained of an absolute whiteness. He mentions, also, that those preserved by iodine are always of a very pale primrose yellow, which has the extraordinary and very remarkable property of turning to a full gaudy yellow, whenever it is exposed to the heat of a fire, and recovering its former colour again, when it is cold.

Ship-building.—The ship-builders of Liverpool, have seldom, if ever, been so busy as they are at present. All the yards on both sides the Mersey are occupied by vessels, of various tonnage, in process of building; and more frames would be laid down if the builders could undertake the work. The ship-builders along the west and the east coast are equally busy, and have frequent occasion to refuse proffered contracts for building vessels. All these circumstances show that the shipping interest is in a very flourishing state.—*Liverpool paper.*

NELSON MEMORIAL.

Merely a single visit to Mr. Rainy's Gallery—just before our presen number was going to press, and when of course we ourselves were greatly hurried,—does not enable us to enter into any critical remarks on any of the designs and models individually, or even to give a general opinion as to the average talent displayed in this competition, further than that satisfactory as the *coup d'œil* of the exhibition itself is, we observed very few designs characterised by originality of invention or propriety of adaptation to the intended site. On the contrary, the larger majority, we apprehend, would be found, on deliberate examination, to be but poorly calculated to suit either the area itself, or the surrounding buildings.

DESIGN BY W. RAILTON, ARCHITECT.

To which the first premium is proposed to be adjudged by the first Committee.

The design makes no pretension whatever to originality, being no more than a fluted Corinthian column, 174 feet high, on a pedestal ornamented with reliefs, and surmounted by a statue 17 feet high, consequently for want of some basement or substructure will be apt to look too small, except as merely a lofty central ornament in the square.

The following description of the two other prizes are by their respective authors:—

DESIGN, BY E. H BAILY, R.A.

To which the committee propose to award the second prize.

Description.—An Obelisk raised to the memory of Nelson by his grateful country. At the base, our great Naval Commander is represented supporting the Imperial Standard; on his left stands the Genius of Britain, hailing with affection the Hero of Trafalgar; his attendant, Victory, being seated on his right. At the back of the Obelisk rests the Nile—Neptune with the subordinate Deities of the Ocean, form a Triumphal Procession round the Rock on which the Monument is placed, thereby indicating that the Victories of Nelson were as extensive as the Element on which h fought.

Dimensions.—The height of the Monument is intended to be 60 feet; the diameter of the steps the same extent; and the height of Nelson to be nine feet, the other figures in proportion, as in the sketch.

Estimate.—To execute the whole monument in Ravaccioni Marble, (the same as the arch before Buckingham Palace is built of) 22,000*l*.—if executed in Bronze, 30,000*l*.

DRAWINGS AND MODEL BY CHARLES FOWLER, ARCHITECT, AND R. W. SIEVIER, SCULPTOR.

To which the committee propose to award the third prize.

This design has been composed upon the principle of combining Architecture and Sculpture; with a view to obtain a more striking effect from their union than either is calculated to produce separately; the one by its forms and mass, to arrest the attention and make a general impression, which may be heightened and perfected by the more refined and interesting details of the other. It would appear from the result of existing instances that a mere structure cannot properly convey the feeling or produce the effect intended by a Monument, designed to commemorate any celebrated character or event. On the other hand a Statue or Sculpture Groupe is inefficient for want of mass and general form; the former is appreciated as a distant object, and the latter only on close inspection. The desideratum, therefore, lies in avoiding these objections, or rather in combining the advantages which peculiarly belong to each art, so that the many who pass by may be struck with the general aspect of the Monument, and the few who may pause to examine its details may find their first impressions carried forward and perfected by the beauty and significance of its historical illustrations.

With respect to the design now submitted, the endeavour has been to render it characteristic and appropriate to the occasion, avoiding plagiarism but without affecting novelty. The rostrated decorations of the pedestal, and its accessories proclaim it at once to be a naval trophy; and the hero to be commemorated will be not less plainly indicated; whilst the sculpture and other details will set forth his achievements.

In regard to the structure, simplicity and strength are the distinguishing qualities of the basement, which is proposed to be constructed of granite, in large blocks, so as to be striking for their massiveness, solidity, and giving dignity to the superstructure. The pedestals at the angles of the platform are to be surmounted with piles of trophies executed in bronze, and crowned with lamps to light both the area and monument; massive granite basins are set to receive the running fountains on three sides, the fourth being reserved for an entrance to the structure within. The colossal figures seated against the four fronts of the pedestal, are designed to represent Britannia, Caledonia, Hibernia, and Neptune, distinguished by their appropriate insignia and attributes.

On the south front of the pedestal, and at a legible distance from the spectator, is proposed to be inscribed a brief eulogium of the hero,—some attempt at which, by way of illustration, is made in the drawing, without presuming to anticipate that delicate task, which will properly devolve upon other and more able hands. The opposite side is intended to contain the historical or matter-of-fact inscription, comprising also a record of the erection of the monument. The other two sides are to have each a shield of arms in relief, encircled by a wreath. The cap or cornice of the lower pedestal is decorated by antique prows of vessels, to give the rostrated character, enriched with festoons of oak and marine ornaments.

The middle compartment of the structure contains on the four faces of the dado simply the names of the four principal actions in which Nelson was engaged; and in the panel over each is a representation in *Basso relievo* of some striking incident, in each battle—the front being distinguished by the grand catastrophe, which formed at once the climax of his achievements, and the termination of his brilliant career.

In order to give character, as well as to provide for an unusually bold projecture, the Gallery above is supported on Cannons, in lieu of the usual architectural consoles: and the intervals in the soffite are enriched with bombs and grenades. The railing of the gallery is composed of decorations and emblems, having reference to the occasion, so as to combine ornament with characteristic expression.

The upper compartment of the monument is distinguished by its circular form, and is more completely charged with decoration, illustrative of the honors which Nelson had achieved. The four large wreaths, embracing the entire circuit of the pedestal, contain respectively the Naval Crown, the Viscount's Coronet, the Mural Crown, and the Ducal Coronet. From these wreaths are suspended the decorations of the four "Orders" to which he belonged. The frieze of this pedestal is entirely occupied by the heraldic motto, which happens to be peculiarly appropriate to the occasion. The ornaments surmounting the cornice, which are analogous in form and application to the Grecian antefixæ, are composed of escallop shells, and the cupola is to be of copper gilt.

The Statue of Nelson crowns the whole, and is to be executed in bronze, about sixteen feet in height, and the entire height of the structure and statue will be 120 feet from the area of the square—viz: eleven feet more than the Column of the Duke of York.

The monument, with all its decorations and accessories, to be completed in the most perfect style for the *sum of twenty-five thousand pounds*. This we are ready to undertake, and to give security for the accomplishment. Having taken the pains to arrive at the conclusion upon which this *bona fide* offer is grounded with all the responsibility it envolves, it is hoped that due precautions will be observed in testing the accuracy of the estimates generally, so as to avoid the delusion that too commonly occurs, which besides misleading the promoters of the undertaking inflicts an injustice in those who are more careful and scrupulous in their proposals.

RESTORATIONS OF ANCIENT MONUMENTS OF ROME, &c.

EXECUTED BY THE PENSIONARY ARCHITECTS OF THE ROYAL ACADEMY OF FRANCE.

(Extract from a Paper sent by M. Vaudoyer, of Paris, Architect, to T. Donaldson Esq., Architect; read before the Royal Institute of British Architects.)

Nos.	Monuments.	Architects.	Nos.	Monuments.	Architects.
1.	Temple of Modesty	Dubut.	19.	Portico of Octavia	Duban.
2.	Temple of Vesta	Cousin	20.	Temples of Pæstum	Labrouste, jun.
3.	Mars Ultor	Gasse.	21.	Coliseum	Duc.
4.	Tower of Metellus	Grandjean.	22.	Temple of Venus and Rome	Vaudoyer, jun.
5.	Antoninus & Faustina	Ménayer:	23.	Temple of Cora	Labrouste, sen.
6.	Arch of Titus	Guénepin.	24.	Isle of Esculapius	Delaunoy.
7	Preneste	Huyot.	25.	Port of Trajan at Ostia	Garrez.
8	Pantheon	Leclerc.	26.	Forum of Trajan	Morey.
9.	Temple of Peace	Gauthier.	27.	Roman Forum	Leveil.
10.	Jupiter Tonans	Provost.	28.	Theatre of Pompey	Baltard, jun.
11.	Jupiter Stator	Suys.	29.	Theatre of Marcellus	Vaudoyer, sen.
12	Temple of the Sybil	Van Cleemputte.	30.	Column of Trajan	Percier.
13	Acqua Giulia	Garnaud.	31.*	Baths of Diocletian	Laudon.
14.	Forum Pompeii	Callet.	32.*	Circus of Caracalla	Destouches.
15.	Basilica of Appian	Lesueur.	33.*	Temple of Serapis	Caristie.
16.	Basilica of Antoninus	Villain.	34.*	Temple of Concord	Constant.
17.	The Baths of Caracalla	Blouet.			
18.	Temple at Ostia	Gilbert.			

* In hand, but not yet finished.

These 34 restorations, with from 8 to 10 drawings each, forming in all more than 300, are sketched upon canvas, and richly bound, each set in a distinct volume of the same shape and size, 3 feet 3 inches English in height. They are also accompanied by a very curious and erudite historical memoir.

This work is not a production of the imagination, but is based for the most part upon positive materials, which up to the present time have never yet been examined and studied with so much judgment and perseverance, and is the faithful record of invaluable monuments, which are daily perishing, and of which many will be lost to posterity—and will one day form a work of the greatest interest, not only with regard to architecture, but to the history of archæology and the fine arts in general.

The Minister of the Interior proposes to publish them for the use of French artists, and for circulation in foreign countries.

Ventilators of the New Court, Old Bailey.—Mr. Perkins has caused subterraneous chambers of a capacious size to be formed, in which are placed coils of hot-water pipes, and others containing cold air, which are so arranged that by turning a valve, the warmed fresh air is admitted through apertures made in the floor and wainscoting of the court—so that a comfortable temperature may be preserved, whether the court be more or less crowded. The foul air, which naturally generates in a crowded court, is drawn off by a shaft under the prisoner's dock, as well as from the gallery and ceiling, which, communicating with large curves on the roof, the foul air makes a thorough exit, and fresh air, either warm or cold, can be supplied in such quantities as necessity may require. Great credit is conceded to Mr. Perkins for his excellent contrivance, and the improvement which he effected upon the antique method of ventilating the courts by canvas bags, and warming them with braziers filled with charcoal. There is one matter connected with this contrivance which ought not to be overlooked. The prisoners for trial on each day were placed in damp and unwholesome cells, where they were kept shivering with cold in the winter months. A genial warmth now pervades their gloomy recesses, so that for the time being their unenviable situation is rendered less intolerable.—*Morning Advertiser.*

REVIEWS.

Observations on Lime, Calcareous Cement, Mortars, Stuccos, and Concrete; and on Puzzolanas, Natural and Artificial: together with Rules deduced from numerous Experiments for making an Artificial Water Cement, &c. By C. W. Pasley, C.B., Colonel in the Corps of Royal Engineers, F.R.S., &c. London: John Weale. 1838.

(Second Notice.)

We now take the opportunity of again referring to Colonel Pasley's work, less for any purposes of criticism than to afford our readers an opportunity to judge of the correctness of the views which we adopted, in recommending it as a highly practical work. In the first extract, of which we shall avail ourselves, the Colonel very properly supports the necessity of specifying the proportions of lime to be used for making mortar by weight, and not, as is generally the case, by measure.

For this purpose I beg to suggest, that whenever the common mode of measuring lime in lumps from the kiln has been intended and used, this shall be particularly specified, and that the average weight per cubic foot of the lime in this state, estimated, however, not from the contents of a single cubic foot measure, but from that of some larger measure, which need not except 10, and should not be less than 5 cubic feet shall also be recorded.* In fact, supposing it required to mix 3 measures of sand with 1 measure of Halling lime, it would afford much greater accuracy and uniformity in the quality of the mortar, to direct 3 cubic feet of sand to be mixed with 37lbs. of quick lime fresh from the kiln, or as a 10 feet measure is most convenient, let it be stated that the mortar shall be made in the proportion of 10 cubic feet of sand to about 124lbs. of lime, which is nearly equivalent to the former; and the mode of measuring the lime from the kiln should also be described or specified, because, although it may be presumed that fair and full level measure is intended or has been used, it is best to leave nothing doubtful.

When the lime from the kiln is directed to be ground to a fine powder, it is still more essential to define the mode in which it is to be or has been measured, whether lightly, or after temporary compression only, or under actual compression.

In respect to sand, the custom is to serve it in by stricken measure, in whatever state it may be at the period of sale, which may vary between more or less dry or wet, according to circumstances, known to the persons who use it, but not to others unless explained, amongst which circumstances the state of the weather has its influence; for sand is not kept under cover, but laid out in masses in the open air. Hence, in order that we may have any precise knowledge of the real proportion which the sand bears to the lime, in the mortar of any work of importance, the person who describes such mortar ought to specify particularly the state in which the sand was measured, whether absolutely dry, or damp, or wet; because the actual quantity of sand obtained by the same measure in these three states, varies considerably between the second, which is the minimum, and the latter, which is the maximum of quantity. But the sand used for building in this country is scarcely ever in either of these two extremes of perfectly dry or wet. It generally varies only between more or less damp, and probably the difference in real quantity, between equal measures of it in those two states, does not exceed one-tenth in the practice of building at any one place. To describe accurately the state in which it has generally been used for the mortar of any important work, the author should specify not only the mean space occupied by it in that state, but also the spaces which the same quantity of the same sand is capable of occupying when perfectly dry, and when thoroughly wet, stating also its weight per cubic foot when perfectly dry, there being no certainty as to the weight of sand in any other state. Moreover to enable a person, who does not know the sort of sand obtained from a particular locality, to understand the nature of it, the size of the particles should be described in the way that has been done by M. Vicat, by stating the diameter of the smallest and of the largest grains composing it, the latter of which may be sufficiently defined by describing the sort of screen through which even very fine sand is almost always sifted, to exclude pieces of wood or other extraneous substances generally found in it. When sand and gravel are to be mixed together, in any given proportion, the size of both should also be described in the same manner; and even in using some natural mixture of these ingredients, such as Thames ballast, in the mortar of any important work, it is desirable that it should be defined in the same manner, for the use not only of foreigners, but of our own countrymen, in those parts of the United Kingdom where it is not used, although those who are accustomed to the daily use of it will of course need no such description.

* Whilst investigating the subject of measures and weights, I found by repeated trials that a 10-cubic-feet measure made of two rectangular wooden cases, open at top and bottom, and each measuring 2 feet by 2½ feet square in the clear and 1 foot high, either to be used separately as 2 five-cubic-feet measures, or jointly by placing one upon the other, was a more convenient arrangement for the measurement of dry materials, as well as for calculation, than the cubic yard measure in common use, which is also usually made in two parts, each composed of a similar case 3 feet square in the clear and 18 inches high. In small buildings, where only few masons or bricklayers are employed, the half of the 10-cubic-feet measure may be the most convenient, as small quantities of mortar only are required to be mixed at a time. But to use a smaller measure than this would not afford a satisfactory estimate of average quantity, because the cubic foot of lime in lumps, measured singly in a one-cubic-foot measure is not equal to one-tenth part of the contents of a ten-cubic-feet measure nor to one-fifth part of the contents of a five-cubic-feet measure.

We have next detailed several experiments upon brick and cement beams, combined with hoop iron, laid horizontally between the joints. From the experience obtained in this investigation, the Colonel derives the following conclusions:—

That cement bond, consisting of four or five courses of brickwork laid in pure cement, if strengthened by longitudinal pieces of hoop iron in all the joints, may be used to supersede not only the wooden lintels of doors and windows, but all timber bond generally in the walls of buildings, as suggested in Article 234, which was written before we had tried these last experiments. In using hoop iron bond in walls, the irons should extend, if possible, the whole length of each wall in one piece; but if a break be necessary, the adjoining ends need not be united together by the blacksmith, but turned down at right angles into one of the vertical joints of the wall by the bricklayers themselves. Without hoop iron bond, on the contrary, the additional strength communicated by cement alone would not suffice in difficult cases.

It is to be observed, however, that a continued string of four or five courses of cement and hoop iron bond, in the walls of a building, would not be exposed by any means to the same strain as our experimental brick beams; for it would not have to bear much more than its own weight in all the unsupported parts over a door or a window, there being other windows above those, and in all the intermediate portions of the wall corresponding with the ends of our experimental brick beams, the courses of cement bond alluded to would not only be supported from below, but their strength would be greatly increased by the weight of the solid parts of the wall above, it being well known that all beams have a much greater resistance, when firmly fixed, than when merely supported at their ends, which Mr. Barlow in his able and useful treatise on the strength and stress of timber estimates from his own experiments, as being in proportion to the numbers of 3 and 2. Besides which, 10 feet between the bearings is a much greater width than would be given in practice to the windows, or even to the doors of the largest building, unless the latter were carriage-gateways, which are more usually covered by semicircular or elliptical arches, than by flat arches or straight lintels.

It only remains further to remark, that the flattest and thinnest brick and cement arch has sufficient power to resist great pressure, in openings of 10 or even 15 feet, as was proved by one of our former experiments; though a straight brick and cement beam is not to be recommended, over such openings, unless consolidated by hoop iron bond.

We have then some experiments on cements, tiles, and bricks, applied for steps or staircases; an investigation bearing upon a very useful professional subject.

In both of these artificial steps the fracture takes place near to the wall, but that part of each, though entirely broken through, was suspended by the irons, which did not break, but elongated or were drawn out from their original position within the wall, just enough to admit of the far end of each step striking the ground in falling. In reference to the consideration before stated, the stone step may be considered to possess a resistance of about 5 times, the plain tile step a resistance of about 3 times, and the paving tile step a resistance fully double of the greatest weight, ever likely to press upon one step of a geometrical staircase 4 feet wide; that is, provided its width, which was only 12 inches, had been increased to 14 or 15 inches, which is the more usual width of the steps of such staircases, and which would of course increase its resistance in proportion. I shall observe also, that as the resistance of plain tiles and of paving tiles without cement was proved to be very nearly equal by our former experiments recorded in Table XVIII. (324), the marked superiority of resistance of the plain tile and cement step over the paving tile and cement step, though both formed of materials equally or nearly equally strong, may probably be ascribed in this experiment to the former being composed of a much greater number of tiles and therefore having a much greater number of cement joints than the latter. Notwithstanding, however, this inferiority of the paving tiles, I would recommend their being used in preference to plain tiles, if the expedient of building staircases with artificial steps composed of tiles, with cement and hoop iron bond, should ever be adopted, because the paving tile step is quite strong enough, and gives much less trouble in the workmanship than any very small sort of tiles, such as plain tiles would do. But instead of using tiles 12 inches square and 1½ inch thick, like the common paving tiles of this country, they should be made 15 inches long, 12 inches wide, and about 1½ or 1¾ inch thick only, so that 4 courses might be used for the steps of the principal staircase, and 5 courses for those of a second rate staircase of the same house, the latter of which are always made higher and also usually narrower than the former. And in order to break joint properly, it would be better to make a proportion of half tiles of the same length, but only six inches wide, than to cut whole tiles in two for this purpose. . . . . .

Colonel Pasley strongly asserts the superiority of cement mortar over hydraulic lime, in the construction of wharf and river walls. Several instances are given of the failure of hydraulic lime for this purpose, and particularly one remarkable instance—in the case of a wall which had stood forty years without showing any symptoms of decay. The Colonel observes,—

Instead of plain tiles, long thin stones, such as schists, or coarse slates not good enough for the roofs of buildings, might be used for the same purpose of forming artificial steps, when united by cement and strengthened by hoop iron bond; but in all materials not before tried, it would be proper to make an experiment step beforehand to ascertain the most suitable dimensions of the parts, and the best mode of breaking bond in putting them together. About three months should be allowed for the cement to set, before such steps are let into the walls of a building. * *

I have seen an official drawing, of 1789, evidently in reference to a project for the completion of this wharf, a section contained in which very nearly agrees with the present profile of the wall, which is known to have been finished more than 40 years,* and I have ascertained by inquiry that no appearance of failure was ever noticed until the year 1825, when part of it was observed to have bulged a little forward, but no material change took place until some yers afterwards, when a substantial granite coping was laid in front of the wall, as a substitute for the timber capping and land ties, which had become rotten. The weight of this coping, which could have done no harm, had the mortar of the brickwork been good, has undoubtedly accelerated the separation of the front of the wall from the counterforts, which action has been gradually in progress, but exerted itself more powerfully, as soon as the bond timber and lower row of bond ties became rotten.† . .

The circumstance of this wall having remained perfect for at least 27 years after it was finished, and of some parts of it still remaining so, may be considered a proof, that the profile was sufficient, if better mortar had been used, for the wall, which was about 24 feet high and had offsets or footings at bottom, had an exterior slope of one tenth of its height, and would have been 6½ feet thick at top, if the back of it had been carried up vertically, instead of which its thickness was reduced to 4 feet at top, by a step in rear, about 7½ feet below the level of the ground. It had very substantial counterforts measuring rather more than 6 feet square in plan, at central intervals of 18 feet, and terminating about 4 feet below the same level, that is several feet higher than the step at the back of the wall, the lower part of which by being thicker was in itself a sort of counterfort to the upper part of it, in consequence of which the front part of the wall being the thinnest and less capable of resisting the pressure of earth in rear, separated from the back part in rear of the said step, whereas had the whole back of the wall being carried up vertically, the separation, resisted by a greater mass of brickwork, would have been less considerable, and would have taken place farther back, entirely behind the back of the wall, and in front of the counterfort.

In the following judicious observations the Colonel points out the cases, in which hydraulic lime may be used, and those in which it ought to be avoided.

For the general purposes of Civil Architecture, concrete should therefore, I again repeat, be chiefly confined to foundations; but I conceive that the failure of the new concrete foundation of the Storehouse in Chatham Dock-yard has proved, that it is generally, or at least when formed as Mr. Ranger has usually done, with rather a greater proportion of lime than was originally adopted by Sir Robert Smirke, liable to settlements like lime mortar, which in fact forms the principal part of it. Hence care must be taken, in commencing the brick footings of a building over a concrete foundation, not only to use cement mortar and hoop iron bond, in order to do away the necessity of the more expensive expedients of Yorkshire landing stones and chain timbers, but also to construct inverted arches under all the proposed openings for doors and windows, in order to equalize the pressure.

In using concrete for the backing of wharf walls or other retaining walls, care must be taken to connect it well with the stone or brick facing of the wall, but I apprehend, that the wall and its backing should be constructed of a sufficiently substantial profile to dispense with counterforts, because a substance having so little resistance and adhesiveness, as concrete, would admit of the wall in front being forced away from the counterforts, by the pressure of earth acting upon the back of it; as has often occurred to retaining walls and their counterforts, even when built of brickwork.

In works of Fortification, whilst I have already reprobated the use of concrete for casemates or vaults, yet as the severest frosts seem to destroy those surfaces of concrete only, which are alternately saturated with water and then exposed to the atmosphere, as in the facing of the wharf walls of tide rivers, I see no reason to withdraw the opinion formed by me, previously to the recent failures in her Majesty's Dock-yards at Woolwich and Chatham, that it may be used for retaining walls not exposed to the action of water, as in the sea wall at Brighton improperly so termed, and also for the revetments of fortresses in the peculiar situations before mentioned, in which it is possible that it might be so much cheaper than regular masonry or brickwork, that although greatly inferior in resistance and consequently liable to be much sooner and more easily breached, whether by battering guns or by mining, this disadvantage would not be a sufficient argument against the use of it in those situations.

We omitted to mention in its proper place that the Colonel has discovered a cement, which appears from the trials to which it has been subjected, stronger than Roman cement, and very useful as an hydraulic mortar. It is composed of 4 parts of pure chalk, and 5½ parts of fresh blue alluvial clay; and the method of preparing, mixing and calcining is fully described.

At the end of the work is an appendix, giving a description and the

* From this drawing one would infer, that a brick wall with counterforts, either finished or perhaps only in progress, existed in 1789, which it was proposed to face with stone. But this is conjecture, as I have never seen any document explanatory of the drawing alluded to.

† To guard against this evil, chain cables or strong iron bolts or bars have recently been used by the engineers of the present day as land ties, for wharf walls. These are particularly necessary in wharfs faced with iron, which has very little stability in itself, and must therefore be aided by long land ties running through the backing of the wharf, and well secured to some immoveable objects in rear.

composition of most of the cements and mortars used in this country, so as to give the architect and engineer much useful information. In this appendix the Colonel has given a description of Mr. Brunel's experimental brick arch, the dimensions and details of which he states that he has derived chiefly from the sixth number of this journal. This account he believes to be correct, except that *nett* cement was used instead of mortar, composed of cement and sand, as stated by us. In consequence of this correction by the Colonel, we again made enquiries of the bricklayer who assisted in the construction of the arch, and who still persists that cement and sand were used, and not *nett* cement; we have also procured a piece of the brickwork from the arch, and we feel bound to state that from its appearance it seems to be constructed of nett cement.

We do not think it necessary to say anything further in praise of this work, for we feel assured that the extracts which we have given from it are sufficient to convince our readers of its highly valuable and practical nature. It is, in fact, a work which every member of the profession may refer to with advantage, as he may place every reliance upon the correctness of the experiments which are there detailed.

Life of Thomas Telford, written by HIMSELF. *Edited by* JOHN RICKMAN. London: Payne and Foss, 1838.

We have purposely delayed our notice of this work, that we might not be accused of not paying due attention to it, or hastily passing a judgment unfavourable to its claims. It is a work which was anxiously awaited by the profession, and naturally looked for as a great accession to the stores of scientific literature, but we regret that its appearance has deceived these expectations. The "Life of Telford," described by his works, offered a field which, in judicious hands, could not fail to have produced a book of standard reputation. The price also, of eight guineas, demanded for the present volume, and the circumstance of funds having been provided for its execution by Telford himself, is so high, as to require great exertions to justify such a charge, and we vainly hoped that, from among the papers of Telford, many valuable ideas would thus have acquired a greater circulation. A large volume of plates is certainly given, but they contain so much that is trite, and so much that is useless, that they greatly derogate from the value of the mass.

The work has been thrown into the form of a narrative, under the plea of insuring greater ease and freedom, but the subject has been so mutilated by the editor, that it is neither an autobiography nor anything else. The few snatches of Telford that are left, give a promise of what he was capable of effecting; and we should have derived an invaluable example in the relation of a progress through life, of which he has given us such a modest commencement. Telford, however, never lived to finish his work, and his editor has taken such liberties, that if anything of Telford is left, it is principally his faults. He has warped the current of the subject to make room for irrelevant dissertations; the descriptions of works, instead of showing the minute care with which an author would dwell on his designs, are derived from the commonest sources, and a considerable part of the work is occupied with parliamentary reports, superannuated documents, Roman baths, and other men's works. We deplore this catastrophe, as it is one which we have heard greatly regretted by many members of the profession, and we had certainly expected something better when we looked at other engineering works of less pretensions. The money and reputation of Telford have been lavished on it, but it shrinks in the scale when compared with such volumes as the "Public Works of England," "Railway Practice," the reprint of "Smeaton's Reports," or the new edition of "Tredgold's Steam Engine;" any one of which contains far more practical information, at half the cost, than this "splendid work of Telford." We need scarcely say that the editor has fully redeemed his pledge of "not requiring classification of subjects," and that he has produced a most admirable and agreeable confusion. As to the literary portion of the work, which Telford's diffidence imposed on the editor, it is very scanty and unsatisfactory; and although we could excuse this from Telford, we can make no concession to the editor. Instead of this work being called the "Life of Telford, written by himself," it should be the "Life of Telford," with the part of "himself" by Mr. Rickman; and thus the name of Telford would be redeemed from the slur cast on it by this compilation. Altogether, Telford is most singularly unfortunate, that when, having taken some care to maintain his reputation, he should have confided the task to one so manifestly incompetent. To deny that the work has some merit would be absurd; for it would be impossible that Telford could be associated with an enterprise without conferring some lustre on it; but our opinion of the compilation as a whole is, that neither the quantity of information communicated, nor its quality, are at all commensurate with the extent of its assumptions or the magnitude of its price. The drawings of Telford, it is true, are to be found in the library of the Institution of Civil Engineers, but who can find time to study them there? Few men can afford to sacrifice, in such researches, their leisure and their time.

The work commences with a descriptive narrative of the works of Telford, and such short snatches of his life as the editor has left unpruned. Thomas Telford was an orphan of a working mason in an obscure part of Scotland, and this avowal which his sense of innate dignity prompted stands in solitary contrast with the lack of farther information. We find him successively working at Edinburgh and at Somerset House, then of a sudden superintending works in Portsmouth Dock-yard, and afterwards county surveyor of Shropshire. We see no proof of merit which could warrant this rapid rise, and we look in vain to the work for an explanation of the circumstances which thus determined his career in future life. We can appreciate the studious and laborious attention with which he cultivated his mental powers, but we must look to other operations for the causes of his promotion, and we may believe that had it not been for the patronage of his schoolfellow, Sir William Johnstone Pulteney, his career might have been in a lower grade, and his reputation of less extent. As county surveyor, we find Telford first engaged as a civil engineer; and here he had full scope for his favourite pursuit of bridge-building. The first bridge the construction of which he superintended was one of three arches over the Severn, and soon afterward he constructed the second cast-iron bridge in England, at Buildwas, the first having been at Colebrookdale. This consisted of a single arch of 130 feet span, of which the iron-work was executed, in 1796, by the Colebrookdale Company, by contract with the county magistrates, for 6,034*l.* 13*s.* 3*d.* Of this bridge an engraving is given in the Atlas; and besides these, he erected forty smaller bridges in the county. This led to further employment in the same line, and he also attempted some works as an architect, though with very little credit to his taste. The parish church of Bridgenorth, in Shropshire, which had been the chapel of a Norman Castle, he rebuilt in a mixture of the Greek and Roman styles.

In 1793 we find him engaged in one of his first great works, the Ellesmere Canal, the managing committee of which was principally composed of county magistrates. Telford's management of this complicated work was such as fully to justify their confidence in him, and he thus acquired new means of displaying the boldness and originality of his mind. Here we find descriptions of two works of magnitude, the Chirk Aqueduct and that of Pont-y-cysylte.

"The Ceriog, or Chirk valley, is 710 feet in width; the banks are steep, with a flat alluvial meadow between them, through which the river passes. To preserve the canal level, the surface of its water must be maintained at 65 feet above the meadow, and 70 above the water in the river. There are 10 arches, each of which is 40 feet span. The first stone of this aqueduct was laid on the 17th June, 1796. Previously to this time, such canal aqueducts had been uniformly made to retain the water necessary for navigation, by means of puddled earth retained by masonry; and in order to obtain sufficient breadth for this superstructure, the masonry of the piers, abutments and arches was of massive strength; and after all this expense, and every imaginable precaution, the frosts, by swelling the moist puddle, frequently created fissures, burst the masonry, and suffered the water to escape, nay, sometimes actually threw down the aqueducts; instances of this kind having occurred even in the works of the justly celebrated Brindley. It was evident that the increased pressure of the puddled earth was the chief cause of such failures; I therefore had recourse to the following scheme in order to avoid using it. The spandrills of the stone arches were constructed with longitudinal walls (as at Kirkcudbright Bridge), instead of being filled with earth, and across these the canal bottom was formed by cast-iron plates at each side, infixed in square stone masonry. Those bottom plates had flanches on their edges, and were secured by nuts and screws at every juncture. The sides of the canal were made waterproof by ashler masonry, backed with hard burnt bricks, laid in Parker's cement, on the outside of which was rubble stone work, like the rest of the aqueduct. The towing-path had a thin bed of clay under the gravel, and its outer edge was protected by an iron railing. The width of the water-way is 11 feet, of the masonry on each side, 5 feet 6 inches, and the depth of the water in the canal is 5 feet.

"By this mode of construction the quantity of masonry is much diminished, and the iron bottom plate forms a continued tie, and prevents the side walls from separation by lateral pressure of the contained water. There being a quarry of excellent flat bedded rubble-stone within a quarter of a mile of the site, and lime-kilns within two miles, the whole, with the exception of quoins, coping and lining the sides of the water-way, which are of ashler masonry, is of rubble work, laid in lime mortar; the materials and workmanship equally excellent. The edifice was completed in the year 1801, and is still in a perfect state; the total cost was £20,898."

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"About four miles north of Chirk, the aqueduct of Pont-y-cysylte forms a still more striking object than that which I have just described. The north bank of the river Dee at this place is abrupt; on the south side the acclivity is more gradual; and here, on account of gravelly earth being readily procured from the adjacent bank, it was found most economical to push forward an earthen embankment, 1,500 feet in length from the level of the water-way of the canal, until its perpendicular height became 75 feet; still a distance of 1,007 feet intervened before arriving at the north bank, and in the middle of this space the river Dee was 127 feet below the water level of the canal, which was to be carried over it; therefore serious consideration was requisite in what manner to accomplish this passage at any reasonable expense. To lock down on each side 50 or 60 feet, by 7 or 8 locks, as originally intended, I perceived was indeed impracticable, as involving serious loss of water on both sides the valley, whereas there was not more than sufficient to supply the unavoidable lockage and leakage of the summit level. To construct an aqueduct upon the usual principles, by masonry piers and arches 100 feet in height, of sufficient breadth and strength to afford room for a puddled water-way, would have been hazardous, and enormously expensive: necessity obliged me therefore to contrive some safer and more economical mode of proceeding. I had about that time carried the Shrewsbury canal by a cast-iron trough at about 16 feet above the level of the ground; and finding this practicable, it occurred to me, as there was hard sandstone adjacent to Pont-y-cysylte, that no very serious difficulty could occur in building a number of square pillars of sufficient dimensions to support a cast-iron trough, with ribs under it for the canal. After due consideration I caused a model to be made of two piers, a set or compartment of ribs, the canal trough, the towing-path, and side-railing, with all the flanches, their nuts and screws and jointing complete. The foundations of the river piers are placed upon hard sandstone rock; those on each bank are either on alternating coal strata, or hard firm gravel. Thus secure of good foundations, suitable sandstone for the masonry, the best of iron, a satisfactory model of the iron work, and able experienced workmen, I proceeded with confidence of ultimate success, although the undertaking was unprecedented, and generally considered hazardous.

"The height of the piers above the low water in the river is 121 feet, their section at the level of high water in the river is 20 feet by 12 feet, at the top 13 feet by 7 feet 6 inches. To 70 feet elevation from the base they are solid, but the upper 50 feet is built hollow; the outer walls being only 2 feet in thickness, with one cross inner wall; this not only places the centre of gravity lower in the pier, and saves masonry, but insures good workmanship, as every side of each stone is exposed. I have ever since that time caused every tall pier under my direction to be thus built. The width of the water-way is 11 feet 10 inches, of which the towing-path covers 4 feet 8 inches, leaving 7 feet 2 inches for the boat; but as the towing-path stands upon iron pillars, under which the water fluctuates and recedes freely, the boat passes with ease. The stone piers are 18 in number, besides the two abutment piers; they were built to the level of 20 feet, and then the scaffolding and gangways were all raised to that level, and the materials being brought from the north bank, the workmen always commenced at the most distant or south abutment pier, receding pier by pier to the north bank; and by thus ascending from time to time in their work, they felt no more apprehension of danger when on the highest, than at first on the lowest gangways; one man only fell during the whole of the operations in building the piers, and affixing the iron work upon their summit, and this took place from carelessness on his part.

"By referring to Plate 14, the general form, and also the details of construction, will be readily understood. This singular aqueduct was opened in 1805, and has now been navigated 28 years with facility and safety; and thus has been added a striking feature to the beautiful vale of Llangollen, in which formerly was the fastness of Owen Glyndwr, but which, now cleared of its entangled woods, contains a useful line of intercourse between England and Ireland; and the water drawn from the once sacred Deva, furnishes the means of distributing prosperity over the adjacent land of the Saxons.

"The whole expense of the aqueduct, and great embankment, was £47,018; a moderate sum as compared with what by any mode heretofore in practice, it would have cost."

Telford had now sufficient standing to recommend him for the execution of great works, and sufficient ability to justify the choice, and we consequently find him employed on the Caledonian canal. This was one of the political lions of the day, and many expectations were formed of the utility of this *national undertaking*; but except forming a fertile source of government and local jobbery and an interminable sink of English money, it has produced nothing but disappointment and disgrace. We shall endeavour to give some explanation of the causes which led to this, and from our own sources point out the reasons for its defeat. To understand the subject better, however, it is necessary that the reader should understand something of the nature of the country, which is explained in the following extracts, describing a singular valley,

"Called the Great Glen of Scotland, which, commencing between the promontory of Burgh-Head in Elginshire, and Cromarty, passes through a succession of sea-inlets and fresh-water lochs (lakes) to the southern extremity of Cantyre, a distance of 200 miles, and in nearly a straight direction between the Naze of Norway and the north of Ireland. The whole of this extensive valley, with the exception of about 22 miles, being occupied by navigable waters, and the excepted space by a navigable canal, saves upwards of 500 miles of dangerous navigation, as compared with that by the Orkneys and Cape Wrath. Ships of war, were this track open to them, might in two days, from a station at Fort George near Inverness, reach the north of Ireland."

The description of the works on the canal is meagre in the extreme, deficient in interest, and destitute of that practical instruction which such immense works might have afforded. Numerous difficulties were to be encountered and overcome, and, as Telford himself observes, the narration of failures often leads to more practical information than the description of success. From the account of the Caledonian Canal we shall give a few extracts, which may serve to explain the comments we have to make thereon.

"About ten miles within Fort George, and one mile to the north-west of the mouth of the river Ness, the tide-way of the Beauley Water is from 5 to 7 fathoms deep, and here, at the fishing village of Clachnacharry, is the entrance of the Caledonian Canal. In order to secure an entrance for vessels of 20 feet draught of water, at the top of neap tides, it was necessary, from the flatness of the shore, to place the tide-lock 400 yards from high-water mark, at the end of an embankment; and in constructing this lock, very considerable difficulties occurred, which will be afterwards described. I shall here only observe, that this sea or tide-lock is 170 feet long in the chamber and 40 feet wide, and that its rise is 8 feet; from this lock the canal is formed by artificial banks, upon a flat mud shore, until it reaches high-water mark at Clachnacharry, where another lock of similar dimensions is placed upon hard mountain clay. Immediately to the south of this, is formed a basin or floating dock, 967 yards in length and 162 in breadth; its area is about 32 English acres. It is furnished with a wharf-wall and warehouse at the south end, and its ample dimensions produced earth by excavation for its own banks, and also for supporting the adjoining locks, instead of having recourse to back-cutting.

"At the south end of this basin, the great north road passes over a swing bridge, and adjacent to it are the four united Muirtown locks, each 180 feet long and 40 feet wide, which together rise 32 feet, lifting the canal to the level of the surface water of Loch Ness, when in its ordinary summer state. From the top of these locks the canal, 50 feet wide at the bottom, 20 feet deep, and 120 feet at surface water, is carried by easy bends in the rear of the insulated hillock of Tomnahuric, to the river Ness at Torvaine, where, by reason of a precipitous bank, the canal is constrained to occupy the former bed of the river, a new channel being made for it by removing the opposite bank, which at the same time produced earth for separating the river and canal; a great work, more than half a mile in length. The same kind of difficulty, but less in extent, is overcome in the same manner twice before the canal enters the small loch of Doughfour, (six miles from Clachnacharry) by a regulating lock 170 feet long and 40 feet wide, actually placed in the old channel of the river Ness, which in this place was heretofore separated into a double stream by an island of gravel. Such a situation points out the difficulty of keeping an extensive lock-pit free from the influx of river water, the ordinary level of which was 20 feet above the necessary excavation. Mr. Davidson's incessant attention was necessary and conspicuous during this unusual operation in the years 1813 and 1814, as well as that of Messrs. Simpson, Cargill, and Rhodes.

"Between the small Loch of Doughfour and the outlet of Loch Ness at Bona Ferry, the river has been deepened, chiefly by a dredging machine. Loch Ness is about 22 miles in length, no where less than a mile in breadth; in depth varying from 5 to 129 fathoms, (a greater depth than is found between the Murray Firth and the Baltic sea,) its direction is straight, with several small bays of moderate depth, affording good anchorage, as at Urquhart, Invermorrison, and Port-Clare, on the north side; and at Dores, the fall of Fyers, and the Horse-shoe on the south side.

"At the south-west end of the Loch stands Fort-Augustus, on the north side of which the river Oich enters the Loch where the canal leaves it, crosses the glacis, and at the back of the village ascends 40 feet by means of five connected locks, each 180 feet in length; from thence it passes along the south side of the river to the north-east corner of Loch-Oich. In this distance of about five miles is the Kytra lifting lock, and a regulating lock, each 170 feet long and 40 feet wide, and the channel of the river has been changed in two places; the breadth of Loch-Oich is inconsiderable and irregular; in some parts it requires deepening by dredging, especially where the river Garry falls in from the north, draining the whole of Glengarry, and having in its course Loch-Garry 6 miles in length, and Loch-Quoich 10 miles; the summit supply of water for the Caledonian Canal is therefore abundant.

"Between the western end of Loch-Oich and the east end of Loch-Lochy, a distance of about two miles, the surface of the ground is about 20 feet above the water level, and the depth of the canal water being 20 feet, there is 40 feet depth of cutting. Near Loch-Lochy are two locks, a regulating lock and a lifting lock; the difference between the surface of the water in these two locks (although Loch-Lochy has been raised 12 feet,) is nearly 10 feet.

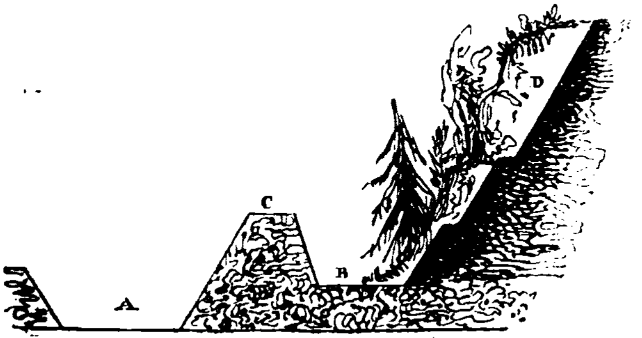
"At the south-west end of Loch-Lochy (which is 10 miles in length) there is a regulating lock as usual, and the canal is carried over rugged ground along the north-west side of the river Lochy, its line intersected by one considerable river, and by several mountain streams; the ordinary level of Loch-Lochy is continued along the canal to within one mile of Loch-Eil, where are eight connected locks, each 180 feet long and 40 feet in width, and together falling 64 feet; from thence the canal is continued on a level to Corpach, where are two connected locks falling 15 feet, and a single sea-lock entering the tideway of Loch-Eil. The sill of this last-mentioned lock was laboriously excavated in rock, so as to ensure a depth of 20 feet of water at high water of an ordinary neap-tide. The operations which were necessary in making this lock were entirely dissimilar, but not much less difficult than those at Clachnacharry, and are worthy of attention.

"The connection with the tideway being to the westward of the general line of the valley, and at the rectangular turn of Loch-Eil towards Fort-William, a well-sheltered roadstead and good anchorage are here obtained. Loch-Eil and the Linnhe-Loch are inlets of the west sea, and the latter joins the usual channel of navigation south of the Sound of Mull.

"The navigation by the Caledonian Canal between the two seas was opened at the latter end of 1823; the eastern district had previously been navigated three years."

From the above description of the works in the neighbourhood of Torvaine the professional reader would be led astray, for no notice is taken of the difficulties which impeded the progress of the works, and which still cause them to remain in a defective state.

To understand this, it must be observed that Torvaine is the name of a very high hill of sand and gravel, at the base of which flows the River Ness, and it was necessary to widen the bed of the river on the south side, which, at the same time, produced earth for separating the river and canal, as stated above, by removing the opposite bank; for in fact, there was no opposite bank to remove, the land on that side being very low and flat; and although the widening was rather considerable, the earth so obtained formed but a small portion of what was necessary to separate, by a proper embankment, the river and the canal. The hill of Torvaine, although at least 150 feet above the river, had to be cut into to a considerable extent, before a sufficient quantity of stuff could be procured and the canal was partly constructed on the hill, and partly in the river. The annexed sketch will better describe the features of the canal at this particular place, and show the peculiar nature of the position.



A—The Ness River.
B—The Caledonian Canal, partly cut out of the foot of the hill, 50 feet wide at the bottom, and 120 feet at the top, and 20 feet deep.
C—Embankment formed from the cutting opposite, with a slope of 1½ to 1, and 20 feet wide on the top, which divides the canal and the river Ness.
D—The part of Torvaine Hill cut away, with a slope of 2½ to 1, and benches 10 feet wide.

The course of the canal from the Muirtown Locks, on towards Torvaine, passes through a stratum of clay, but as it more nearly approaches Tomnahuric and Torvaine, the stratification becomes loose and porous. At Torvaine, in particular, the whole hill is composed of sand and gravel, which continues through the Muir of Dunanchroy, and on to Dochgaveh. The engineers, notwithstanding the knowledge of these materials forming the banks of the canal, neglected taking any precaution to line the canal with puddle, but entirely depended on the great supply of water which they had in the Loch and River Ness, which run close to the canal through nearly the whole district. These, they trusted, would supply the loss of any water by filtration; and they also calculated that, by means of this, the deposit of the river would ultimately have filled up the interstices of the gravel, and that, thereby, the canal would be rendered water-tight. With this impression, no side-lining or bottom puddle was provided, and the consequence was, that they could never keep the canal full, but the water filtered out before it reached Tomnahuric. This circumstance occasioned much surprise and disappointment at that time, and a dam was placed across the canal, to retain a depth of about five feet of water through the Moir of Dunanchroy, so as to try the effects of filtering. Many thousand tons of loamy silt were brought down and hove into the bottom of the canal, but to no purpose; for, as fast as it was thrown in, it was carried through the sides and the bottom into the river; and instead of the silt filling up the interstices, every part of the canal when the water was let in, became more and more porous; for the water not only carried away the stuff thrown into the canal, but it also carried away all the sand and smaller pebbles, making the gravel still more porous, so that in a very short time the bottom and sides of the canal became as open as if it had been made through a mountain of macadamized stone. The contractors were employed for many days near Dunanchroy, trying to prevent the leakage, but without the least practical effect.

There can be no doubt that the want of a puddle lining in this part of the canal was attended with disappointment, great expense, and to a certain extent a failure of what the canal proposed to be, and what it ought to have been conducted on a different plan. Instead of using the porous materials of Torvaine Hill for the embankment, the clay which was found between Torvaine and the Muirtown Locks should have been employed, instead of which it was wheeled into spoil, and thus thrown to waste. The canal ought also to have been cut much deeper and wider, not only to receive the necessary puddle of clay, but also for a sufficient protection of gravel facing to keep it firm. All this could have been done at half the expense, or perhaps one-third, of that afterwards incurred; but the most unfortunate part remains yet to be told. It is a fact, that after having proved the ineffectual and superficial manner in which the canal had been constructed, and having determined to deepen and widen it to the necessary size for receiving a proper thickness of puddle to resist the pressure of water, by some unaccountable error the canal was never made deep nor wide enough for the purpose, and up to this day the canal at that part has not strength of side and bottom lining to carry more than 12 feet water, instead of 20. We ask the editor, is not this the true cause of the failure of the canal, instead of the ridiculous statement set forth in the work before us at page 66? The facts we have stated are quite sufficient to prevent large vessels from navigating this canal, and until the line is made perfect there, it is quite useless to have 20 feet of water in any other part. We recommend strongly that an inquiry should be made to see how far the defect we have pointed out, and any others, might be remedied, so that the canal may be perfected for 20 feet of water throughout, and what would be the cost.

After such an immense sum of money has been expended upon this canal formed on such a grand scale, with its locks of size and depth to carry through a frigate with all her stores, it is worth while knowing why and wherefore no vessels drawing more than twelve feet water can navigate through it. We are of opinion that a comparatively small sum, as compared with what it has already cost, would make this canal a credit to its projector and a source of profit to the country; and, in time of war in particular, its advantages in letting through ships of war and steam boats would confer incalculable benefit, which in a Russian war could not be too highly prized.

To revert to the progress of the work before us, the next object of considerable magnitude and boldness is the formation of the sea lock at the eastern entrance.

Foulston's Public Buildings.

SECOND NOTICE.

Of the buildings here described, that containing the Theatre, Hotel, and Assembly Rooms, is the most important subject in the volume, both on account of its extent, and of the fulness with which it is illustrated. Its principal, or north front, is 270 feet in extent, 70 of which are occupied by its octastyle Ionic portico, which is raised on five steps, and whose columns are thirty feet high. The remaining one hundred feet on each side of this centre, has three tiers of windows (seven in each tier), viz. ground floor, principal, and attic or mezzanine; all of which openings have dressings to them, those of the ground floor and mezzanine *kneed* architraves, in addition to which those of the principal floor have both frieze and cornice. The general appearance is good,—has a certain degree of breadth and simplicity that are sufficiently pleasing; and although it is upon a somewhat lesser scale, this façade very much resembles in its style that of our Post-office here in town, while it certainly cannot be said that the architect was in any degree indebted to the latter building, since it appears that his own was commenced several years before, namely in 1811, the foundation stone having been laid on September 10th in that year.

So far, indeed, from suffering very greatly by a comparison with a structure that is a national work, and one moreover that cost the country upwards of 230,000*l*., the Plymouth building—and Plymouth, as Mr. Foulston himself tells us, is, though spirited, proverbially poor—need not shrink from it, as in some respects it will gain by such comparison, particularly if we bear in mind its priority of date, and the means placed at the disposal of the respective architects. This difference in regard to means becomes all the more striking, when we consider that the Plymouth architect had to provide a good deal in the way of decoration both in the assembly room and theatre, to say nothing of the various other apartments; whereas the rooms at the Post-office exhibit nothing further than desks and bare walls. We may further remark, that in regard to the windows, their features are far better in the Plymouth building than in the metropolitan one; and while they are less bald and insipid in themselves, they are not squeezed so close together, consequently do not impart to the design that ordinary dwelling-house aspect which, whatever the design may be in other respects, is almost sure to communicate itself to the rest where such openings are too numerous in regard to the space allotted to them. We may further observe, that the style of the façade is very properly kept up in the adjoining fronts, or returns at the ends, whereas in Sir R. Smirke's building very little similarity of character seems to have been aimed at in its different sides. While we admit thus much in favour of what Mr. Foulston has here done, we feel it incumbent upon us also to notice some defects. As he himself, so far from putting forth any claim to originality, is content to forego all commendation on that head, we feel no reluctance in saying that we must withhold it; but it also appears to us, that notwithstanding his professed admiration of Greek architecture, he does not show himself to have imbibed its real spirit, and caught its feeling. The portico exhibits to us an Ionic order, treated with literal correctness, indeed, as regards certain established particulars of detail, but without any artistical expression or effect. Were it not for the capitals of the columns it would be an absolute negation of any distinct order, because as to all the rest, it is marked, not by positive characteristics of its own, but merely by the omission of those which serve to distinguish the orders.

The entablature is of the plainest description, far more so than that of the Doric order, which is the only one, we may observe, in which our modern architects have thought fit to retain any degree of decoration as regards the frieze. Here both the entablature and frieze have a particularly naked, and not a little heavy appearance; and yet, notwithstanding the rigorous economy—not to say poverty—displayed in those parts, statues are introduced on the acroteria. The doors within the portico are, taken by themselves, pretty enough; but although their prettiness, would recommend them as part of a shop front, or something of that kind, it is altogether out of keeping with the character which ought to be kept up in a building of this class. There is, however, one merit in this portico that ought not to be passed over in silence, which is, that instead of being crammed full of doors and windows, there are only three doors, and as many windows over them, placed so as to correspond with the alternate inter-columns in front, owing to which there is an agreeable degree of breadth and repose in the back ground to the colonnade. The ball-room, which is on the principal floor over the great dining-room, is 77 feet by 40, and 32 high to the centre of its segmental ceiling, through which it is lighted from five lunette windows on each side above the cornice, forming *arcs doubleaux* in the curve of the ceiling itself. The Lysicrates example of the Corinthian order is here introduced, in columns placed two at each end on the sides of the room, coupled with antæ behind them; and the capitals of these latter, which are continued each side, so as to divide it into five compartments or inter-columns, are similar to those of the columns themselves. Whether these pillars and pilasters are of scagliola, or painted either in imitation of that material or of stone, is what we are not informed, neither is it said what is the colour of the walls, although a very few words to that effect would have served to remove the uncertainty in which we are now left in regard to what is a matter of some importance in itself. In our opinion too it would have been far more satisfactory had Mr. F., who is so liberal of his illustrations as to gives a representation of the Lysicrates capital and entablature, favoured us with a drawing of one of the compartments of the ball-room, drawn to the largest size his book would allow. In that case we might perhaps have been better satisfied with the design of the panels on the walls, which, as shown in the general section, have a poor, not to say too trumpery look, for they appear to consist of mere lines with sprigs at their angles. Whether they are really such, or raised mouldings, or whether distinguished by gilding from the general surface of the walls, we are unable to judge.

There are many other parts of the interior which, on examining the plan, seem greatly to stand in need of further elucidation, by means of particular sections on a larger scale. A larger section, or rather two or three of the kind, are very much wanted to show the interior of the audience part of the theatre, for, as represented in the general section, it is so small that very little can be made out in regard to it, especially as the mode of engraving here adopted (lithography) is by no means very favourable to neatness and distinctness when the subject is minute.

On the other hand, a greater number of plates than seems altogether necessary—no fewer than twenty are devoted to explaining the carpentry and machinery of the stage—and as very little, if anything, has been before published in this country on the construction of that part of a theatre, and the various apparatus required for effective scenic changes and exhibitions, this work will doubtless afford great assistance to those who may be called upon to execute anything of the kind; but the letterpress explanation to these plates is exceedingly brief indeed, which is the more to be regretted, because it requires some previous familiarity with such mechanism and contrivances in order to comprehend it—at least to judge how far that here shown is marked by any improvement.

At page 7 of our present volume will be found a table of the dimensions of some of the principal theatres, by referring to which the comparative size of the Plymouth one may at once be estimated; for we shall here transcribe the author's own account of it.

"This is the only fire-proof theatre in the country, the whole of the framing for the boxes, corridors, &c., being of cast-iron. The roof (the span of which is 60 feet) is of rolled iron, and though no piece is more than $\frac{1}{16}$ of an inch in thickness, it is yet remarkably strong, and not more than half the weight of a timber roof. The particular construction of the ironwork to the boxes and the roof is shown in plates No. 41 to 45.

"The auditory is included within a circle, the ends of the boxes being rounded off at three-fourths, and their back partition continuing to the columns of the proscenium, by which there is a perfect view of the stage for the spectators, to the depth of 25 feet from the least eligible seat in the boxes. The pit, which is 33 feet in diameter, will afford accommodation for 200 persons. There are two circles of boxes, capable of receiving 512 persons, and above them a gallery and slip boxes, which will jointly contain 480 persons. By means of an arched colonnade, continuing along the gallery and the slips, the ceiling of the theatre is completed in a perfect circle."

The other dimensions are as follows: the diameter across the boxes, 48 feet; width of curtain, 28; depth of stage from curtain, 30; height from floor in centre of pit to ceiling, 40.

Almost adjoining the preceding building, or separated from it only by a street on the west side of it, is another edifice of Mr. Foulston's, namely the Athenæum, which was begun in 1818. Its north front, or that on a line with the hotel, is a Grecian Doric tetrastyle, and though somewhat lower than the other, is of a richer character, for in addition to the usual ornament of the frieze, the pediment is filled with sculpture, at least is so represented both in the view and elevation, and is surmounted by a figure on its apex. Within, this portico has only a single door below, and three windows above, or rather a window-niche, over the door, with a statue, and a window on each side of it, which arrangement gives some originality and play to the composition. As to the details of the order, which occupy two out of the six plates devoted to this subject, we could very well have spared them, and should have been better pleased to find the various parts of the interior more fully represented. Of the remaining designs we must defer speaking till next month, when we shall pass them in review, and examine how far Mr. Foulston has been successful in his attempts with other styles.

Isometrical Perspective. By T. Sopwith. Weale. 1838.

This is a new edition of Mr. Sopwith's well-known work of Isometrical Perspective, in which he has extended its application to mining. In this department it appears well calculated to be useful equally for professional purposes, as to explain the subject to persons generally interested in it. Mr. Sopwith has introduced several improvements in principle into this edition, and altogether it presents one of the most valuable works which has yet been published on this subject.

The Universal Calculator. By J. Wallace. Glasgow, M'Phun. 1838.

This is the cheapest work on the subject which has yet been published, and has condensed in the smallest possible space, most of the arithmetical knowledge necessary to the engineer. Most of the calculations are made by logarithms, and many new processes of calculation suggested by the able compiler. Altogether it is a work recommended by its portability and the moderation of its price.

LITERARY NOTICES.

We have an article prepared on the subject of *Engineering Education*, but we regret that the pressure of matter has obliged us to defer its publication until next month.

We shall next month refer to Mr. Hay's work on *Colour as applied to internal Decoration and House Painting*.

Loudon's highly interesting work, *The Suburban Gardener*, we shall review in our next number, for in our present crowded columns we should not be able to do justice to it.

We are happy to find that the sister Arts, Painting and Sculpture, have now a periodical devoted to them under the title of the "Art-Union," the first number of which has been transmitted to us.

We have had placed in our hands the correspondence between Mr. Hyde Clarke and the West Cumberland Railway Committee, but it is too long for our pages, although we think that Mr. Clarke has not been treated with proper attention.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

ADDRESS OF JAMES WALKER, ESQ., THE PRESIDENT,

To the Annual General Meeting, January 15, 1839.

I thank you very sincerely for the manner in which you have expressed yourselves of my endeavours during the past year. It is truly gratifying to me if, through your partiality, I have been at all the instrument of forwarding this institution, and the object of the excellent man (Telford) whose picture is now behind me.* • •

There is really so much doing in this country alone, that without drawing largely upon genius, it would be sufficient to register but a proportion of the new works in progress to keep us fully employed; and surely the most timid associate or graduate need not be afraid of assisting in this. By the original by-laws a candidate for admission was required to present a drawing or paper; this has been waived, but still I consider the claim remains as almost a debt of honour, and the discharge of it would be found agreeable, if set about; agreeable not only in the execution, but in the anticipation of reward; and I would have gentlemen only reflect upon the subjects for which premiums have been adjudged, to see that the distinction requires no particular skill, but only resolution and moderate application; where there is the will, I am sure there is in this case an easy way. I am aware of the difficulty that frequently arises from indecision and in choosing a subject; a difficulty often felt and confessed by our most distinguished English essayist. To remove this, the council have given subjects for papers; and it has occurred to me that it might even be desirable to charge individuals with particular subjects---thus not only imposing more specially a duty upon the individual, but confining his attention to the particular subject (and even to limit the time)---both of which, I have found, from long experience, the best preventives to wandering and procrastination.

Let us remember also, that as the importance of our profession is increasing, and is being felt, it behoves us to exert ourselves to maintain our relative station. Classes, with professorships, for the education of the civil engineer, are established at our colleges; and there is now upon the table a prospectus for the establishment, on a large scale, of a college for civil engineering.

We have every reason to be grateful for our success heretofore, but our motto must be "Forward," and we must keep up to it. There is an ample harvest to reap from the new works which are going on throughout this country, from the Land's End to the northern extremity of Scotland, and in Ireland; and as the powers of human invention and discovery increase, the range for it becomes more ample---the higher we rise, the more enlarged is the sphere that bounds our prospect. There is reason to believe, from analogy, that we know as yet but a small portion of the powers and capabilities of matter, and which require but the application of mind to bring them to light. Much, I admit, has been done within the last century; but as our deepest pits are, when compared with the radius of the earth, but scratches on the surface, such, I believe, would our stock of knowledge, much as we think of it, appear to a mind that could comprehend all the properties and beauties of nature, even of that province with which the civil engineer has to deal; and this would appear the case to the last of a succession of Newtons, or Watts, or Huddarts, supposing each to add to the stock of his predecessor, even more strongly than it does to us. How much then ought we to admire that beautiful adaptation, which is fitted to man in every stage of his mental improvement! I sometimes doubt whether, when mechanical and other scientific improvements are made, we are disposed sufficiently to refer to nature, and then to rise to the author of Nature, in admiration of the treasures which have been opened, and are still in store for mankind. Thus, in admiring the genius of a Newton, and others, we are not so disposed as we ought to be to carry our admiration back to the natural substances which have produced the glass, without which the principal phenomena of light would still be unknown; and to reflect, that these substances have existed from the beginning, although their combinations are of human discovery of no very ancient date. Again, when we admire the stupendous fixed or the active locomotive engine, or the fine machinery of Huddart, for drawings of which you have seen two premiums awarded, and reverence the minds which have brought these to their present state, let us not forget how small are these compared with the materials for steam and for manufacturing the steam-engine,---the water, the coal, and the iron; how insignificant these minds compared with the mind which gave to them the properties they have,---to steam its elasticity and wondrous velocity,---and impressed upon matter those beautiful and uniform laws which govern it, and enabled a Huddart to calculate with certainty the strength of his materials, and what would be the result of his complex combination of wheels and pinions! What the poet said of the undevout astronomer, that "he is mad," may apply with equal truth to the undevout mechanic or engineer; and it would be well if those delightful feelings were cultivated, and invariably associated with the study and practice of the engineer, so that his mind might in every pursuit dwell upon the wondrous adaptations of nature to the wants and pleasures of the community, and both in its lowest and most improved state be led to the contemplation of the power which formed, and the goodness which so admirably fitted the whole for the use of his creatures.

I have been led without premeditation into this train of reflection. I gratefully acknowledge the attention you have paid to me on the present and on every occasion, and now leave the chair with a repetition of my thanks for all your kindnesses.

Jan. 8.—The PRESIDENT in the chair.

The discussion on this occasion was on the use of peat in the manufacture of iron. It had been remarked at a previous meeting that the iron made with peat fuel was more malleable than Swedish, and that the tools were of a superior quality. It was doubted whether peat fuel had been recently employed, or, indeed, whether it could be used at all in the puddling furnace, though it might in the refining or smelting furnace, but with a diminished produce. The working of iron by peat fuel was known to improve its quality in some respects, and the welds especially thus made were superior to those made with coal. The Dartmoor peat was frequently used for this purpose, and found exceedingly good. The improvement of iron by the use of a particular fuel seemed a very difficult question. The weld made with ligneous carbon, owing to the absence of sulphur and pyrites, must be better than that made with a fuel containing these impurities. The analysis of peats is very various. They all contain 5 per cent., and some 20 per cent., of earthy matter. Some kinds of peats were stated to produce three times as much gas as coal. Peat was said to contain no sulphur, but the experience of several gas-works, in which peat was employed, proved that some peats contain large quantities of sulphur, as the purifiers become rapidly filled with sulphuretted hydrogen. All coal, however pure to the eye, contains pyrites and sulphur, so that sulphur must be considered as one of the elements of coal. Much is to be attributed to long practice in the use of fuels; the smiths of Cornwall can use peat, and the smiths of Pembrokeshire anthracite, for all purposes of working iron: both would, however, use pit coal could it be conveniently procured.

Jan. 29.—BRYAN DONKIN, V.P., in the chair.

On framing Lock Gates without Iron-work, by S. BALLARD, A. Inst. C.E.

The horizontal pieces in gates thus framed are held to the back by dovetailed tenons and wedges; the use of iron T pieces being thus wholly dispensed with, the premature decay which invariably takes place where wood is in contact with iron is entirely avoided. The mortices into which the pieces are inserted are previously filled with tar, or white lead, and on the wedge being driven in, every part is rendered perfectly water-tight. This method has been adopted in gates on the Herefordshire and Gloucestershire Canal, and, after eight years' experience, found completely successful.

On Tubing the Boilers of Locomotive Engines, by G. BUCK, M. Inst. C.E.

The author's object has been to determine the diameter of the tubes of a locomotive boiler, so that the greatest quantity of steam may be produced by a given quantity of fuel, on the condition that the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air and the time of contact conjointly. The result of this investigation is, that the distance betwixt the diameter of two adjacent tubes should be equal to four times the interval between their internal surfaces. On comparing the aggregate surface of a locomotive boiler tube, in this proportion, with those generally employed, the former is superior by from 23 to 26 per cent. to the latter.

On the state of the Suspension Bridge at Montrose, after the late Hurricane, with remarks on Suspension Bridges, by COLONEL PASLEY, Hon. M. Inst. C.E.

The hurricane of the 11th of October carried away a third part of the roadway of the suspension bridge at Montrose, and broke or bent very much all the rods on the west side. From the effect here produced, and his experience of the motions of suspension bridges, the author is of opinion that the dangerous undulations are longitudinal; that the whole roadway is brought, by the action of the wind or pressure of the air beneath, into a state of waves, by which the roadway is ultimately broken up; that this can only be obviated by adopting a strong longitudinal trussing, as has been done by Mr. Tierney Clark in the Hammersmith Bridge, in which no motions of this nature are experienced, even in the most violent gales. This opinion of the action of the wind on the under side of the roadway, is confirmed by what Colonel Pasley once witnessed at Chatham Dockyard. One side of the roof of a large ship-building shed rose up and down repeatedly, flapping like the leaf of a book, until a portion, of about the extent of 40 feet by 40, was floated up like a sheet of paper, and carried to a distance of 50 yards.

Feb. 5.—The PRESIDENT in the chair.

The following gentlemen were elected:—Alfred Burges, John Taylor, as Members; Joseph Baxendale, J. M. Parsons, J. Bennett, as Associates; and Charles Wood, M.P., as an Honorary Member.

Mr. C. W. Williams presented specimens of Peat, from the first state, as taken from the bog, to the last, when compressed and converted into a hard coke; and of his new Resin Fuel, or artificial coal, which is composed of resin and turf coke. This resin fuel is found of the greatest use in long voyages, when used with a proper proportion of coal, as it enables the fireman to maintain the requisite pressure of steam with great regularity, and also to raise steam more rapidly on any emergency. It is not adapted for use as a fuel by itself, but when about 2½ cwt. of this fuel is used with about 20 cwt. of coal, by throwing it in front of the fire with each charge of fresh coal, a much better combustion of the coal takes place, and the effect is equal to that which would be produced by 27 cwt. of coal. Thus 2½ cwt. of this fuel so employed is equivalent to 7 cwt. of coal. The cost is from 35s. to 40s. per ton. The Transatlantic steamers carried from 40 to 60 tons of it, and besides the advantage attending its use, there was a saving in room, which was applicable to the stowage of cargo.

A long discussion took place on the important facts which the application of this fuel had elicited. These appeared in some measure contradictory to the results, which could not be doubted, that 9 lb. of coke will do as much in any department of the arts as 12 lb. of coal: for on adding to coal a peat and a hydro-carbon far more inflammable than coal, the result is equivalent to that which is produced by all the carbon, hydrogen, and oxygen, in many times the quantity of coal. It was remarked, that the circumstances under which fuel was employed ought to be considered, as the consumption of fuel under steam-boilers could hardly be compared with the consumption for simply heating and keeping hot a large mass of matter as in a glass-house. It could not be believed, that the absolute quantity of heat from the coke of a ton of coals is the same as of the ton of coals, for in that case all the heat of a coke oven would go for nothing, and there were instances of this being beneficially employed.

INSTITUTE OF BRITISH ARCHITECTS.

Feb. 4.—P. F. ROBINSON, V.P., in the chair.

The Cavalier Bianchi was elected an Honorary and Corresponding Member.

The report of the Council, as to the adjudication of the Prize for the best restoration of an ancient castle, was read and confirmed; and the letter, bearing the motto of the successful drawings, having been opened, the author appeared to be Mr. Samuel Sharp, Associate, of York. In consideration of this being the second time that Mr. Sharp had entitled himself to the approbation of the Institute, for the zeal and talent with which he had executed the restorations of St. Mary's Abbey, York, and Sheriff Hutton Castle, it was resolved that a gold rim be added to the Soane medallion, which will be awarded to him.

A translation, by MR. DONALDSON, *was read, of a memoir of the late* M. PERCIER, *architect, of Paris, Honorary and Corresponding Member, forwarded by* M. VAUDOYER, *architect.*

Charles Percier was born at Paris of a respectable family, and received a liberal education. From his earliest age he evinced a talent for drawing, was placed by his father at the free school for drawing, then under the management of the founder, M. Bachelier, painter to the king. His taste leaning to the side of architecture, he soon after entered the studio of M. Paris, whose school had long enjoyed considerable reputation. In 1783, M. Percier carried off the second great prize; and in 1786, having gained the first great architectural prize, he became a travelling student to the French Academy at Rome. He there became the companion and intimate friend of M. Fontaine, who, possessing like tastes, like ardour, and like information, entered with him into the same branches of study, and from that time the two friends worked together, travelled together, and lived in the same dwelling; and, till they were separated by death, they shared the same glory, the same joys and sorrows. On the return of MM. Percier and Fontaine to France, the storm of 1792 was raging, and they employed their talents in designing for manufacturers of carpets, paper, furniture, &c. It was at this time, also, that they engraved and published their many useful studies in Italy. A calm having at length succeeded, M. Percier's talents began to be appreciated under the Emperor, and in the following reigns he was called to assist in great works. Le Carrousel, the Triumphal Arch, the interior of the Tuileries, the Rue de Rivoli, the completion of the Louvre, Le Chapelle Expiatoire, the improvements of l'Elysée, de Malmaison, de Neuilly, and Fontainebleau. M. C. Percier died on the 5th of September, 1838, at the age of seventy-four. He was a man of great general information, conversant with the literature of his own and foreign countries, well informed in history, antiquities, a lover of painting and of music, to all of which he had devoted much attention. In consideration of the advantages he had in his youth derived from the Royal Free School of Design, M. Percier bequeathed a sum of 150,000 francs to this institution, for the encouragement and assistance of poor and deserving students. At the conclusion of the paper, Mr. Donaldson reviewed at some length the various merits of the numerous works published by Messrs. Percier and Fontaine.

At an Ordinary General Meeting, held at 16, *Lower Grosvenor-street,* 18*th Feb.*, 1839, P. F. ROBINSON, V.P., *in the Chair.*

A letter was read from Mons. Vaudoyer, acknowledging the thanks of the Institute for his former communication, and enclosing a list of the restorations made by the students of the French Academy at Rome, and preserved at the Academy of Fine Arts, at Paris.

The following donations were announced as having been received since the last meeting:—

From Mons. Laves, Hon. and Cor. Mem. at Hanover: A Print of the Waterloo Column and Hall of the Knights, Hanover; and Pamphlets on the Qualities of Woods.—George Saunders, Esq.: two steel standard foot measures, prepared by Ramsden.—H. E. Kendall, Fellow: Cast of the Lion's Head, from the Parthenon.—C. J. Richardson, Fellow: Proof impression of a view of Holland House.—T. L. Donaldson, H.S.: one volume of Transactions of American Institute, containing the questions published by the R. I. B. A.—W. C. Mylne, Fellow: Editio Princeps of Vitruvius, and Autograph Letters of G. B. Piranesi, Bonomi, Robert Mylne and Lewis, Architects; and of Sir William Hamilton, formerly British Ambassador at the Court of Naples.—Copy of Resolutions of Associated Architects, to consider cases of frequent fire and means of prevention.—Thomas Chawner, Fellow, presented twenty guineas.

A paper was read from Mr. Martin, of Derby, describing a new species of cement invented by him, accompanied by specimens.

A paper was read by John Shaw, Fellow, on Ecclesiastical Architecture applicable to Modern Churches; a printed copy of which Mr. Shaw also presented.

A Description of the Manufacture of Paper Hangings, by Mr. John Gregory Crace, was read; illustrated by various samples of papers, and explained by specimens executed by Mr. Crace's assistants at the time.

A Letter was read from Wm. Wilkins, Esq., R.A., addressed to his Lordship, the President, calling attention to some drawings which accompanied the letter, made by a young self-taught draughtsman at Cambridge. The letter also stated that another volume of the Dilettanti would soon be ready for publication.

ARCHITECTURAL SOCIETY.

Ordinary Meeting of the Society held 29th January, 1839.—WILLIAM BARNES, Esq., in the chair.

Michael Meredith, Esq., of Blomfield-street, Finsbury Circus, was elected a member.

The Chairman announced a donation of twenty guineas, by J. Griffiths, Esq., (member,) of Finsbury-place, South.

Monthly Meeting of the Society held Tuesday evening, the 12th February, 1839.—WILLIAM TITE, Esq., President in the chair.

Thomas Nichols, Esq., of Castle-street, Holborn, was elected a Member.

E. W. Brayley jun., Esq., delivered a Lecture "On Limestones and other substances affording materials for Cements," being the second of a course of lectures now in progress of delivery in the Society's Rooms.

The Chairman announced that the subject for the sketches proposed to be produced by the student members at the next meeting was as follows:—"The elevation and plan of an entrance to a Lunatic Asylum, detached with lodges each side."

The next Public Meeting will be held on Tuesday evening, the 12th instant, when Mr. Brayley will deliver his third lecture "On artificial substances employed as substitutes for Stone."

ROYAL SOCIETY.

Feb. 7.—The MARQUIS OF NORTHAMPTON, President, in the chair.

James Heywood, Esq., and the Rev. H. Mosely, M.A., were elected fellows.

A paper was read, entitled, '*Notice of a Shock of an Earthquake, felt in the Island of St. Mary's, one of the Scilly Islands, on the 21st of January,* 1839. *By the Rev. George Wordley.*'

The tremulous motion of the ground is described as being very slight, and felt chiefly in the south parts of the island. It was accompanied by a peculiarly harsh and grating sound, which was only of momentary duration, and no particular agitation of the sea was observed.

A paper was also read in part, entitled, '*Observations on the Parallel Roads of Glen Roy, and of other parts of Lochabar, with an attempt to prove that they are of marine origin,*' by CHARLES DARWIN, Esq., F.R.S.

Feb. 14.—J. W. LUBBOCK, Esq., V.P. and Treas., in the chair.

A paper was read, entitled, '*Researches on the Chemical Equivalents of certain bodies,*' by RICHARD PHILLIPS, Esq., F.R.S.

The author examines, by a new series of experiments, the truth of the theory of Dr. Prout and Dr. Thomson, namely, "that all atomic weights are simple multiples of that of hydrogen"—a theory which the late Dr. Turner had maintained is at variance with the most exact analytic researches, and consequently untenable. Although the experiments of Dr. Turner, and the inferences which he drew from them, agree very nearly with those of Berzelius, it still appeared to the author desirable to investigate this subject; and it occurred to him, that the inquiry could be conducted in a mode not liable to some of the objections which might be urged against the processes usually employed. Dr. Turner having adopted a whole number, namely, 108, as the equivalent of silver, this substance was selected by the author as the basis of his inquiry into the equivalent numbers of chlorine, and some other elementary gases. It appeared to him, that the chance of error arising from the fusing of the chloride of silver might be entirely removed, and other advantages gained, by experimenting on silver on a large scale, with such proportions of the substances employed as were deemed to be equivalents, and instead of calculating from the whole product of the fused chloride, to do it merely from the weight of such small portion only as might arise from the difference between theoretical views and experimental results. The author concludes, from the train of reasoning he applies to the series of experiments so undertaken, that no material, and even scarcely any appreciable, error can arise, from considering the equivalent numbers of hydrogen, oxygen, azote, and chlorine, as being 1, 8, 14, and 36 respectively.

A paper was also read, entitled, '*Some Account of the Hurricane of the 7th of January, 1839, as it was experienced in the neighbourhood of Dumfries,' in a letter addressed to* P. M. Roget, *M.D., Sec. R.S., by* P. Garden, Esq.

After describing the position of his house, and the nature of the instruments employed for observation, the writer gives his observations of the barometer and thermometer on the 6th and 7 of January last, and proceeds to state, that on the 6th, at about ten minutes past ten o'clock, P.M., violent squalls commenced, at first with intermissions of perfect calms, but gradually becoming more frequent, and being accompanied by the sound of strong and increasing whirlwinds. By eleven o'clock, the wind was observed to proceed from the east, and its velocity was estimated at forty miles an hour. Its violence then increased, and threatened to blow down the chimneys. At midnight it abated, at the same time shifting to the south or west. At two o'clock in the morning, nearly two tons of lead were torn away by the wind from the west-end platform on the house-top, and thrown down behind the house in a westerly direction. Some of the lower windows having been left a little open, the wind thus admitted into the house forced up and blew off the very heavy batch door of the roof, which was covered with lead. The whole house rocked terribly, and even the stone floor of the half sunk kitchen story heaved as if shaken by an earthquake; the slates from the roof were blown in every direction, some being carried to a prodigious distance. During the greater part of the night the rain fell in tremendous torrents. In the interval from two to half-past three in the morning, the barometer sunk very nearly an inch and a half, and reached its greatest depression. But the tempest continued till about four o'clock, when it began gradually to subside. Extensive devastation occurred among the trees; some that were blown down raising two or three tons of clay soil with the roots. Several trees thus thrown down fell with their tops to the W.N.W. The writer concludes, from these and other observations, that the first and squally part of the storm began from the E.S.E., and blew from S. by W. at about midnight, and that most injury was done to the slating and roof when the wind was not far from the south. It then gradually veered to the west, till noon, and reached the N.W. point by eight o'clock in the evening of the same day.

Feb. 21.—J. G. Children, Esq., V.P., in the chair.

Captain Arthur Conolly, and Lieut.-Col. W. Reid, C. B., were elected fellows of the Society.

The following papers were read:—

1. 'An Account of the Processes employed in Photogenic Drawing,' in a letter to S. H Christie, Esq., Sec. R.S., by H. Fox Talbot, Esq., F.R.S.
2. 'A Description of an Hydro-pneumatic Baroscope,' by T. J. Cooper, Esq.
3. Continuation of Mr. Darwin's paper 'On the Parallel Roads of Glen Roy, and other parts of Lochabar.'

THE ROYAL IRISH ACADEMY.

January 14, 1839.—Sir W. R. Hamilton, A.M., President, in the Chair.

His Grace the Archbishop of Dublin, V.P., having taken the chair *pro tempore*, the President communicated to the academy the first part of his researches on the Dynamics of Light.

William Bald, Esq., *Civil Engineer*, read a paper entitled "*An Account of the Survey and Map of the County of Mayo.*"

The author commenced by giving a brief account of the origin and progress of the construction of topographical maps in Europe. In modern times, the first attempt at the construction of topographical maps may be dated from the seventeenth century, and was due to the Swedes. Under Charles the Ninth, a surveying department was organised, placed under the direction of Buræus, and particularly encouraged by Adolphus. In 1684, the Swedes had completed the general topographical map of Sweden; but it was kept secret, and at the end of a century, they had only published some parts of it. These maps were constructed for the purpose of ameliorating the condition of several provinces of the kingdom, which had been desolated by war. The Dutch also commenced early to construct topographical maps.

The measurement of many arcs of the meridian to determine the figure of the earth, had very much extended geodetical operations, and had, in many cases, become the elements on which topographical maps were based. The numerous geodetical surveys called into activity the inventive powers of the ablest artists in Europe, and instruments of extreme accuracy were produced; and the skill of observing and determining angles kept pace with those improvements connected with this important branch of science. The repeating principle due to the celebrated Tobias Meyer, gave birth to Borda's circle of repetition about 1789, an instrument which has been connected with the most brilliant scientific operations which adorn the annals of the eighteenth century.

Mr. Bald then showed to the academy some specimens of the new map of France, and noticed briefly the trigonometrical survey of England—the Down survey of Ireland—the maritime surveys of Ireland—the county surveys, and the bog surveys. He made some observations on the great importance of accurate maps, especially to professional men engaged in conducting public works, such as roads, canals, river navigations, harbours, railways, supplying towns with water, irrigations; to the geologist and miner, exploring the strata, and mineral wealth of the country; to the statesman devising improvements, and developing its resources; and to the poor, by affording useful employment to the working classes.

The author then alluded to the map of Egypt, which was made during the period it was under the dominion of the French republic, and which received from Bonaparte all that protection and assistance, which so much distinguished him on all occasions regarding the advancement of the works of science. This map was engraved on fifty-three sheets of copper, and the names are engraved both in Arabic and French.

After this introductory account of the rise and present state of the topographical art, Mr. Bald proceeded to the details connected with the survey of Mayo.

The instruments used in this survey were a seven inch theodolite; two five-inch theodolites, by Troughton; a small theodolite, by Dollond; and also a five-inch one by the same artist. In taking the levels over the bogs, two of Troughton's best levels were used. The barometers were made by Mr. Thomas Jones, of London. There were also two plain tables, a chain for measuring base lines, a sextant four inches radius, and two sextants, each ten inches radius, divided to ten seconds for observing altitudes, one of which was made by Troughton.

The proceedings of the geometrical details of the survey were then given, and the mode of describing the rise and fall of the ground, which was shaded on the map with a depth of colour corresponding to the sines of the angles of inclination. The irregularities of surfaces were simply delineated by hatching lines, drawn in the direction of the declivities, forming a series of normals, perpendicular to the horizontal lines of equal level.

Dr. Smith read a paper (by Lieutenant Newenham, R.N.) "*On a Tumulus or Barrow, near Rush, County of Dublin.*"

The barrow, called Knocklea, or the Giant's Hill, is situated on the edge of the cliff, about midway between the village of Rush, county of Dublin, and the martello tower to the northward, called Dromanick, and immediately in front of Sir William Palmer's residence, Kinure Park.

It appears to have been composed of quantities of boulder stones and earth heaped up into a conical form, and sloping away to the base, which was square, as appears from the eastern angle, which yet remains perfect. Within the base of the mound there was a circle formed of large stones placed on their ends, and about one hundred paces in circumference.

The farmer who rents the land on which it stands has removed about one-half of the mound, for the sake of the earth as a manure, and nearly one-half of the circle of stones on the south side, for the purpose of building a wall, part of which is erected on the stones forming the western side of the circle. In the course of his depredations he discovered a passage which opened on the south side;* its entrance was funnel-shaped, and the walls of this passage were formed of flag-stones placed on their ends, and roofed in with the same. It was about eleven yards long, and one in width; and led to a low chamber about eight feet long, and six wide, which was situated nearly in the centre of the barrow, and formed of stones in the same manner as the passage.

The farmer removed all the stones forming the western side of the passage, and in the course of his excavations found some human bones on the south side of the chamber, and within the circle of stones. The lines of stones forming the sides of the passage appear to continue on through the mound towards the north side; and a few feet below the present surface of the barrow, a little to the north of the chamber, there is a bed of periwinkle shells, about eight inches thick, with some limpet and muscle shells intermixed; and beneath this bed of shells there is a quantity of rich dark mould, with some reddish earth, which has the appearance of being burned. A few human bones, and some bones of small animals, were found in the earth beneath.

Outside the circle of stones, and on the very edge of the cliff, near the western angle of the mound, there was found a rudely-formed grave containing a human skull, with the bones of the arm, leg, and thigh, which apparently had never been disturbed; the bones of the back, ribs, &c., could not be discovered.

There are several remains of entrenchments and smaller mounds in the neighbourhood.

Circles of stones are found enclosing many similar barrows in Ireland. At New Grange, near Dowth, in the county of Louth, the circumference of one measured about four hundred paces; and in a barrow near Drogheda, an engineer officer found a gigantic skeleton, a pair of elks' horns, and a spear, in an upright position: the horns were above the skeleton. There are many barrows in the neighbourhood of Drogheda, which, if opened under the direction of competent persons, would probably lead to many very interesting discoveries.

The President gave an account of a singular appearance of the clouds, observed on the 16th of December, 1838, at the Observatory of Trinity College, Dunsink. They appeared, for at least the last four hours of day-light, to be arranged in arches which converged very exactly to the N.E. and S.W. points of the horizon; while the breaks or joints in these arches were directed, though with less exactness, to two other horizontal points, which seemed to be always opposite to each other, but ranged from N.W. and S.E. to N. and S. Conjectures were offered with respect to the cause of this appearance.

SCHOOL OF DESIGN,

MARGARET-STREET, CAVENDISH-SQUARE.

We are happy to witness the progress of this excellent institution, which under its able conductor, Mr. A. de Villalobos, seems to effect all the purposes

* Mr. Newenham thinks that, as far as his observation has extended, the entrance of all barrows is on the south side.

for which it was originally designed. In addition to the excellent system of instruction, and the valuable collection of the antique, Lectures on Anatomy have been commenced, and form an additional attraction, if any were needed.

MEETINGS OF SCIENTIFIC SOCIETIES FOR MARCH.

Royal Society, Thursday, half-past eight, P.M., 7th, 14th, and 21st.
Society of Antiquaries, Thursday, eight, P.M., 7th, 14th, and 21st.
Institution of Civil Engineers, 25, Great George-street, West, Tuesday, eight, P.M., 5th, 12th, 19th, and 26th.
Royal Institute of British Architects, 16, Grosvenor-street, Monday, eight, P.M., 4th and 18th.
Architectural Society, Tuesday, eight, P.M. 12th.
Society of Arts, Wednesday, half-past seven, P.M., 6th, 13th, 20th, and 27th.
Ditto, Illustration, Tuesday, eight, P.M. 12th.
Geological, Wednesday, half-past eight, P.M., 7th and 21st.
Royal Geographical, Monday, nine, P.M., 11th and 25th.
Graphic, Wednesday, eight, P.M. 13th.

ROYAL EXCHANGE.

We regret that we cannot yet announce any final decision in regard to this building. The disgraceful delay which has now arisen in consequence of the dispute between the City and Government will be the cause of losing the very best time of the year for getting in the foundations of the building. If the city authorities were to determine to-day to issue notices to architects for the designs, there must be a delay of at least three months, to give them an opportunity of working out their ideas, and at the end of that time after the committee should have determined upon the design to be adopted, there must be a farther delay of another three months for the preparation of the contract and working drawings, specification and estimates for the builders, which would bring us to the autumn, and drive the builder into the short day and the inclement season. As there cannot be any difference between the parties as to the necessity of clearing away the immense quantities of rubbish and the old foundations for the new building, we should recommend to the city the necessity of immediately engaging with a contractor for that purpose, which will be very considerably forwarding the works.

For our part we cannot see for what reason the city should be afraid of submitting the selected design to government. If all is "to be fair and above-board," and if the city really intend to submit the designs to public competition, and select the best without *favour or affection for any party*, there can be no fear that the government will act in opposition to the city, when thus so honourably calling upon the profession for their labours. We do hope and trust that before our next Journal is published, some decision will have been made and this vexatious delay arrested.

THE FINE ARTS.

THE NELSON MONUMENT.

On Saturday the 25th ultimo, a highly respectable meeting of the general committee was held at the Thatched-house, St. James's-street, to receive the report of the sub-committee, who were appointed to recommend to the consideration of the general committee those models and designs which were sent to Rainey's gallery, Regent-street, for the Nelson monument, and also to adjudge to the three best the prizes of 200*l.*, 150*l.*, and 100*l.* Amongst these present we observed Lord Minto, the Marquis of Northampton, Sir John Barrow, Mr. Rice, the Marquis of Breadalbane, Lord Melville, Lord Yarborough, the Earl of Hardwicke. Sir Thomas Troubridge, the Right Hon. John Wilson Croker, Sir George Cockburn, Lord Colchester, the Hon. Captain Grey, Sir George Murray, Lord Hotham, and numerous other persons of distinction.

In the absence of his Grace the Duke of Wellington, the Marquis of Northampton was called to the chair. Mr. Scott, the secretary, then read the resolution of the general committee, appointing the sub-committee, declaratory of their power to recommend which of the models and designs were entitled to the prizes. There were in all 118 drawings, and 41 models. The report stated to design No. 81 they recommended the first prize, that of Mr. Railton, being a column of 174 feet, surmounted by a statue of 17 feet. The committee, however, expressed an opinion that they thought on a column of such an altitude that the features and character of the statue would be lost, and they therefore were of opinion that a statue executed in marble, placed under the shelter of the National Gallery, or some other public building open to the public, was the most appropriate way to evince a country's gratitude. The report further stated, that the model No. 10, of Mr. G. H. Bailey, was entitled to the second prize, and that of Messrs. Fowler and Siever was entitled to the third prize. The secretary thought it fair to state, that between the second and third prizes there was a diversity of opinion amongst the committee on their respective merits.

The Hon. Captain Grey objected to the confirmation of the report as regarded the prizes, as many members of the committee had not seen the designs and models; and out of a committee of upwards of 140, not more than 37 had been to view them. He therefore proposed the consideration of the report should be adjourned for a fortnight, so as to afford an opportunity to the committee to inspect them.

Sir G. Cockburn was willing to consent to an adjournment, particularly as his Grace the Duke of Wellington was absent, who had taken so great an interest in the business.

After a desultory conversation between several members of the committee, a resolution was proposed by Mr. Rice, and seconded by Lord Minto, "That the public, in the week after next, might obtain cards of admission to view the Models and designs in Rainey's gallery, by application to the secretary or any member of the committee."

[We sincerely hope that the committee will delay finally fixing the choice of the models or drawings for the three prizes until after the exhibition of the whole of the Designs has been open to the public inspection, as by this means a tolerable correct opinion may be obtained as to the feelings of the public on the decision of the committee. It appears, however, to us rather out of place that the committee should have selected a design for the first prize, and at the same time think it unsuitable for that situation which has been almost universally admitted to be the best, *Trafalgar-square*.—ED.]

WELLINGTON STATUE IN THE CITY.

On Saturday, 25th ultimo, the general committee assembled at the Mansion-house for the purpose of completing the final arrangements with the sculptor, Sir Francis Chantrey. The Right Hon. the Lord Mayor in the chair.

Sir P. Laurie presented the report from the sub-committee, which stated that her Majesty's government had presented to the fund for the city statue of the Duke of Wellington, gun-metal taken in his victories by his Grace of the value of 1,520*l.*, which, together with the sum of about 9,000*l.* already subscribed, constituted an amount of 10,520*l.* It also stated that the sub-committee had come to an agreement, subject to the approval of the committee, to hand over to Sir Francis Chantrey 3,000*l.* upon signing the agreement, 2,000*l.* with the metal when the small model is finished, and the remaining 4,000*l.* upon the completion of the work. The time for the completion is fixed for the 18th of June (Waterloo-day), 1843. The report concluded with stating that the 6,000*l.* be immediately invested in the government funds, in the names of Sir P. Laurie, Mr. Masterman, Mr. Barclay, and Mr. R. L. Jones, as trustees.

It is to be an equestrian statue of bronze, and not less than ten feet high, from the top of the pedestal on which the horse stands to the top of the head of the rider. The site was not determined upon, but the most eligible one was considerored to be between the Bank and the Globe-office, where the buildings are now occupied by the Sun Fire-office, Messrs. Ladbroke and Co., and Mr. Thomas's, but intended to be taken down to improve the avenues to the new Royal Exchange. Sir F. Chantrey was unable to attend, being engaged at Buckingham-palace with her Majesty, who sat to him for her bust, but his acquiescence in the contract and entire approval of the whole proceedings was signified by Sir Peter Laurie on his behalf.

The committee are to provide a site and to erect a pedestal of granite or some other stone three months before the completion of the statue.

STATUE TO MR. STEPHENSON.

MEASURES are now in progress to commemorate the services rendered by Mr. Robert Stephenson in the improvement of locomotive power. This proposition has originated with the iron trade, and a highly influential committee of iron masters has been formed for its promotion. It is intended to erect a statue, which, on the suggestion of Mr. Hyde Clarke, is to be made of cast iron. We believe that this material has been employed in an equestrian statue at Berlin; no doubt means may be discovered for defending the iron from oxidation. At all events the experiment is worth trying, as its success would enable us to use statues more extensively as a means of decoration. The committee met on the 15th February, when models were laid before them by Mr. Loft and several other eminent artists. We think that there is another name connected with the progress of locomotive power, which is well worthy of some tribute, we mean Richard Trevithick, the inventor of the high pressure system, and the rival of Watt, and to whom the Spanish government proposed to erect a statue of silver.

COLOURED PRINTS.

Instructions to the Printer, or Colourer of Engravings.

The plates to be printed in a bluish-gray ink (this is the neutral tint for the light and shade of the landscape), and the colourer to wash in the sky with blue or violet, &c., according to each sketch; also *going over* the distances with each colour, then wash the foregrounds and middle distances with red, orange or yellow, copying the drawings; and when dry, wash over with blue, to produce the greens in the middle distances: this being done as a dead colouring, a few touches with the hand of the master, and a harmonizing tint to soften the whole, will produce the effect expected from a coloured print.—*Fragment from Repont.*

A Transparent Watch.—A watch has been presented to the Academy of Science at Paris, constructed of very peculiar materials, the parts being principally formed of rock crystal. It was made by M. Rebellier, and is small in size. The internal works are visible; the two-teethed wheels which carry the hands are rock crystal, the other wheels of metal, to prevent accidents from the breaking of the springs. All the screws are fixed in crystal, and all the axles turn on rubies. The escapement is of sapphire, the balance-wheel of rock crystal, and its springs of gold? The regularity of this watch as a time-keeper is attributed by the maker to the feeble expansion of the rock crystal in the balance-wheel, &c. The execution of the whole shows to what a state of perfection the art of cutting precious stones has been carried in modern times.

ANTIQUITIES.

Discovery of Ancient Coins, &c., in the Temple.—Within the last few days the workmen employed in digging the foundation of the chambers in Paper-buildings, Temple, have discovered several earthen vessels of curious construction, some of them containing coins of an ancient date. Many have been purchased, and the spot is daily visited by antiquaries, who evince great anxiety to possess some of the relics.—*Morning Chronicle.*

Egina Casts.—These casts in the British Museum have now been arranged as the originals are in the Glyptothek at Munich, so as to exhibit their position on the pediment of the temple. This is almost the solitary architectural monument in the museum, and it is well calculated to animate the public mind in favour of architectural decorations, while it more than ever induces us to regret the blind policy of the government in having allowed the originals to escape them. The arrangement confers great credit on Mr. Loft, the modeller to the museum, who has had the superintendence of the work.

Venerable Relic.—In the very ancient ecclesiastical structure called King's Chapel, at Islip, in Oxfordshire, formerly stood a stone font, which was used, as tradition affirms, for the baptism of Edward the Confessor, more than 800 years ago. It has long been displaced, and now occupies a far less pious position in the gardens of Sir Henry Brown, who resides not far off, at Nether Roddington, and affords free access to this antiquarian curiosity.

Egyptian Stone Coffin.—There is now on board of the brig Elizabeth Ann, Captain Ellis, lying at the north end of the Queen's Dock, a remarkably ancient Egyptian stone coffin, recently imported from Alexandria, in the vessel called the Hope, whence it has been transhipped, to be taken to the British Museum. It is eight feet six inches in length, measured outside, and three feet six inches in width. It is covered with curious carving of human figures, hieroglyphics, and emblematical devices. It was discovered far in the interior of Egypt, and has been sent to England by our consul at Alexandria. The cost of its conveyance it is supposed will reach 1,000*l*, owing to the want of roads in Egypt, and the necessity of employing men chiefly as carriers.—*Liverpool Paper.*

Sarcophagus.—In the Island of St. Margaret, on the Danube, betwixt Pesth and Ofen, has been found a sarcophagus of coloured marble, and of distinguished workmanship, containing the body of a female, embalmed, and in a remarkable state of preservation. It is clothed in a dress of silver brocade, with a crown of massive gold on the head; a pearl necklace surrounds the neck, and each finger is covered with rings, made of precious stones, besides which there are many other ornaments of the same material, as well as of gold. It is generally thought that it is the body of St. Margaret, daughter of Bela IV., King of Hungary, patroness of the island. The sarcophagus having been taken to the Bishop of Pesth, he has ordered it to be temporarily deposited in the Cathedral.—Near Pesth has also been discovered in a cave, on a hill, amidst the bones of the mammoth, and other extinct species of animals, an ancient vase, of an extraordinary shape, totally new to antiquarians.

At Mansal, in France, workmen excavating the bed of the river Seille have found, amidst the remains of aquatic plants, and buried deep in the soil, twenty skeletons in perfect preservation. They lay in different positions, without any weapons by them some having fractured skulls, some with their face to the ground, appearing to indicate their having been peaceable men, who fell victims to an unexpected attack of warlike invaders. Their necks, their arms, and their legs were surrounded by bronze rings like those found in the tumuli of Brittany. One of these rings, or solid necklaces, is of remarkable workmanship, elegance and finish. This is formed of gold and bronze, and being fitted tight to the neck, so that it could not pass over the head, it must either have been put on the person who wore it in early youth, or have been soldered when on. These relics, supposed to be two thousand years old, are occupying the attention of the antiquaries of France, whose descriptions, details, and suppositions would consume more space than we can spare. The bodies, from the appearance of the ancient brickwork beneath them, appear to have sunk into the soft slime of the river, which has subsequently solidified, and been augmented by successive depositions of earth and aquatic plants.

The Society of Antiquarians of Normandy have decided on elevating once more in its place a miliary stone found in 1819, near Bayeux. It bears an inscription in honour of the Emperor Claudius, and was erected in the XLVI. year of the Christian era. It is the most ancient monument of Romans found in Normandy. In coming to invade England the Emperor Claudius twice traversed France, and Suetonius relates that in the last journey he made, which only took up six months from the moment he left Rome, till that when he returned there in triumph, he travelled on foot from Marseilles to Boulogne. It was probably after these expeditions that he established the military road of which this miliary stone was one of the appendages.

Cathedral of Chartres.—The *Moniteur* publishes a report, addressed to the Minister of Public Instruction by M. Didron, Secretary of the Historical Committee of Arts and Monuments, on the archæological monography of the cathedral of Chartres. Amongst other interesting facts, M. Didron establishes that the statues taken down during the revolution of 1793 from the gallery over the grand portal of Notre Dame de Paris were not the statues of the Kings of France, as has been stated by the Benedictines and Sauval, and as was believed by Napoleon, who intended to repeople the gallery, but simply the statues of the Kings of Juda, the ancestors of the Virgin Mary, and Joseph. In the report the statue of Liberty is also described—a statue belonging to the 13th century, and decorating the northern porch of the Cathedral of Chartres.

A curious and interesting sepulchral monument has lately been discovered at Rome. The ancient aqueducts at the Porta Maggiore, bearing on their lofty entablature the three inscriptions, will be familiar to the recollection of all persons who have visited the antiquities of Rome.—(The reader will find a description of these majestic arches; and the subsequent rude works of Honorius placed against them, in Burgess's "Topography and Antiquities of Rome," vol. ii. p. 311, 312, and 329.) Two of the arches of the Claudian aqueduct served for two gates of the city, respectively conducting to the roads which led to Præneste and Labicum. Stilicho, the general of the Emperor Honorius, placed some cumbrous walls against those arches. In an attempt to clear and repair some of these walls last September, the workmen discovered a portion of a bas-relief, which finally led to the demolition of the tower on the right in going out of the city gate. The tower was found to enclose a remarkable monument, as singular for its construction as for the subjects it represents. It was found in very good preservation. In clearing away the surrounding walls, the next discovery, after the bas-relief, was a slab of marble, on which were two recumbent statues, rather larger than the life, male and female; close by them was the following inscription.—

FVIT ATISTIA VXOR MIHEI
FEMINA OPITVMA VEIXSIT
QVOIVS CORPORIS RELIQVIAE
HOC PANARIO.

The form of the monument is that of a machine which was used by the Romans for enclosing the newly-baked bread, and which was perforated with holes or tubes to let out the steam. These are curiously imitated in the construction of the tomb. The bas-relief represents the whole process of making bread; it runs all round the top, and is supported at the angles by pilasters, the capitals of which are neatly ornamented. These descend half way down, and repose upon a broad square plinth, on which is the following inscription *on one side*:—

EST HOC. MONIMENTVM MARCI
VERGILI EVRYSAC—

On *the other side* the three first words are wanting as far as the M in monimentum and the name of Marcus Vergilius Eurysax is written with some little difference in the paleography. The cognomen of EVRYSACIS, however, is complete, and then follow these three words, PISTORIS. REDEMPTORIS APPARET. On the sides, along the upper part, are placed horizontally, in rows of three, nine hollow stone cylinders, and in the lower part (beneath, the inscription Est Hoc, &c.) two columnar masses are placed perpendicularly, separated by a square block. The "Panarium" was also found, and is carved in the form of a circular wicker basket. It is observable that the southern side of the monument, which probably stood within the property of Vergilius Eurysax, is formed of fine Travertine stone, while the sides exposed to the public roads are of Tufo. The whole of this sepulchral monument was completely enveloped in the comparatively modern wall built against the aqueduct. It is proposed to clear away the obstructing walls, and to lay open the tomb and the Porta Labicana to public view. The two statues have been conveyed to the Vatican Museum. The materials of which this tomb is built, and the paleography of the inscription, appear to show that it is a monument of the republic. It is not improbable that the Travertine stone may have been added at a more recent period: the words QVOIVS, MIHEI, and OPITVMA, may be compared with the inscription on the sarcophagus of L Scipio Barbatus, where we have QVOIVS FORMA VIRTVTEI PARISVMA. RELIQUIAE QVOD is also very ancient.—*Athenæum.*

STEAM NAVIGATION.

Ericsson's Steam-Boat Propeller.—The great power exhibited during the early trials of this propeller, about eighteen months since, induced some American canal proprietors to order an iron steam-boat, with a 50-horse engine, to be fitted with the new propeller. This small iron steamer, called the Robert F. Stockton, has lately arrived in the Thames from Liverpool, and will shortly proceed to the United States; her dimensions are 70 feet length on deck, and 10 feet beam. A variety of experiments have been made in presence of several scientific and practical men, who consider the success to be perfect. Although constructed for towing purposes only, this boat has frequently gone at the rate of twelve miles an hour. As to her power as a tug, we are informed that on Tuesday, Jan. 29, she towed the American packet ship, Toronto, from Blackwall to the lower point of Woolwich, a distance of three miles and a quarter, in forty minutes, against the flood tide, then running from two to two and a half miles; thus towing her through the water at the rate of upwards of six miles an hour. The Toronto is 650 tons burden, she measures 32 feet beam, and drew at the time of the trial 16 feet 9 inches; thus presenting a sectional area of more than 460 square feet. Now the fact of this body having been moved at a rate of upwards of six miles an hour, by a propeller, or piece of mechanism, measuring only six feet four inches in diameter, and occupying less than three feet in length, is one which, scientifically considered, is interesting in the extreme, and in a practical or commercial point of view, is of immense importance. We understand a company is about being formed to apply the propeller to a ship of 1,000 tons burden, to be employed in trans-Atlantic navigation; and as her sailing qualities will not at all interfere with her steaming power, it is confidently anticipated that increased safety will be insured, and her passage greatly accelerated, at a saving of at least one-half the fuel.—*Times.*

Departure of the Great Western, Bristol Jan. 28.—The Great Western having been completely refitted during her stay at Pater, a new quarter deck having been built, and increased stowage-room provided for upwards of fifty tons, sailed this day on her first voyage for New York this season. She set sail at about twenty minutes before six p. m., carrying with her 107 passengers, among whom is Captain Hudson of the Guards, with Government despatches, and Mr. Balls of Covent Garden, upwards of 8,000 letters, and a full cargo of British manufactured goods, consisting of silks, Irish poplins, and cotton goods. She is expected to return about the 7th of March.

Christiana, Jan. 22.—Orders have been given to build an armed steam-boat of 100 or 120 horse power, after the drawings of Lieutenant Sommerfeldt, on the model of the Medea, which is reckoned to be the first armed steam-boat in Europe.

The Kite, Post-office Steam-vessel, running from Liverpool to Dublin, has lately been refitted at Woolwich. Her machinery and boilers are the manufacture of Messrs. Fawcett, Preston, and Co., of Liverpool, who have introduced some improvements into them. On her first trial, about the 22nd of January, in consequence of the immense draft to the boilers, it was considered proper to shorten the chimney eleven feet, which, in ordinary cases, would so check the draft as almost to destroy it. She then proceeded on her second trial, when it was admitted that her machinery was excellent and satisfactory; that the boilers, with the chimney eleven feet shorter, produced a superabundance of steam, the engines making their full complement of revolutions; and, to the surprise of all on board, scarcely any or no smoke was seen issuing from the chimney, which was then explained to be in consequence of the peculiar form of the bridges applied to the furnaces. These are a new invention of Mr. E. Hopkins, 61, St. John-street, Clerkenwell, and have the effect of returning the light fuel and gases on to the fire, when the smoke is consumed, and coals are consequently saved.

FOREIGN RAILWAYS.

Austria.—The rails in the Austrian railways are now made of iron from Styria which are said to be found more durable than those supplied in England.

Austria.—The Austrian government is at present occupied with the plan of a railroad between Vienna and Salzburg, by the way of Lenz, upon the right bank of the Danube, which will be speedily carried into execution. The constant communication upon this road promises every prospect of success to this undertaking.

The Versailles and St. Cloud Railway.—The works have been commenced at five points at once within the commune of Versailles, and are carried on with the utmost activity. As the works on the other parts of the line are nearly finished, the whole of the two lines of rails are expected to be laid from Asnières to the limits of Versailles before the end of the month. Independent of the ordinary works, the company has had to form the tunnel under the Park of St. Cloud, 1654 feet in length; another tunnel of 607 feet, under the Park of Montretout, and the high road between Saint Cloud and Mantes; a third tunnel of 272 feet, at Courbevoie, under the road between Paris and Poissy; two large viaducts of five arches each; 36 bridges over high, departmental, and cross-roads, and 10 aqueducts. There remain besides five bridges to be erected in Versailles. All these works are comprised within a limit of four and a half leagues. In the plan laid down by the government engineers, upon which the undertaking was founded, there were only one tunnel, 28 bridges, and four aqueducts mentioned; and the greater part of the additional works have been occasioned by the decrees of the municipal councils.

St. Cloud Railway.—The jury of expropriation has just decided at Versailles upon the indemnities to be paid to proprietors affected by the last portion of the line of the Versailles and St. Cloud Railroad, from Viroflay to its entrance into the first-named town, but the sums awarded have in general been much less than those demanded. Property in Montreuil, for which 656,755f. were demanded, has been adjudged at 264,111f. Ten houses in the same place, estimated by the owners at 207,343f., have been awarded at 83,400f. Some gardens in Versailles, for which 211,615f. were asked, have been given to the company by the jury at 50,200f.; and the total amount of 1,548,150f. for the portion of the line has been reduced to 640,665 Two extreme cases deserve to be mentioned: the lessee of a field at Versailles demanded 21,243f. as an indemnification for one acre of land, and produced documents signed by some architects of that place in support of his estimate. It was, however, reduced by the jury to 400f. Another proprietor claimed 6,620f. for the suppression of a right of way across his land; the company offered 10f. for it, and the jury awarded him nothing.

Belgium.—From a report recently laid before the Belgian Chamber of Representatives by the Minister of Public Works, it appears that the total expense of maintenance, purchase, and repair of machinery, watching, &c., of the Belgian railways since the completion of the first line in 1834, up to the 1st of November, 1838, is 3,374,570frs.; that the total receipts during the same period have been 5,144,645frs.; giving a net profit of 1,770,075frs., which, upon the capital expended in the construction of the roads, returns an annual dividend of 4 per cent. The average cost of the construction per league has been 531,000frs., about a sixth of the cost of the English lines; and the average price paid by passengers is 12 centimes per league, about a fifth of the lowest rate of charge in England. The total length of the Belgian lines, now completed, is 64 leagues, about 270 miles.

Russia.—The Hamburg papers mention, upon the faith of letters from St. Petersburg of the 12th December, that a new railroad was about to be established from the town of Morschausk, on the river Zora, to the mouth of that river, in order to facilitate the communications of some of the richest provinces of the south, which send all their wares and produce to Morschansk, one of the first commercial towns of the empire, with St. Petersburg and the north.

Proposed Railways in America.—One of the grandest railroad schemes ever conceived by the mind of man, has been submitted to the public by General Gains, of the United States army. It proposes a system of railroads, all diverging from a common focus or centre in Kentucky and Tennessee—the middle point of the Union; and thence to branch in as straight directions as possible, like the radiations of a star, to all the large cities, and important frontier posts in the country. Thus New Orleans, Portland in Maine, New York, the other Atlantic cities, and Detroit in Michigan Chicago, in Illinois, Fort Gibson, in Arkansas, St Louis, in Missouri, the northern lakes, and the southern sea of Mexico, the ocean and perhaps the Rocky Mountains, will all be united in bonds of iron, steam, and rapid public intercourse. The General says that such a system would make the United States prosperous in peace and impregnable in war. I think that before many years have rolled away this scheme will be commenced. The United States are the very republic for railroad enterprise.—*Daily Paper.*

The New Philadelphia railroad is at present doing an excellent business; the month of December, one of the dullest of the year, will realise over 8,000 dollars. January and February are the months when the merchants from the western states commence their purchases for their spring business, when the amount of freight passing over our road will be very great. I feel more and more satisfied of its being one of the very best stocks in our state, and you can with perfect safety give the bondholders every assurance that their bonds will increase in value every year they hold them. The Cumberland Valley have completed their bridge over the Susquehannah, and formed their connexion with our road, which will enable our Philadelphia merchants to forward their goods 160 miles by railroad in thirteen hours towards Pittsburg, which is just half way. Formerly goods were 18 to 20 days reaching Pittsburg, and you, who are so familiar with the rapid increase of the population of the western states, and their consequent necessities, dependent entirely on our Atlantic cities for their supplies—you can readily calculate the great importance of our road, and the certainty of its immense revenue."—*Morning Herald.*

FOREIGN INTELLIGENCE.

The completion of the Column, in commemoration of the Revolution of July, may at length be expected within a definite time. Messrs. Soyer and Inge a few days' since cast the capital and the tambour, by which it is to be crowned, in one mould. This is the largest single cast of a capital that has ever been made.—*Paris Paper.*

Two new marble statues, those of Lekain and Talma, have just been stationed right and left of the author of *Zaire* in the hall of the Theatre Français.

Iron Steam Ship.—There was launched from the building yard of Mr. C. Wood, Dumbarton, on the 22d Jan., an iron steam-ship, 146 feet long, and 26 broad, intended for South America. On being launched this vessel drew only eighteen inches water, and with machinery and cargo will not exceed three feet. She is intended for passengers chiefly, of whom she can carry a thousand. This fine vessel was built by Messrs. J. and W. Napier, in Glasgow, and we understand that these gentlemen have her machinery ready for putting on board, so that we shall soon have an opportunity of seeing this splendid specimen of the improvements of the present day leaving our river for a distant part of the world, another trophy of the success of the enterprising engineers on the Clyde. She is now at the Broomielaw, and is worthy of inspection. The carpenterwork of the vessel was done by that eminent shipbuilder, Mr. C. Wood, of Dumbarton.—*Glasgow Paper.*

Steam Navigation to South America.—A memorial, which includes among its signatures those of Baring, Gladstone, Rothschild, and other firms of mercantile, banking, and manufacturing eminence, has just been presented to the Treasury, praying for a monthly line of steam-packets, from Falmouth to Madeira, the Canaries, the Cape de Verd Islands, Pernambuco, Bahia, Rio de Janeiro, Monte Video, and Buenos Ayres. The packet establishment now existing is so irregular, that with the ports of Pernambuco and Bahia a communication can be had but six times in the year, trade winds and ocean-currents hindering any sailing vessel from touching at either, except during some half-dozen months of a periodical season. The passage outwards to Rio de Janeiro averages fifty-six days, and homewards seventy-four, while, from computing the speed of the Great Western steamer across far less favourable seas, two-thirds of that time might, in all probability, be saved. An allowance of 40,000*l.* per annum is at present made for the tardy packets upon this important line, and for the same sum contractors could doubtless be found to deliver twelve monthly mails outwards and homewards, in steam ships of the very first class. We do not surely err in anticipating for this memorial the most immediate and attentive consideration which Government can give it.—*Daily Paper.*

The *Debats* quotes letters from Havannah, announcing that the magnificent Government steamer Véloce, Capt. Béchameille, which had recently entered Havannah after its transatlantic experimental voyage, had been burned in that habour.

PROGRESS OF RAILWAYS.

Eastern Counties Railway.—The rapid progress of the works on this line bespeaks an active executive. We had no idea of the forward state of the works towards Brentwood. It was only in October last that the contract was let, and looking to the time of year we considered nothing would have been done but prepare for the spring. On inspecting this part of the line, we found the works in full operation; several bridges and large culverts erected, and the embankments carried over them. There are three extensive cuttings on this contract, all of which are in full work, even during the late and present unfavourable weather there has been excavated and carried to the embankment near 200 yards per day. The cutting in the hill on this side of Brentwood is so deep as to be carried on in four lifts, near to this excavation is erected a handsome skew bridge, the angle of which is very oblique, we should suppose about 40deg. At Romford great activity prevails, several large bridges and culverts are in the course of erection; close by at Hare-street, a large bridge over the railway, of three or more arches, is commenced, the foundations are about 35 feet below the surface. Between London and Romford there are five locomotive engines incessantly employed in expediting the earthwork, besides an immense number of horses. The long and expensive embankment over the Stratford Marsh is now just completed; and as the distance between its termination and the commencement of the viaduct at Bethnal Green has been formed from side cutting, there remains nothing of importance between London and Romford but the viaduct, portions of which are in a very forward state.

Bristol and Exeter Railway.—Within the last few months coffer dams have been driven preparatory to the erection of a bridge, 100 feet span, over the river Paret, about three-fourths of a mile higher up that river than the town of Bridgewater. The contractor is now employed in building the abutments, and the arch will be turned in the latter end of the spring, when the work towards Taunton will be begun immediately. The cutting at Pariton Hill is proceeding with much vigour, upwards of 500 men are employed on it at present, and more will be shortly. This is the only hill, for many miles, and as soon as it is got through, which, if the Company go on at the rate they have begun, will be soon, nothing remains but to lay the permanent rails. The broad guage will of course be adopted. The town of Bridgewater possesses facilities for being made one of the principal manufacturing towns, and one of the first ports in the kingdom; and when the communication with London on the one side, and the West of England on the other, is opened, we know nought more wanted, save a few more spirited men in the middle.—*Bristol Journal.*

Birmingham and Gloucester Railway.—Mr. Norris, of Philadelphia, has received an order for ten of his locomotive engines, from the Birmingham and Gloucester Railroad Company, in England.—*New York Paper.* If this be correct we are not surprised that the shares of this company are at a great discount. Do they expect Englishmen will support their projects if the money subscribed is to go out of the country? and does the company expect that the public will have any confidence in the safety of the engines when made abroad.—*Ed. C. E. and A. Journal.*

London and Brighton Railway.—The locomotive engine which has been named "The *Brighton*," lately sent down by the railway company to facilitate the works on the Shoreham branch, was tried on a portion of the line, about a mile and a half in extent, on which the permanent rails have already been laid. We are happy to state that the works on the Shoreham branch are progressing with great activity. The tunnel under Lashmar's mill is proceeding night and day; and the land purchased of Mr. Kemp has been enclosed from the mill to the terminus, crossing the Montpelier road. As great a number of excavators as the space will admit are engaged on the cutting at Fuller's-hill, in the parish of Aldrington; and as soon as this is completed, which it is anticipated will be the case in a month, permanent rails will be laid for the distance of about four miles, and the engine will be used for the purpose of removing the earth from the cuttings and tunnels at the Brighton end of the branch The works on the London part of the line are also proceeding with great rapidity.—*Brighton Gazette.*

Havre.—The Minister of Commerce, it is reported at Havre, has informed the Chamber of Commerce of that place, that Government intends proposing to the Chambers a grant of 150,000f., for the formation of two trenches in the new entrance port, in order to enable large steamers to lie there afloat at low water. To this plan the *Journal du Havre* is opposed, as being a poor substitute for a large dock, especially devoted to the reception of steam-vessels, which the town of Havre has been anxious to have constructed, in order to be enabled to set up a line of steamers to New York.

Havre.—A few days since a considerable portion of the cliff at Cape La Hève, near Havre, gave way, and carried with it into the sea upwards of 140 feet by 12 feet wide of land which was in cultivation.

A chain-bridge over the Allier at Vic-le-Comte gave way for the second time a few days since. The first time it sank under the weight put upon it to try its strength, but was rebuilt with greater solidity. The second broke down while a wagon heavily laden was going over. The vehicle with its contents fell into the river, and was lost with the horses; but the driver was fortunately saved.

La Tour d'Auvergne.—A monument is about to be erected to Corret de la Tour d'Auvergne, known in the French army as the "First Grenadier of France." The monument to this gallant Breton is to be erected at Carhaix, his native town, which has voted 200*l.*, the Council-General of the department having added 40*l.*

The French King has approved of a proposition laid before him by the minister of the marine, for commencing in the spring a hydrographical survey of the French coast in the Mediterranean. The result of this survey, when published, will form a supplement to the *Pilote Français*. The operations are to be under the direction of M. Mounier, hydrographic engineer of the first class.

The steam-generator of M. Giraud's sugar-manufactory, at St. Saulve-lez-Valenciennes, burst during this month; and, although it weighed 6,000lbs, was forced upwards through the ceiling and roof, and carried to a distance of 100 feet, together with the tubes, and other apparatus attached to it. Two of the stokers, who were at the fires, were seriously injured.

The minister of the interior has granted 2,000f. to be applied in the restoration of a fine specimen of the statuary of the middle ages, called the *Puits de Moïse*, in the ancient monastery of the Chartreux, at Dijon.

French Coasting Trade in 1837.—The number of vessels employed in that trade in 1837 was 64,900, carrying 2,209,269 tons, and manned by 254,152, and the whole of their cargoes weighed 900,000 tons, or 17,821,091 metrical quintals. The trade of the different ports, in metrical quintals, is as follows:—Rouen, 2,005,509; Marseilles, 1,734,820; Bordeaux, 1,446,610; Havre, 1,254,777; Nantes, 623,571; Toulon, 516,084; Dunkirk, 400,442; La Rochelle, 344,486; Caen, 388,290; Libourne, 301,200; Cette, 217,550; Arles, 215,728. The trade of the Mediterranean ports is only one-fifth of the whole, and the whole coasting trade is twice as much as the French foreign trade, and three-quarters of the whole foreign trade.

A fine marble statue of the illustrious Goethe, executed at Milan, by Marchisi, at the expense of three citizens of Frankfort, has arrived in that city, which was the great poet's native place. The statue is to ornament the principal room of the public library.

The *Milan Gazette* gives the following details of the organization of the institutes of sciences, arts, and letters, and the technical schools recently founded at Milan and Venice by the Emperor of Austria:—"The institute at Milan will be composed of three classes of members—ordinary, honorary, and corresponding. The first will be 40 in number, twenty of whom will receive a stipend of 1,200f. per annum each. The object of this institute is to encourage studies which may influence the prosperity of the Lombardo-Venetian provinces by the cultivation of science. All that attend to the improvement of agriculture, the useful arts, and commerce, as well as of letters, will be under its care. It will have to award prizes at Milan and Venice to such Lombardo Venetian subjects as have invented or introduced any new branch of industry, or fresh source of prosperity. The journal *La Biblioteca Italiana* is to be made the *Journal of the Institute*, in which reports of its proceedings are to be regularly inserted. The Academy of the Fine Arts, founded by the Empress Maria Theresa, is henceforth to be subjected to fixed regulations. The professors are to have specific ranks and classes, and to be associated with counsellors, ordinary and extraordinary, honorary members, and artists. It will be endowed with an ample revenue for the distribution of annual prizes. The technical schools are to be established at Milan as well as at Venice. Such youths as are intended for commerce will be taught in the writing, arithmetic up to its highest degrees, the Italian, French, and German languages, history, geography, book-keeping, and the whole system of commerce. Those who are destined for the useful arts and manufactures, will be instructed in physics, natural history, and chemistry, as applicable to the arts. For such as devote themselves to the fine arts, drawing schools are to be established."

The Saxon government are about to construct a theatre at Dresden, upon a scale of magnificence hitherto unequalled, and MM. Semper and de Lüttichaw, of Dresden, have been sent to London, Paris, and Italy, to ascertain what improvements have been made in this department. Mr. Stephenson's machinery is expected to be adopted in this theatre also, Professor Semper having proceeded to Paris to meet Mr. Stephenson, who was in attendance upon the French commission.

Swedish Navy.—Orders have been given to build an armed steam-boat of 100 or 120 horse power, after the drawings of Lieutenant Sommerfeldt, on the model of the Medea, which is acknowledged to be the first armed steam-boat in Europe.

The Russian journals announce that Professor Jacobi, of St. Petersburg, has succeeded in transferring engravings on copper to other plates, formed of a certain composition, by means of a galvanic process, reproducing, with exactitude, the most minute lines. The emperor, it is added, has granted sufficient funds for perfecting this discovery.

Turkish Opera.—The theatre at Pera is building by two French architects, and is to be finished towards the end of next summer. In the mean time, a house has been rented near the place of Atmeidan, where Italian operas are performed three or four times a-week. There is accommodation in this temporary theatre for about 1,600 spectators, and it is said to be always full, notwithstanding the dearness of the prices, which vary from 10f. to 50f. The Sultan has already honoured this place of amusement with his presence. The performers, for the most part, belong to an Italian company who have acted at Odessa. The Prima Donna, a Milanese lady, appears to be making a good thing of it at Constantinople; for, being well skilled in the Turkish language, she is engaged to give instructions in singing in the first Mussulman families of the Turkish capital, and is stated to be carried about to her pupils' residences in a splendid litter, covered with gilding and crimson velvet curtains, and carried by four black slaves, who are preceded or followed by eight others.—*French paper.*

Constantinople Medical School.—On the 10th December, the Sultan visited the new building just terminated at Galata Serai, in Pera, for the Medical School. The establishment is intended to be very complete, as there is a dissecting.room, library, museum, botanical, chemical departments, hospital, and everything necessary for the education of young doctors there. The students are to take up their quarters there shortly after the bairam.

A line of telegraphs is being established at Constantinople; and a successful trial has already been made on the Bosphorus. It is intended to extend to the Dardanelles, and subsequently two more branches will convey intelligence to and from the extremes of the European provinces, whilst others are to lead far into Asia Minor. The best part of them at present is, that they are not expensive.

A letter from Bucharest states, that the project of cutting a canal from the Danube to the Black Sea is to be carried into execution during the spring, by the common consent of England, Austria, and Turkey; and that the last of these powers has issued an order for a levy of 20,000 workmen for this purpose.

Upper Syria.—M. Eusebe de Salle has just returned to Beyrout, from a tour through Upper Syria, as far as the Tamian Chain and the Desert of Palmyra. This country is a species of Syria Petrea. The plains of Antioch of the Turkomans, and the valley of the Orontes, present at every step ruins, sometimes of entire towns, which date either from the most remote antiquity or from the Byzantine period. In the Upper Orontes alone, Prince Puckler Muskau professes to have discovered upwards of ten cities or towns omitted on the most accurate maps. M. de Salle has discovered at least as many between Antioch and Aleppo. The constructions with which he was most struck are Roman camps or redoubts, built probably between the times of Crassus and Trajan, during the wars of the Parthians. These antique piles, which are still remarkable for their solidity, were retouched by the Byzantines, the Turks, the Saracens, and the crusaders, which has no doubt hitherto prevented them from being recognized.

Road to the Red Sea.—We learn by letters from Alexandria, that 800 Europeans crossed the isthmus of Suez last year, on their passage to and from India; and that a regular coach conveyance will be soon established between the shores of the Levant and the nearest points for embarkation on the borders of the Red Sea.—*Bath Guardian.*

ENGINEERING WORKS.

Pure Water.—Four of the Water Companies of the metropolis, viz., the New River, the East Middlesex, West Middlesex, and the Grand Junction intend to apply to Parliament for power to draw their water higher up the Thames, so as to improve its quality.—*Morning Advertiser.*

The Portland ferry bridge has been opened with a grand procession, both of civil and military.

River Lune Navigation.—We find by the *Lancaster Guardian* that a discussion on this important subject is occupying the people there. Mr. Rooke, the author of "Geology as a Science, applied to Engineering," in objecting to the plans adopted by the Messrs. Stevenson, adopts their own data, that the force of the flux of spring-tides in the River Lune exceeds that of the reflux more than two-fold; and then goes on to prove that it is the backwater which is the cause of the setting up, and that instead of shutting out the tidal action, as recommended by Messrs. Stevenson, that it is necessary to allow it greater play. Engineering subjects like this and the Morecambe-Bay subject form the staple material of the local papers in the north-west counties; and while the profession must benefit by this excitement of public interest, so the cause of science is promoted by directing the attention of engineers to the laws of natural action. It is perhaps the misfortune of engineers that whereas in other cases they have only to deal with inert masses, in the construction of harbours they are drawn from their old habits to a new competition with the active forces of nature.

New Docks at Liverpool.—A capacious dock, to be called the Egerton Dock, is being now constructed at the south end of the town, adjoining the Herculaneum Pottery, for the use of the immense and still increasing carrying trade of Lord F. Egerton. The dock trustees also contemplate the enclosure of the strand to the westward of Trentham-street, and the formation of two docks, running east and west, in lieu of the present Salthouse Dock. This central position, adjacent to the New Custom-house, and within a few minutes' walk of the Exchange, will be of immense advantage to the commerce of the port. It appears also, that by removing the present graving docks to the extremities of the town, a further addition of 10 or 12 acres may be obtained to meet the increasing wants of the port, together with a large entrance-basin, in lieu of the present inconvenient old dock gut. The land to the westward of the Salthouse Dock now produces a very trivial rent, being principally occupied by ship-building yards; and by carrying out these bold designs, dock space will be provided for many years to come in the very centre of the town, and the necessity of any further extension will be obviated to the northward, more especially where the difficulty of docking vessels in bad weather is severely felt.—*Liverpool Times.*

Bow Bridge.—On Thursday, the 14th ult., the new bridge erected over the river Lea, at Bow, was opened with ceremony by Mr. Alderman Thomas Wood, the sheriff for Middlesex, and Mr. W. Colten, the sheriff of Essex, attended by a numerous train of the magistrates and gentry of the two counties.

MISCELLANEA.

St. Saviour Southwark.—The demolition of the nave of this ancient collegiate church is about to commence; the old materials have been sold, and directly they are removed, the building of a new church on the site, at an expense of 8,000*l.*, to be connected with the present tower and the choir, in which divine service is now performed, will be proceeded with.

Geology.—A few days ago a tremendous fall of chalk took place at the facing of the rock forming the entrance of the west tunnel through Shakspeare's Cliff. By this fall the geologists have a treat, as the vertebræ of an immense animal has been laid bare, and it is expected that the remaining parts of the skeleton will be found on the removal of the fallen rubbish.

A Sheet of Paper.—There was lately sent from the paper manufactory at Colinton a single sheet of paper weighing 533lb., and upwards of a mile and a half in length; the breadth was only 50 inches. Were a ream of paper composed of similar sheets made, it would weigh 266,500lb., or upwards of 123 tons.—*Scotsman.*

We recommend to the notice of the profession, Mr. Day's, Advertisement, his pencils we have tried, and find the lead to be of a good quality, and may be depended upon as being of one degree of hardness through the whole length of the lead.

Mr. P. Thomson, on Thursday, the 21st ult., obtained leave to bring in a bill to provide for the copyright of designs for articles of manufacture, and a bill for extending the copyright of designs for calico printing to other woven fabrics.

Lace Caps.—A new and important manufacture has lately arisen in the hosiery trade, in making lace caps from the stocking-frame, by the aid of the jack tickler machine. This machine has been latterly applied to the making of laces in breadths, and with such brilliant success as to astonish even the oldest workmen.—*Nottingham Journal.*

Iron Statues.—A correspondent, M. G., suggests that as it is of importance that public statues should be executed of a cheap metal, whether the use of iron might not be contemplated to be preserved from rust by the preparation of the Anti Oxidisation of Metals Company.

Carvings in Wood.—Two very curious and very elaborate carvings, in walnut-tree wood, of the alto-relief class, have just been brought to this country. They were formerly in the possession of the Emperor Napoleon, whose eagerness to possess the rarest gems of art was much more than commensurate with his respect for *meum* and *tuum*. These carvings are each about five or six feet in length, and about three or four in height or width. One of them represents the victory of Constantine over Maxentius. The design is from Julio Romano, and is known to artists. It contains upwards of two hundred figures of combatants, horse and foot, mingled and grouped with great pictorial effect, and carved with extraordinary boldness and accuracy. The finish of the armour, costume, and minute details is very delicate. The second tablet is after a design by Rubens; some of the figures are after Leonardo da Vinci. The subject is the scriptural battle in which Joshua commanded the sun to stand still. This carving is in higher relief than its companion; it contains fewer figures, and most of them are equestrian. It is full of spirit, and cut with great freedom of hand. These carvings, which certainly surpass anything that is generally to be seen in this country, are by an Italian artist, Simon Cognoselli, and bear date 1761. Upon the downfall of Napoleon they were returned to their original locality, the Castle of Salms.—*Gent's. Mag.*

A Great Hurricane.—A severe hurricane has devastated the north-west of Europe. It is supposed to have come from the West Indies across the Atlantic, and spent its chief fury in the Irish sea. Liverpool, Manchester, and Dublin, particularly suffered, and the loss of shipping is very great, besides the damages to public works, parks, and trees. The loss of life in Ireland is said to have been above 200 persons. The hurricane swelled up the waters in the north sea to such an extent, that irregular tides were produced, the coast works of Denmark, Germany, and Holland, severely injured, and the waves of the Elbe forced up into Hamburgh four feet above the level of the Exchange. A remarkable feature is the deposition of sea salt eighty miles inland in Ireland, Lancashire, Cheshire, and Yorkshire.—*Wyld's Monthly Index and Register to the Metropolitan Morning Papers.*

Geological History of last Month.—The principal geological events are presented by the effects of the activity now prevailing in the volcanic basin of the Mediterranean. The eruption of Mount Etna has ceased, but that of Vesuvius continues, and in the early part of the month supplied a great quantity of cinders and lava. Earthquakes have been felt at Edinburgh, Leicester, Berlin, and Malta. Coal has been discovered in Greece.—*Wyld's Monthly Index.*

NEW PATENTS.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 29th JANUARY, AND THE 23rd FEBRUARY, 1839.

Thomas Collette, of Aylesbury, in the county of Buckingham, for "Improvements in Children's Cots."—21st January; 2 months to specify.

Charles James Blasius Williams, of Half-Moon-street, Piccadilly, Esq., M.D., for "Certain Improvements in two-wheel Carriages."—29th January; 6 months.

Robert Carey, of Breadgar, Kent, gentleman, for "Certain Improvements in Paving, or Covering Streets, Roads, or other Ways."—29th January; 6 months.

Frank Hills, of Deptford, Manufacturing Chemist, for "Certain Improvements in the construction of Steam Boilers, and of Locomotive Engines."—29th January; 6 months.

Thomas Barnabas Daft, of Regent-street, gentleman, for "Certain Improvements in Ink-stands, and in Materials and Apparatus for Fastening and Sealing Letters, or other Documents."—2nd February; 6 months.

Moses Poole, of Lincoln's Inn, Gentleman, for "Improvements in the means of conveying and transporting Persons and Goods from one place to another."—4th February; 6 months.

John Evans, of Birmingham, Paper Manufacturer, for "Improvements in the Manufacture of Paper."—4th February; 6 months.

Thomas Robinson, of Wilmington-square, Middlesex, Gentleman, for "Improvements in the process of Rectifying or Preparing Spirituous Liquors in the making of Brandy."—7th February; 6 months.

Christopher Binks, of Newington, Edinburgh, Manufacturing Chemist, for "Certain Improvements in Obtaining or Manufacturing, and in rendering Chlorine, the useful Chlorides of Lime and Soda, and other Compounds of Chlorine applicable in Bleaching."—8th February; 6 months.

Charles Gabriel Baron de Suarce, of Red Lion-square, Middlesex, Colonel in the French service, and William Pontifex, of Shoe-lane, in the city of London, Coppersmith, for "A new mode of obtaining Dyes, Colours, Tannin, and Acids, from vegetable substances."—11th February; 6 months.

George Henry Manton, of Dover-street, Piccadilly, Gun Maker, for "Certain Improvements in Fowling Pieces, and other Fire Arms."—11th February; 6 months.

Edward Pearson Tee, of Barnsley, York, Dyer, for "Improvements in Weaving Linen, and other Fabrics."—11th February; six months.

John Thomas Betts, of Smithfield Bars, Rectifier, for "Improvements in the process of preparing Spirituous Liquors in the making of Brandy."—11th February; 6 months.

Frederick Catley Worsley, of Hollywell-street, Westminster, Esq., for "Certain Improvements in Locomotive Engines and Carriages."—14th February; 6 months.

Richard Prosser, of Birmingham, Civil Engineer, for "Certain Improvements in Apparatus for Generating Steam, Consuming Smoke, and Heating Apartments."—19th February; 6 months.

Moses Poole, of Lincoln's Inn, Gentleman, for "Improvements in Epaulettes and Ornamental Metallic Wire Fringe, and other Ornamental Articles or Fabrics of Wire. A Communication from a Foreigner."—21st February; 6 months.

Johann Andreas Stumpf, of Great Portland-street, Musical Instrument Maker, for "Improvements in Grand and other Pianofortes."—21st February; 6 months.

Matthew Uzielle, of Fenchurch-street, Merchant, for "Improvements in Locks or Fastenings."—21st February; 6 months.

Herbert Reid Williams, of Gloucester, Surgeon, for "Improvements in Trusses and Surgical Bandages."—21st February; 6 months.

Thomas Hall, of Leeds, Brass Founder, for "A New Combination or Arrangement of Parts, forming an Improved Furnace for Consuming Smoke, and Economising Fuel, applicable to Steam-engine Boilers and other Furnaces."—21st February, 6 months.

William Nash, of Budge-row, Merchant, for "Certain Improvements in the Constructions of Bridges, Viaducts, Roofs, and other Parts of Buildings."—23rd February, 6 months.

John Sylvester, of West Bromwich, Stafford, Whitesmith, for "Certain Improvements in the Arrangement and Construction of Apparatus for Hanging and Closing Doors."—21st February; 6 months.

William Johnson, of Saint Mary Cray Paper Mills, Kent, Paper-maker, for "A Certain Improvement, or Certain Improvements, in the Manufacture of Paper"—21st February; 6 months.

William Nash, of Budge-row, Merchant, for "Improvements in Machinery for Winding, Spinning, Doubling, and Throwing Silk and other Fibrous Materials."—23rd February; 6 months.

OBITUARY.

Death of Rudolph Cabanel, Esq., Architect.—On the 4th of February Mr. Cabanel, after a long and severe illness died at his house, Mount-Gardens, at the age of 76. He was a native of Aix-la-Chapelle, but had lived in England since his boyhood. He was the architect of the stage of Old Drury-lane, for he blended with high talents as an architect an ingenious and inventive turn of mind, and an extensive scientific and mechanical knowledge. He was the sole architect of the Coburg Theatre, which, as he left it finished, was acknowledged by the most competent judges at the time to be the most perfectly-constructed theatre in London, or perhaps in England. He was the sole inventor of the roof known by his name, besides a number of machines and other matters of great value. He lived much respected and died much regretted by a numerous and highly respectable circle of friends.—*Morning Advertiser.*

ERRATA.

In our last number, page 35, 1st column, line 2 of 4th paragraph, "polished and gilt." Now the bronze capitals and bases of the columns of the Isaac Church, at St. Petersburg, are *not* gilt, neither have they ever been, or will they be.

Page 37, 1st column, Candidus, describing the Isaac Church at St. Petersburg, says, "The height of the dome is 340 Russian feet, or nearly 400 English ones." We are not prepared to say whether the height be 340 or 400 feet; but Candidus is under a great mistake regarding the value of the Russian foot, which is *identical* with the English foot. We are the more anxious to see this error corrected, as it is as generally as erroneously imagined that the Russian and English foot are different measures, whereas they are *exactly one and the same.*

Page 43, 2nd column, lines 39 and 40, for "level, when," read "level with."

Page 44, 1st column, line 1, for "indicates our," read "indicates the correctness of our."

ADDRESS.

Our readers will perceive, by the cover, that we have this month added another sixpence to the price of the Journal, and they will see, by its contents, that the enlargement of size, and increase of wood engravings, have been proportionate to the additional charge. This measure has been reluctantly forced upon us by the extent of matter which we have hitherto been obliged to reject, and we trust that every one will feel that this has been done less for our own profit than the public advantage. This increase of size we have long resisted, but its necessity has now become so apparent, that, however unwillingly, we have been compelled to submit to its adoption. As we feel convinced, however, that cheapness is most conducive to our own interest and the public convenience, we shall, if the press of matter should diminish after the present season, again reduce the size to its old standard.

For this increase of matter we are principally indebted to the engineers; and though we have every disposition to give equal scope to architecture, we regret that the extent of communications we receive from that branch of our readers, is not correspondent to our desire to do justice to their wishes. We earnestly request from all classes the communication of anything they may deem likely to promote the objects of our Journal; and we are sure they will feel convinced that no want of attention on our part will ever cause them to regret their exertions in its favour. We may, in conclusion, confidently appeal to our past efforts, and the present number, to show that, while we do everything in our power to merit the support of our readers, we have not been inefficient in fulfilling this desire.

TO CORRESPONDENTS.

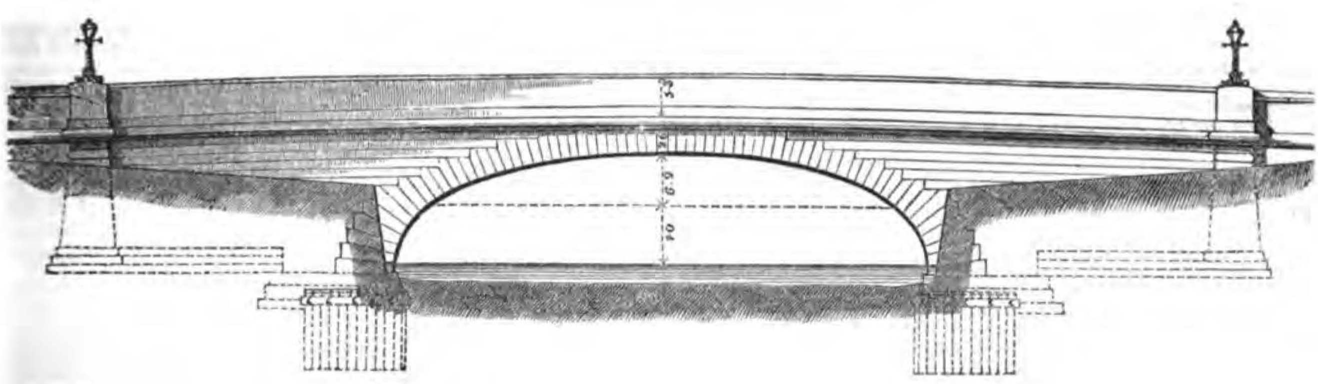
We have just received, as we were going to press, a satirico-poetical effusion from one who signs himself "A Candidate vanquished, but not cast down," of which we can now spare room for no more than the concluding couplet, which is not without some point.

"Hurrah! for brave Nelson, now England may boast,
That in death, as in life, he still sticks to his *post.*"

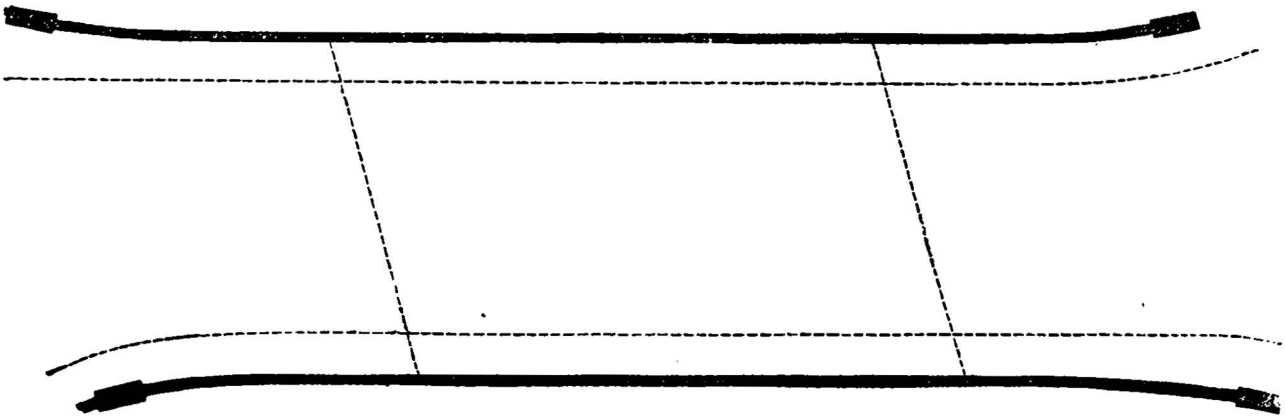
BOW BRIDGE.

ENGINEERS, MESSRS. WALKER AND BURGES.

Elevation of the New Bridge.

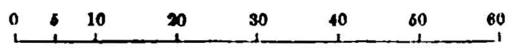


Plan of Roadway.

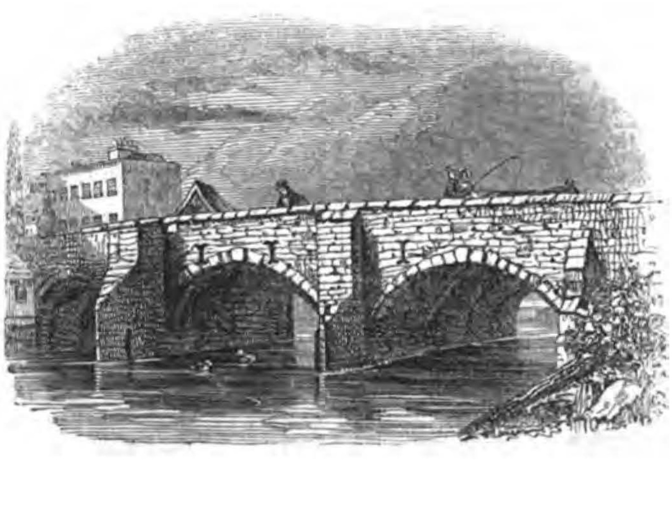


Section of Roadway and Centre of Arch.

Scale of Feet.



View of the Old Bridge.



BOW BRIDGE, AT STRATFORD-LE-BOW, IN ESSEX.

The great and still-increasing traffic between the county of Essex and the metropolis has of late years led to many important improvements in the line of the Great Essex-road, but nothing yet done has been so highly appreciated by the public as the new bridge across the river Lea, at Bow, which is built upon the site of the ancient structure and was opened for traffic last February. Before we proceed to describe the new bridge, we will give some particulars of the old bridge, a view of which is given above, a description of it we extract from an interesting account by Mr. Burges, in the Archæologia, vol. 27, pp. 77 to 95, communicated May 17, 1836.

Of the antiquity of Bow Bridge there can be little doubt, as we have proved from the best authorities that it was erected by order of Matilda, queen of Henry the First, which must have been between the years 1100, when she became queen, and 1118, the year of her death.

If any portion of the present structure can be identified as part of the original edifice, it may be considered, if not the oldest bridge extant, as at all events possessing an age which few other bridges in the kingdom can so satisfactorily trace, the long period of upwards of seven hundred years, and it must consequently be considered as a highly interesting work of antiquity.

In the construction of this bridge, we find all that characterises the very early specimens of bridge architecture; the small openings for the water, and wide piers with large angular projections, not only to divide and throw off the force of the current, but for foot passengers to retire into, to avoid the danger from carriages and horsemen when passing along the narrow roadway.

"That the bridge was originally built of stone can need no further confirmation; but the number of arches it originally consisted of is a question we have now no means of ascertaining, though, in all probability, it never had fewer openings than it has had in our day. Lysons indeed states it be a bridge of one arch, but he does not give his authority; neither have I met with any other writer who has favoured that opinion, or advanced one argument to lead to such a conclusion. That it had at any time more than the present number of arches is uncertain, unless it were furnished with small openings or archways at each end under the causeway for the passage of the land floods; but if there were such, they could not in fairness be considered as forming any part of the bridge. Of such arches, however, I have not been able to discover the slightest remains, either from the excavations made purposely to determine that point, or from any examinations of the bridge itself.

"That the present pointed arches formed no part of the original construction of the bridge must be evident, as no other but a circular arch would have been used at that time; the pointed form of arch not having been introduced into the buildings of this country till many years after. The original arches therefore appear to have been removed, and may probably have given place to several forms of construction, each partaking of the fashion prevalent at the time of their erection. It may also be observed that the form of the present arches is of that particular description which was last of all introduced into our architecture, and is commonly known as the Tudor Arch, from being found in most of the buildings erected in the reigns of the two last Henries, or about the latter end of the 15th century; and it may therefore fairly be stated, that the present arches cannot be older than the date assigned for the introduction of that species of arch, to which they are similar, but have in all probability been erected since that time, as is clearly the case with regard to the arch of the centre opening of the bridge.

"Before closing this account of the bridge, we are led to inquire into the origin of its name, and the circumstances which gave rise to its being called the Bow, or Bow-bridge. Most writers ascribe the derivation to the resemblance of the arch to the form of a bow, then called *de Arcubus*, or the Bows. The description given by Stow, in his annals, goes to state 'the bridge was arched like a bowe, a rare piece of worke, for before that the like had never been seen in England;' and Grose observes, it might derive its appellation from the word *beau*, or handsome, an epithet very likely to be given to it in those days.* * * * *

"The piers for the support of the arches occupy a very large proportion of water-way of the river, and, like many other ancient structures of this description, are placed at an angle with the stream, causing interruption alike to the navigation and to the passage of the flood-waters.

"The width of the bridge was originally only thirteen feet six inches between the parapets, but in the year 1741 it was increased to twenty-one-feet.

"A few years previous to the bridge being widened, an accommodation had been made for foot-passengers, by projecting a wooden platform five feet wide over the piers on the north side; this has lately been rebuilt, at the expense of the two counties, after having been the subject of litigation for two or three years.

"Very little attention appears to have been paid to uniformity in building this bridge, as scarcely any two corresponding points in the structure agree. We find the springing courses upon different levels, and also the elevation of the arches above the surface of the water, besides which the two piers are unlike both in width and length.

"The side arches claim particular notice, from having a centre rib of considerable strength projecting below the line of the arch; a form of construction frequently to be met with in old buildings of this kind.

"The centre arch, which is without any rib, has evidently been rebuilt upon the remains of a former one, probably to meet the demands of an improved navigation, it being in its present state much better adapted for the passage of vessels than if formed after the model of the side ones, as it no doubt was before being altered, for the springing stones still remain.

"At this distant period it is difficult to determine with any degree of certainty the description of stone used in the original construction of the bridge. As in many other ancient buildings erected in this part of the country, Caen stone appears to have been used for arching, some of which still remains, while Kentish rag and Purbeck stone were employed in the inferior parts of the work. The present face of the piers consists of Portland and Kentish stone, laid in courses of various shapes and dimensions.

"Bow Bridge, unlike many of the old English bridges, has no starlings or projections beyond the line of masonry of the piers, which may be accounted for by the shallowness of the river at the spot; at low water, during the summer months, the difficulty of constructing the foundations could not have been great, as they are laid upon a stratum of gravel 3 to 4 feet below the present bed of the river.

"The filling-in of the arches between the face-courses and the centre rib is little better than rubble masonry, the stones of which are both rough and irregular in size, the joints wide, and in several places tiles are employed to wedge the whole together.

"The masonry of the centre arch is of a different character to that already described; the outside face-courses are also in two thicknesses, composed of Kentish rag stone, with a few of Caen stone, which no doubt had been saved from a former arch, while the filling-in between is entirely built of Kentish stone in regular courses very neatly put together, and, as already stated, without any rib or other projection.

"The external face of the bridge above the arches is formed of common rubble masonry, and the interior part over the piers and arches, no doubt filled up nearly to the level of the roadway with chalk or stone built in mortar, the plan generally adopted by the ancient builders in works of this description.

"The masonry of the additional arching, &c. made to the bridge in 1741, consists principally of Purbeck and Portland stone, built in regular courses in a firm and substantial manner."

After many years of unceasing endeavours on the part of the trustees of the road, an act of Parliament was obtained in 1834 for taking down the old structure and building a new bridge. As this was to occupy the same site as the old one, it became necessary to provide a temporary bridge for the public during the erection of the new one, and this was done by the erection of a wooden bridge across the river, near to the same spot, which was opened for traffic July 25th, 1835, and on the same day the old bridge was closed, and in a short time after "not one stone was left upon another" of that once celebrated structure, which Stow relates to have been "a rare piece of worke," at the period when he wrote.

The works of the foundation of the new bridge, on the Essex side, having been sufficiently advanced, the ceremony of laying the first stone took place on the 12th day of December, 1835. The stone was of granite about 5½ tons weight, in which was deposited, in a hollow made for the purpose, a glass bottle, containing a series of new coins, and a brass plate upon which was engraved the following inscription:—

Bow Bridge.

The old bridge over the RIVER LEA, founded on this site by MATILDA QUEEN of HENRY I., having become inadequate for the increased thoroughfare by land and water, and a new bridge to replace the ancient structure having been resolved upon, this first stone was laid on XII December, MDCCCXXXV, by EMMA, the lady of JOHN HENRY PELLY, of Upton, in the County of Essex, Esquire, F.R.S., Deputy Master of the Trinity House, and Chairman of Trustees of the Middlesex and Essex turnpike roads, assisted by the Committee of Trustees appointed to carry into effect the provisions of the Act 4 & 5 William IV., chap. 89, in relation to Bow Bridge.

COMMITTEE.

JOHN HENRY PELLY, ESQ., F.R.S.
Chairman.

The Venerable Achdeacon Jones	James Graves, Esq.
Sir Thomas Barrett Leonard, Bart.	Richard Gregory, Esq.
Robert Westley Hall Dare, Esq., M.P.	Richard Hallett, Esq.
James Bridger, Esq.	John George Hammack, Esq.
Benjamin Brushfield, Esq.	John Hodgson, Esq.
John Burnell, Esq.	John Hubbard, jun., Esq.
John Carstairs, Esq., F.R.S.	William Maiden, Esq.
Nicholas Charrington, Esq.	John Milner, Esq.
William Cotton, Esq., F.R.S.	William Pearce, Esq.
William Davis, Esq.	Joshua Pedley, Esq,
John Drinkald, Esq.	Samuel Taylor, Esq.
George Fox, Esq.	John S. Thompson, Esq.
John Francis, Esq.	Edward Vincent, Esq.
John Hillson Giles, Esq.	

George Dacre, Clerk to the Trust.
James Walker, F.R.S., and Alfred Burges, Engineers.
Samuel Farey, Surveyor to the Trust.
Thomas Curtis, sen., and Thomas Curtis, jun., Builders.

The last stone of the arch was laid Jan. 31, 1838, by the chairman of the trustees, J. H. Pelly, Esq., F.R.S., &c. &c., when a bronze medal of Queen Victoria was deposited in the bed of the stone, inscribed upon the edge with the occasion, date, name, &c. &c.

The bridge was publicly opened on Thursday, Feb. 14th, 1839, by the Sheriff of Essex, William Cotton, Esq., F.R.S., &c., and a retinue of carriages driving from the Essex side, meeting on the centre of the bridge, the Sheriff of Middlesex, Alderman Thomas Wood, accompanied by the chairman of the trustees, and followed by a long retinue of carriages, containing the trustees, the engineers, &c. &c.

The form of the bridge, as shown in fig. 1, is a very flat segment, the rise not being more than three feet, and consists of an oblique arch of an elliptical form, the wing walls extending at each end of the bridge terminated with granite pedestals surmounted by lamp irons.

The following are the principal dimensions of the bridge:—

	ft.	in.
Span of arch, measured on the face	66	0
Span of arch, measured square with the abutment line	64	0
Rise of arch	13	9
Thickness of abutments	15	0
Length of bridge at wings	146	0
Width of bridge in clear of parapet	40	0
Width of carriage way	30	0
Width of each footpath	5	0

The arch stones are 4 feet thick at the springing, and 2 feet 6 inches in the crown.

The contract for the new structure, with the temporary accommodation for the public during the erection of the new bridge, is stated to be about 11,000*l*. The stone used for the external face is blue Aberdeen granite, backed with the masonry of the old structure. The foundations are laid upon a bed of strong gravel several feet below the bed of the river, and a protection of sheet piling is driven in front of the masonry several feet into the solid ground.

It was expected that in excavating the bed of the river, for the foundations of the new bridge, some antiquities would have been discovered, but in fact few articles of any interest were found, and those of trifling value. The most interesting were some brass tokens, two of which are more particularly connected with the subject before us; a few silver coins of little value, some ancient iron keys, with the remains of an iron spear head, nearly comprise the catalogue of all that was found.

We must not omit to notice that in the demolition of the old bridge it was found that the masonry of the arches was not originally covered by gravel, &c., to form a roadway, as it is now usual, but that the carriages and horses went directly upon the stone-work of the arches, and that ruts of the wheels had been worn in places to a depth of nine inches, and holes were worn through, evidently made by the tread of the horses.

ISOLATED HARBOURS OF REFUGE—EXAMPLES OF NATURAL FORMATION,

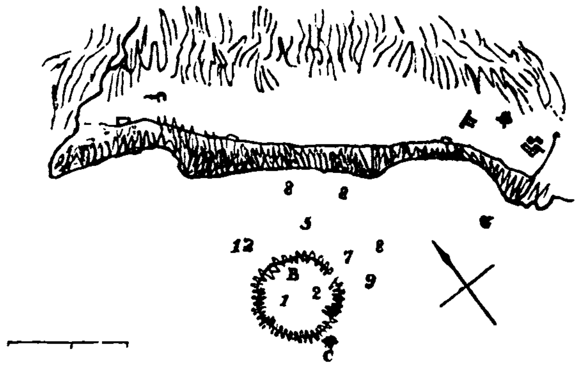
BY HYDE CLARKE, ESQ., C. E.

As I have strongly advocated, and I believe introduced, the principle of insulation as applied to harbours, it is not unnatural that I should take some interest in that of isolation, which is certainly one of the most important principles which has lately been elucidated. Its author, Mr. Tait, may congratulate himself on the acknowledgement of its merits which it has so generally received, and I shall be happy if the few remarks I now contribute should afford any additional reason for its support.

It is certainly augural of the advancement of harbour engineering, that instead of plans being merely confined to local circumstances, so much attention is now being devoted to the illustration of general principles; which, however, can only be drawn from nature. The importance of philosophical instruction to the engineer is powerfully inculcated when we see the manner in which objects, apparently so remote, are brought to bear upon our immediate pursuits. It is true, indeed, that this is a principle of philosophy, but it is one, the importance of which does not seem always to be recognised, although it should be remembered that even the abstract sciences are derived from the observation of natural phenomena, and that the laws of mechanics are equally developed in the motions of the heavenly bodies, as in the construction of the animal and vegetable kingdoms. The face of nature is, in fact, the great book of truth, written by an unerring hand; and it is upon the precepts there taught that equally in science, literature, and art, all excellence depends.

Mr. Tait has, indeed, informed me that it was from the Isle of Wight that he partially conceived the idea of his own plan, and upon that basis Mr. Rooke has also founded his modifications. To shew, however, that this is not an individual example, but part of a general rule, I now present some instances of natural isolated harbours, which, while they support the principle advocated by my two philosophical friends, may throw some inductive light upon the probable result of future operations.

Fig. 1.



PORTO DO ILHEO.

The figure B here inserted is the representation of an isolated harbour in active operation. It is called Porto do Ilheo, and is situated in the island of St. Michael's, one of the Azores, opposite the town of Villa Franca, and not above six miles from that of Ponte Delgada, one of the most important shipping places for the fruit and wine trade. From the nature of the basin it may be readily referred to a volcanic formation, and this is supported by its general configuration, as much as by its situation with deep soundings around it. It has all the appearance of an extinct crater; consisting of a wall of rock rising in most places 30 to 50 feet high, with a hollow centre, and an opening on one side. As nearly as I can recollect, it is about a quarter or half a mile across, and at low water has, in the centre, from eight to ten feet water, with a sheeting of mud covering the bottom. The mouth is to the north-east, of course opposite to the prevailing winds, and it is the only place in the islands which is sheltered against the westerly winds, but it is unprotected in the south-east when a heavy swell runs in its neighbourhood. The island is often used for careening, and it is the general place of refuge in westerly winds for the vessels from Ponte Delgada, which run here until the fury of the storm is abated, and lie without a wave to ruffle them, except that sometimes there is a dash of spray through a break in the west wall. Its importance was impressed upon me at the time I was engaged with the Atlantic Steam Navigation Company, the first which was brought forward in 1836, when my plan was to have used the Azores as a central station for communication to North and South America and the West Indies. The use of this island as a depot was strongly enforced upon me by a merchant captain well acquainted with it, and I proposed to have had it deepened and an entrance made, accessible at all times of tide.

All such cases, it must be remarked, are of volcanic formation, and the entrance is almost uniformly found opposed to the prevailing winds. No satisfactory account of the cause of this has, however, been given, and the reasons assigned by Lyell are far from clear or convincing. In the recess called Rowley Shoal, off the north-west coast of Australia, however, as described by Captain King, in Lyell's Geology,* where the east and west monsoons prevail alternately, the open side of one crescent-shaped recess, the Imperieuse, was turned to the east, and of another, the Mermaid, to the west.

In the Yellow Sea there is a remarkable horse-shoe volcanic harbour, mentioned in Macartney's Voyage to China, and the Chagos Isles in the Indian Ocean, described by Horsburgh, which have their openings to the north-west, are most important to navigators. These harbours are well known for their security, and ships can enter and depart with ease.

The Coral Islands, in Polynesia, are nearly all of this horse-shoe formation, so that of thirty-two examined by Captain Beechey (†), twenty-nine had lagoons in the centre, the land being merely a narrow ring. Some of these lagoons were as deep as thirty-eight fathoms, and the largest was thirty miles in diameter.

The following cuts represent a view of Whitsunday Island and a section.

* Vol. II., p. 233.

† Beechey's Voyages, Part I.

Fig. 2.—View of Whitsunday Island.

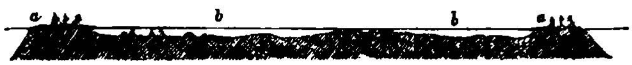


Fig. 3.—Section of Whitsunday Island.

The channel leading from the sea into the lagoon is nearly always a deep narrow passage, which is kept open by the efflux of the sea at low tides. Lyell observes, that it is sufficient that a reef should rise a few feet above low water mark to cause the waters to collect in the lagoon at high tide, and when the sea falls, to rush out violently at one or more points. This, he remarks, is strictly analogous to that witnessed in our estuaries, (where a body of salt water accumulated during the flow,) issues with great velocity at the ebb of the tide, and scours out or keeps open a deep passage.

We see from these extended examples that Mr. Tait's principle is one that is neither unsanctioned by example nor useless in its results, although in the present state of science we have not perhaps the opportunity of carrying it out artificially upon the great scale which is exhibited to us by nature. The force of volcanic action, which can elevate reefs from the depth of the ocean, our greatest steam power cannot imitate; but the day may perhaps come when we may be able to employ this agent with the same ease that we do the strength of the ocean.

CURTIS'S RAILWAY IMPROVEMENTS.

We have before had the pleasure of recording several of Mr. Curtis's railway improvements, and we now add two others, well deserving the serious attention of all railway companies, for arresting those awful accidents, "collisions of trains," which, we are sorry to say, we see too often recorded in the daily papers to the injury of railways. We consider both contrivances admirably well adapted for the purposes intended by the ingenious inventor; they form part of several other improvements for which Mr. Curtis has recently received her Majesty's letters patent. In our next number we shall give some particulars of his other inventions. The following descriptions we extract from the specification of the patentee:—

A Break or Carriage for arresting the Progress of an Engine or Carriage, and which may also be applied for clearing the Line of impediments placed or lying upon it.—The best form of this brake is shown in fig. 1, 2, and 3; fig. 1 is a side view, and fig. 2 an end view of the same, it may be placed either in front as shown, or behind the engine or carriage; but I prefer the front of the engine, because it is made then to act as a means of clearing the line as above stated.

A shaft, F, is placed across the framing of the engine, and upon this shaft are fixed the two legs or levers, C C, and to the lower ends of the levers are attached the shoes, E. E., by the pins of the connecting rod, G., but in cases where the connecting rod, G., would not clear the timbering of the bridges of the line it may be omitted and the joints made by pins only; the cross-bars may be either omitted or placed higher on the parallel rods, D D, used to keep the lower surfaces of the shoes parallel with the rails, and to give them a certain degree of steadiness; the shoe is formed either of wrought or cast iron, or of timber shod with iron, with a flange upon its inner edge to correspond with the flanges of the wheels; the back end is formed to the curve of the contiguous wheel, so that where it is in gear it impinges against it, and the flange of the wheel enters the grooves formed in the shoe, and thus very materially adds to the stability of the apparatus. The groove is shown clearly in figure 3, which shows the upper plan of the shoe, and fig. 4 the under side of the same. A rubbing piece of wrought iron or other metal may be introduced into the under side of the shoe, and secured by rivets or other means, which can be renewed as it becomes worn out by the friction of the rails when in contact with them. A crank is fastened upon one end of the cross-shaft, F, to which is connected the rod, B; the other end of this rod is connected with the lever A, working upon a pivot, by which the engineer can work the brake as circumstances may require; the cross-shaft is connected by the carriage to the frame in the usual way, and the pin makes likewise the connexion of the parallel rod, D, at its upper end, and the pin at its lower end; the lever may be substituted by a screw, which may be made to act in a line with the connecting rod, B, for the purpose of working the apparatus, or any other fit and suitable leverage may be adopted. When the engineer observes anything upon the line he is desirous to remove with the brake, he depresses the shoes to within a very short distance of the rail, which distance may be denoted by a stop placed upon an arched segment, against which the lever, A, may work, or by any of the usual means for the same purpose, and when he is desirous to stop the engine he causes the brake to come into contact with the rails by moving the lever, A, further forwards, and if to stop the engine as short as possible, the lever is thrown forward until it occupies the place shown by the dotted lines, when the apparatus assumes the position also shown by the dotted lines in figure 1, the effect of which is to raise the engine a space equal to that included between the black and dotted lines.

The force required on the part of the engineer to produce this effect is very trifling, because the momentum of the engine forces the shoe into gear as soon as it is brought firmly into contact with the rails; the springs, by their re-action, still keep the wheels upon the rails, but the weight being transferred for the most part to the brake, the tractive power of the driving wheels is very much reduced, at the same time such an extensive rubbing surface is brought into action that it will be sufficient to bring the engine to a dead stop although the steam may not be shut off. It is evident by examining the figures that any degree of retardation may be produced between that necessary to bring up the engine and that slightly to check its velocity, as in descending inclined planes and by moving the lever more or less forward, and the leverage must be also sufficiently powerful of whatever kind it may be formed, so that the shoes may be drawn out of gear without stopping the engine.

An Apparatus to prevent Collisions between Trains on the same Line of Rails.—This apparatus is shown in figures 5 and 6. Figure 5 is a side view of the apparatus and an engine in contact with it, attached to the last carriage of a train, and figure 6 is a plan of the same.

The sledge or retarder, A, is formed like a wedge, with its superior end turned up upon the inner side; flanges are formed, so as keep it upon the rails, the two sides are united together by the cross-bar, J, the plate, K, and the cross pieces, G G, and the sides are set to the same gauge as the rails, so that an engine may run upon it without difficulty to the cross-bar, J; two buffers, D D, are fixed, which correspond with other buffers, I, formed upon the front frame of the engine, so that when the engine comes in contact with the retarder these buffers receive the concussion; the plate K is used, in order to unite the sledge as near to the point as possible, and still to allow a free passage to the flanges of the wheels; to the cross pieces G G, the spring pieces, B B, are fixed, which form shafts for the wheels C C, upon which the apparatus is carried when out of gear; E is a counter-balance weight to counterpoise the weight of the sledge, so that a man can move it along the line, like a truck, with great facility; the coupling F is formed for the purpose of connecting the sledge with the train in the usual way, by means of a joint and pin.

The retarder or apparatus, when out of action, and connected with a train, is attached to the last carriage, as shown at L; then the sledge rides above the rails, and is suspended by the spring pieces B B; but should an accident happen which would stop the train, one of the conductors immediately detaches the retarder, and runs back with it, and places it 500 or 600 yards behind the broken-down train; then, should not the engineer of the following train observe the train before him, and stop his engine, the engine would run into the retarder, and would become a sledge; the driving wheels, if not stopped by the great resistance which would now be opposed to them, would skid round in the retarder, and would have no power to move forwards. No violent concussion would take place, but the engine would slide along a certain short distance in the retarder when the train would be brought to a stand-still; a hanging frame, K, must be formed from the engine frame, and the buffers usually placed upon the head board transferred to the lower frames, or other buffers I, placed there. As I do not consider it would be the best plan to make the superior end of the retarder, A, so high as to meet the buffers placed on the head board in the usual manner, the flange of the sledge A may be either continued all along, as drawn, or may be made in detached pieces at certain intervals in the length, as may be found the best. In the case of a swift train overtaking a slow one in a fog or at night, the swift engine would run into the retarder, and the same effect upon the engine and train would be produced as before stated—viz., that it would be brought to a stand, and the only effect produced to the slow train, behind which the retarder was travelling, would be, that it would be torn away from its fastenings; for the purpose, therefore, of meeting a case of this nature, it will be advisable to make the fastenings such, that it may be torn away without the last carriage being subjected to any violent shock, with this view the pin at F may be of oak, or hard wood strong enough to drag the retarder, but sufficiently weak to give way in the case mentioned.

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

A BREAK FOR ARRESTING THE PROGRESS OF AN ENGINE OR CARRIAGE.

Fig. 1, Side View.

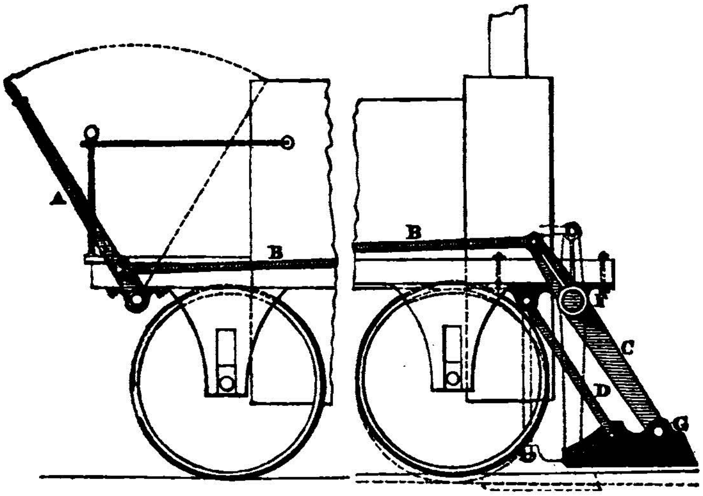


Fig. 2, End View.

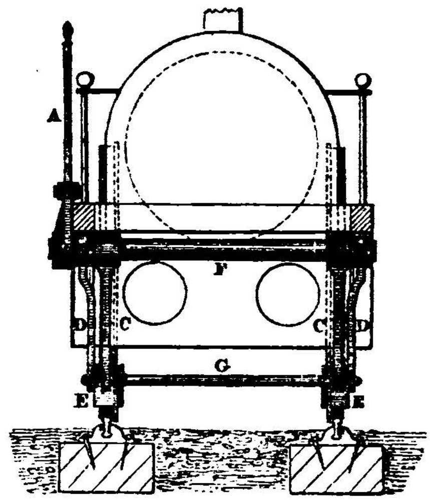


Fig. 3, Top of Shoe.

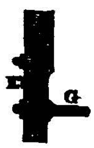


Fig. 4, Underside of Shoe.

AN APPARATUS TO PREVENT COLLISION BETWEEN TRAINS ON RAILWAYS.

Fig. 5, Side View of Apparatus.

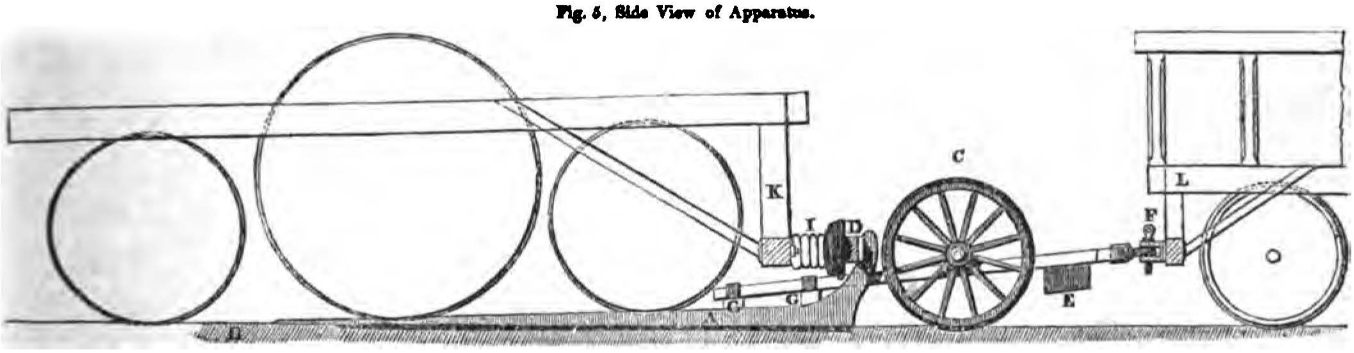
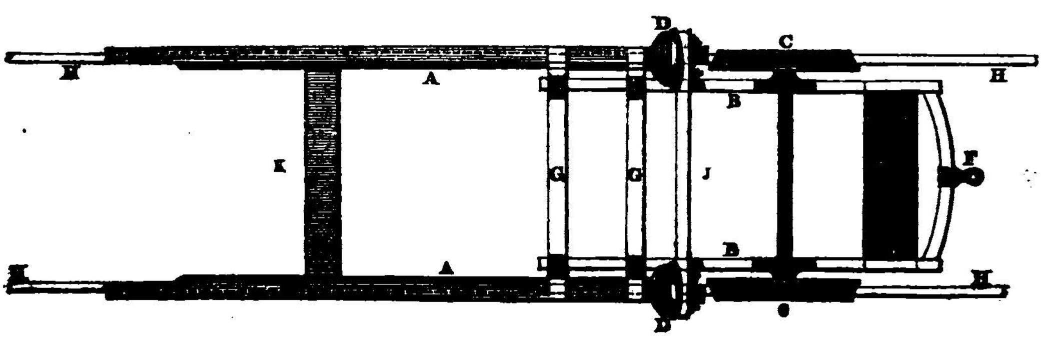


Fig. 6, Plan of Apparatus.



CIVIL ENGINEERING EDUCATION AND REWARDS.

In our last volume, p. 369, we were induced, under this title, to give an answer to the many fallacies which were then afloat on these subjects, and particularly to the misrepresentations of writers in the *Times* and *Athenæum*, by refuting the theories founded on the Polytechnic School. Not one of our arguments has been contradicted, and in no other periodical has any reply been attempted. The article has created some sensation, and we should not have recurred to the subject, having, in our own opinion, said enough to settle the question; but we have received so many letters respecting it, that out of deference to our correspondents we cannot avoid resuming it.

We particularly objected to the notion that engineering education could be taught only in schools, and expressed our conviction of the impolicy of separating it from the present system of practical instruction in the offices of engineers. We have thus unwittingly knocked on the head the favourite crotchet of some of these writers, and we have received a volley of letters in abuse of our arguments, but not in refutation. The following takes a higher stand, and out of respect for the writer, we give it at length, curtailed only of an exordium giving a long definition of criticism:—

Sir,—I cannot refrain from expressing both surprise and regret at finding, in more places than one of the "Civil Engineer and Architects' Journal," an attempt to show that engineering instruction is either unnecessary in this country, or that it is sufficiently provided for. Both assertions are equally erroneous. I need only advert to numerous instances of failure in engineering works, too well known and too severely felt by the parties concerned in them, to show how absolutely inadequate is the knowledge of our civil engineers generally, and how necessary it is that those who intend following that important career be adequately instructed; and I need only observe that the faculties established at Durham, and in University and King's College, are, though eminently useful, but secondary objects in those establishments, to show that engineering instruction is very far from being sufficiently provided for in this country. I am not one of those who are disposed to see everything good that is done abroad, and everything bad that is done at home; but equally do I deprecate that erroneous and narrow-minded prejudice which sees perfection in all that is English, merely because it is so, and can find nothing but sneers and ridicule for the finest establishments of other countries, because they are not English. The man who would endeavour to ridicule the Polytechnic School of France, must be the veriest—but no, as Peter Pindar has it, "at calling names I never was a dab."

I will not make invidious comparisons; I will argue the point of engineering education on other grounds. It has been said, that "the English student derives his knowledge from private study in books, and not by oral instruction from professors." I confess I had yet to learn that our English youth were so passionately fond of study as to require no teaching. It is elsewhere said, "if science were only to be gained from the dictates of professors, we should indeed be in a state of mental degradation;" and pray, I would ask, what are the books from the private study of which our youths are to become such perfect adepts, but the dictates of professors? Has the writer of such senseless sentences received no benefit in his lifetime from oral instruction? If so, he must either be very ignorant or a natural prodigy.

In the article on civil engineering education, to which I allude, there is a flaming paragraph setting forth our superior excellence in all things, which, as having nothing to do with the point in question, would have been much better omitted; to praise ourselves is fulsome and undignified. The writer goes on to state, "To whatever department we direct our search, it will not be very easy to find any symptoms of inferiority in the working of our present system." Indeed! It is easy to see the writer has had none of his capital engaged in the thousand and one speculations which have failed for sheer want of the very first elements of scientific knowledge. Again the writer falls into a comparison between France and England, in which, according to him, France has few or no great works. Were we so disposed, we could presently show him his very egregious mistake. Nay, let alone France, we could point out in other countries, countries we are disposed to despise as barbarous, works equal in beauty, magnitude, scientific combination, and practical skill, to anything we can boast; but we repeat it, we will institute no comparisons.

That we have many, very many magnificent works no one can or will attempt to deny; but what does this prove? That if we have been able to effect so much without the aid of special scientific knowledge, we may fairly hope to achieve the greatest things if a proper system of instruction be introduced.

Will any man be bold enough to say that the payment of a 1000*l.* to some celebrated engineer or architect, and that five or seven years "copying and transcribing in an office" are sufficient to qualify a young man to become a civil engineer? I appeal to the writer of a paper in the "Civil Engineer and Architect's Journal," page 159, vol. I.; I appeal to every man of common sense. Is any one absurd enough to imagine that an engineer or an architect of first rate eminence, whose every moment is employed in his professional duties, can by any possibility devote any portion of his time to the instruction of the pupils placed under him? or is any man disposed to think himself unfairly treated because such instruction is not given to his son? Is it not an acknowledged thing, a tacit understanding between parties, that the 1000*l.* paid to Mr. A. or Mr. B. is solely for the privilege of saying my son was in Mr. A.'s or Mr. B.'s office, and nothing more.

But will any one be so doggedly ridiculous as to maintain that such a system is all-sufficient for the education of our civil engineers, and that too at a moment when the amazing increase of industry calls loudly for a whole host of fully competent engineers?

The English mechanic, it is said, "has no Ecole Royale to frequent, and no Conservatoire des Arts et Metiers in which to exhibit his performances, but he can study in his own house, has his own periodicals, can learn from his brother workmen, and frequent a Mechanic's Institute in every town, while he has the free-born spirit of the English race to direct him, and the statue of Watt to remind him how his fellow countrymen can appreciate his labours." To call this anything but ridiculous bombast would be to misname it.

If the English mechanic has not the various advantages above stated, so much the worse, so much the greater shame to this rich and industrious country. As for the mechanic's study in his own house, it amounts to very little at most, and instruction from periodicals to still less. His brother workmen, with a few honourable exceptions, are little disposed to teach him anything but the way to the gin-palace, and nine times out of ten he understands not one word of the lectures given at the so-called mechanics' institutes; and as for his free-born spirit, it directs him in too many cases, alas! to little else than to rail at all above him, and at the institutions of his country. Finally, as for the statue of Watt, I would like to know how many have seen it, and how many from the contemplation of it have risen in their career.

But now come we to the point. Hitherto we have been told that instruction, other than private reading of books, is useless; that without any systematic education we have done wonders; but now we have a recommendation of the course proposed by the English colleges, and, despite the ridicule just thrown upon oral instruction, we are now told that "the practice of the students attending philosophical lectures will prove an important help to their professional education, while we are to deprecate any attempt wholly to educate them, whether in an English academy, or the Ecole Polytechnique itself, which might turn out a very good surveyor's hack, but which would not be very likely to produce a Smeaton, a Brindley, or a Watt."

Now, Sir, I would ask—not to advert to the preposterous idea that the instruction of such men as Monge, Biot, Francœur, Hatchett, La Place, Legendre, La Croix, Prony, Hassenfratz, Fourcroy, Berthollet, Chaptal, Gay Lussac, Thenard, &c. &c., can only turn out surveyors' hacks—what, I would ask, is all this but the puff direct of the classes of civil engineering lately established in some of the English colleges? —the puff exclusive—the puff ridiculous, inasmuch as contradictory of what was before advanced—the puff mischievous, as it deprecates the only means by which solid instruction can be given in civil engineering —viz., special tuition in an establishment organised solely for the purpose of creating efficient engineers. None can see with greater pleasure than ourselves, that attention is being directed to the necessity of particular instruction in civil engineering. The establishment of the classes alluded to, sufficiently disproves the assertion with which the writer of the article we are commenting sets out. Too long, indeed, have we been guided by dear-bought experience and expensive blind experimentalizing. It is high time that theory, which is nothing more than the results of the best practice, methodised and reduced to axioms, be combined with practical operations to enlighten them, while practice, in its turn, points out the possibility of fresh improvements, with this advantage, that by a knowledge of scientific truths they are founded on certain principles, and are not derived from vague and indefinite conceptions.

Indeed, the necessity for scientific knowledge is forcibly pointed out in an article headed "Mining and Mines," in the "Civil Engineer and Architect's Journal," p. 419, vol. I; and what is essential to miners must be still more so to the civil engineer; for mining is but a part—a section—of the attributions of the civil engineer, whose profession extends from the laying down of a gaspipe to the construction of a jetty; from the fixing of a crane to the construction of a locomotive engine; from the paving of a court-yard to the construction of a railway; from the tracing of a drain to the connexion of seas by a canal; from the building of a porter's lodge to the erection of the most extensive manufactory; from the draining of a cellar to the draining of a country or of a mine. His knowledge must be general as his labours are multifarious. Of minerals, metals, and vegetable substances, he must know both the nature and the use; the chemical and physical properties and actions of bodies, he must be intimate with. He has to employ forces of every kind, and must hold them under his control, which he can only do by thoroughly understanding them. In a word, his knowledge must not only be general, but perfect, as ignorance in any one correlative object paralyzes or counteracts the effects of his knowledge in the rest. Can this be denied? and will any one, in the face of such truths, maintain that science is unnecessary to the civil engineer, or that it is amply provided for among us? The preface of the "Civil Engineer and Architect's Journal" contains an enumeration of several establishments as teaching civil engineering. In every one of these, certain branches of engineering knowledge may be taught: indeed, it is hardly possible to teach anything with which the civil engineer should not be acquainted, but we have no such thing as special schools for civil engineers. Particular classes are highly useful, no doubt, as auxiliaries, and we are happy to see them established; but to say that they are sufficient, or that more adequate knowledge is likely to result from such unconnected, and, therefore, imperfect studies, than from a regular course in an establishment where all the elements of a good engineering education are combined, where all the efforts tend to the one main point desired, would be to say an absurdity too palpable to be for a moment dwelt upon.

In conclusion, sir, I will merely observe, that engineering education is, with us, wofully deficient; that, at no period was it ever more loudly called for; and that, judging by what has been effected without it, we may fairly anticipate incalculable benefits when proper scientific instruction shall guide our practical skill. Let schools, then, be established, and let us not, to favour any particular interests, dissuade the public from a "consummation so devoutly to be wished," as the establishment of special schools for civil engineering.

I am Sir, yours, &c.. * * *

We pass over the reflections in the above letter on ourselves, for we feel conscious of having done our duty to the profession, and the *magis amicus* truth; as to any assertions of venality, it is unnecessary to protest against them when our venal arguments remain unanswered; but we can assure the writer that we are neither shareholders in the universities, nor interested in the professors' fees, and that, still more, we are not on the look out for a berth in any college, to be or not to be.

We are next assured that the man who would endeavour to ridicule the Polytechnic School must be the veriest, (*magnus hic deflendus hiatus*,) but no! as Peter Pindar has it, "at calling names, I never was a dab." Now, we never ridiculed the Polytechnic School at all, although we are not aware what sacred protection it should have in the eyes of Englishmen. Then it is asked—what are the books from the private study of which our youths are to become such perfect adepts, but the dictates of professors? We never said that they were not, or that the dictates of a professor on proper subjects were not of use, but we feel indebted to our correspondent for this argument in favour of the use of books. By and bye he assures us, that he can negative our comparison of the inferiority of French public works, and hints something about a barbarous nation. We can only assure him that we should willingly have received the refutation, and paid equal attention to it. We next learn an important fact, that engineers' pupils are not expected to learn anything, but only to pay their money. The writer then introduces a political declamation against our English mechanics, which every man of experience can contradict, and in reply to which we can do no better than recommend him to study that amusing work, "Hints to Mechanics," by Mr. Claxton. We never said that instruction, other than the private reading of books, was useless and consequently need not advert to such a gratuitous assumption. We have read with due attention the long muster-roll of names, almost equalling the enumeration of Homer, and we give full credit for the industry in assembling all the names of professors, living or dead, that could be found; the names are very good, certainly, and include many eminent chemists, mathematicians, astronomers, philosophers, &c., but we should like to know how many engineers? We can find plenty of colleges in England to furnish a list of well-known names, but we do not see what that has to do with engineering. The writer then falls into a farther mistake, when telling us that special tuition must be given in an establishment organised solely for the purpose, he instances the Polytechnic school, believing that it is entirely devoted to civil engineering. By referring to our first article he will, however, see that it is no such thing. The concluding definition is also rather loose; it informs us that duties of civil engineers are to construct locomotive engines and build porters' lodges, and manufactories. We always thought that such things belonged to the practical engineer and the architect.

We shall now enter into a farther consideration of the subject, and shall first endeavour to ascertain how far the nature of the profession of a civil engineer influences his education. It appears to us that the course pursued in one profession does not necessarily involve its application in another, but that each requires a system adapted to its peculiar pursuits. If we correctly understand the question, civil engineering is essentially a profession of genius, having to deal with many new and unforeseen cases, and that as decidedly as any branch of the fine arts; it is therein distinct from law and medicine, which are principally systems of the application of old processes. No one by force of genius could become a lawyer, and it would be very difficult in the same way to obtain a qualification for the practice of medicine, although the study of physiology affords opportunities for the exercise of the exercise of the higher faculties of the mind. Genius we consider to be the ground-work of civil engineering, and the means of carrying out designs are derived from general philosophical studies and the use of technical processes. All these are intimately enwoven togetner, in the same manner as in painting. Genius must be united with the mechanical handling of instruments; as in architecture the conception must equally be instructed to be carried out in the treatment of style and its adaptation in construction.

For the attainment of this practical instruction we imagine no man of sound judgment would prefer a school to an engineer's office, while to engraft education upon a theoretical instead of a practical basis, or to consider practice as merely the handmaid of theory, instead of its parent, would be undoubtedly to destroy all the advantages which we now so eminently enjoy. It is an error among pedants to substitute theory as superior to practice, instead of remembering that theory is only a classification of the results deduced from it, and that practice in engineering holds the same rank with regard to theory as the observation of phenomena does in philosophy. It would be a similar error in politics to consider laws as existing before the population from which they arose, and it is from one of these pedantic conceits, in supplanting language by grammar, that the study of literature is so much thwarted in modern education. Theory, like practice, properly speaking, is only the representation of one faculty of the mind, and does not constitute the whole; practice resembles perception, and theory is an extension of the power of abstraction and generalization.

As to the instruction in theory, it must be remembered that facilities exist in England in the shape of private teachers and scientific institutions, which the system of universitary police does not allow in France and other parts of the continent. There, consequently, theoretical instructions must be given wholly in public establishments, or it is difficult to introduce it as an accessory to practical studies. The way in which we look upon the collegiate classes in England, is only as they resemble and supply the place of that system of instruction which already exists, being rendered subsidiary to the general course of education.

To show that the views which we entertain, however erroneous, are not without some support from other members of the profession, we shall refer to the view entertained by the Institution of Civil Engineers. In their regulation for the admission of candidates, they expressly recognise the force of native genius, "which commenced the profession with a Brindley and a Smeaton, and was in our own time exemplified by a Rennie and a Telford." They proceed upon the basis of considering practical instruction as the groundwork of the profession, and require from candidates that they should either have served the usual time of pupilage, and then had subsequent employment for five years, or else that they should have practised on their own account for five years, and have acquired considerable eminence. What great names would English architecture be able to produce, had they excluded Wren, Aldrich, Vanburgh, and so many others? Where would the arts have been without those names which have sprung from the ranks of genius, a higher school than all the academies which were ever founded? Schools are limited, and genius is widely dispersed; so that the more you restrict your boundaries, the less chance you have of acquiring great men, and the greater certainty you have of falling into that general decay which the mannerism of schools and restricted competition produce.

The present proposals of giving a preference to theoretical instruction are peculiarly ill-timed, when it has been so strongly felt in other cases that a greater attention to practice was the only sure guide to eminence. It is well known that the medical world are strongly inclined to abolish the unnecessary distinction between physician and surgeon; and that they are more than ever convinced of the importance of the preparatory instruction acquired in apprenticeship. As to the idea of making civil engineers in colleges, it is one of the most preposterous which ever entered the head of a theorist. We know what has been the success of attempting this system in the fine arts, and we can see what a plentiful crop of daubing mannerists it has produced. We may thus form some idea of what would be its result among the civil engineers; there would be no lack of them, certainly, but there would doubtless be a terrible deficiency of talent and a great abundance of mediocrity. There is one defect attendant upon collegiate education, which has done that to damp the energies of students which no other exertions have been able to remedy. Collegiate instruction soon becomes so expensive as to come only within the range of a certain class; and while the selection is thus limited, the effect on the students is, that often possessing a competence, they have no other ambition than to pass through their course with as little trouble as possible. It must be conceded, on the other hand, that collegiate instruction effects a considerable saving in time; but it should be remembered, that self-study, like a mechanical power, makes up in strength for what is lost in time. Even in professions where knowledge is communicated by lectures, the benefit of individual instruction begins to be appreciated, and in the opening speech, last session, of the Dean of the Medical Faculty, at King's College, he strongly recommended this course to be adopted. The idea of teaching civil engineering solely in colleges we cannot but look upon as absurd, and we know no means of expressing our views more strongly than by repeating the words we used in the preface to our last volume.

"The system of teaching by lectures, it has been found by experience, cannot successfully inculcate every thing; and while it has been abandoned at our older universities, in medical studies it is accompanied by demonstrations and clinical instructions, such as can never be applicable to mines or engineering. We can have no dead railways to dissect, no prepared veins and lodes to illustrate; and although construction may be partially learned from models, yet it is in the open field of practice that its application must be acquired."

MEMOIR RELATIVE TO THE COURSE OF THE SHINGLE ON THE COASTS OF SUSSEX AND KENT, AND THE LAWS BY WHICH IT IS GOVERNED.

By J. H. Williams, Lieut. Colonel, Royal Engineers.

1. The general bearing of the coast from Beachy Head to the South Foreland, is from W.S.W. ½ south, to E.N.E. ½ north, by compass.

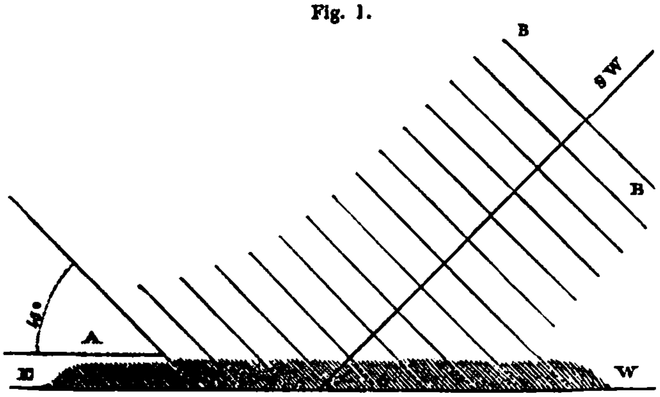
2. Shingle of a similar kind, produced by constant detrition of the Beachy Head Cliffs, and augmented by detritus from the Kentish Cliffs, is found in large quantities all along the shore from Beachy Head to the South Foreland.

3. It is ordinarily drifted along the shore from the westward to the eastward, though subject to occasional interruptions.

4. Wind and wave are the principal propelling powers. The latter closely follows the course of the former, though at times deflected somewhat more southerly; and a light air and undulation are sufficient to carry the shingle in an opposite direction to a strong tide.

5. The shingle is invariably borne along in the direction of the acute angle, which the waves form with the shore; and the drift is more or less rapid, in proportion to the strength and direction of the wind, and the height and velocity of the tide.

Fig. 1.



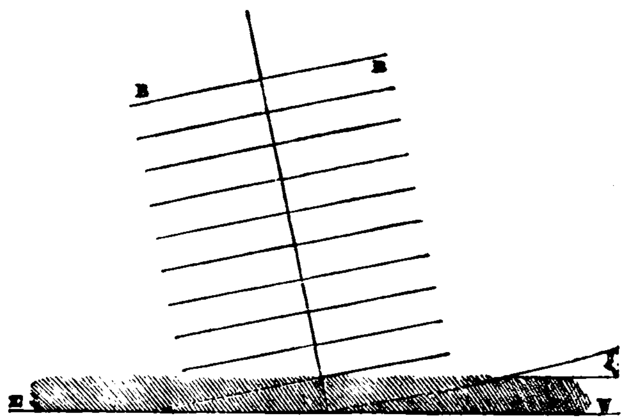
The Shingle borne to the Eastward.
A, Angle of Wave, 45°. BB, Line of Wave.

6. The easterly and wonted course of the shingle is the effect of the great prevalence of westerly winds in the English Channel. The quantity put in motion, and the rate at which it is borne along, are greatest on the Hastings shore, in a gale from the south-west, accompanied by a spring tide, when the wind and sea impinge on the shore, at an angle of about forty-five degrees (see fig. 1).

7. When the wind blows from the eastward of south, a motion of the shingle to the westward is speedily perceptible, and in a gale from the south-east considerable quantities are moved in a westerly direction.

Fig. 2.

S. by E



The Shingle borne to the Westward.
BB, Line of Wave.

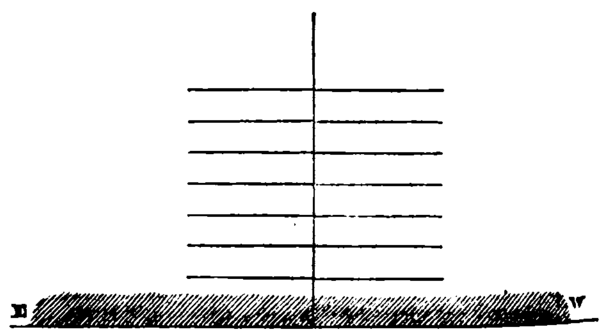
8. When the wind sets directly on or off the land, the shingle is quickly laid in ridges parallel to the shore, and there is no indication of any drift of shingle along shore at such times. The truth of this view of the subject will scarcely be doubted by any one who will carefully watch the action of the shingle about a groin perpendicular to the line of shore.

9. The foregoing data clearly prove that the motion of the shingle is strictly governed by the direction of the wind and wave, and as these prevail from the westward for nearly nine months in the year, and storms are most frequent from that quarter, it follows that shingle must be carried to the eastward in great excess.

10. The force-propelling beach to the eastward may be considered to be exerted between the west-south-west and south-by-west points; and therefore allowing for an action of the wave somewhat more southerly than the wind, no harbour on this part of the coast should be open to any point of the compass west of south, nor should the relative positions of the pier-heads be such as to receive the set of the sea between south and west.

Fig. 3.

South.



The Shingle is moved up and down the Slope, but is neither carried to the East nor to the West.

11. Any projection of magnitude must cause a permanent alteration in the form of the adjacent shore. The utmost care should therefore be taken, in carrying out a pier or breakwater, that the new line of beach may lay as nearly as possible at right angles to the point of the compass from where the wind blows, that causes the greatest drift of shingle. By such a disposition, the most effectual counteraction will be given to the easterly passage of the shingle that can be obtained; but if this principle cannot be fully carried out, let the nearest approach be made to it that circumstances will permit.

12. A chart upon a large scale will show that there are inflexions of the coast where shingle must be heaped up, and cannot drift, at the very times where it is borne along the general line in the greatest quantities. The shores on each side of the Point of Dungeness are examples. The extension of the Point to seaward, and its enlargement, may, it is presumed, be adequately accounted for by the theory advanced in the preceding remarks; and, assuming such to be the fact, a very decisive corroboration of the system here propounded is obtained.

RALPH REDIVIVUS.—No. XV.

THE YORK COLUMN.

The aspect of the planets happens now to be so favourable, if not to monumental columns at least to discussion relative to them, that perhaps I cannot possibly do better than make choice of the York column for my present subject.

Notwithstanding the force of classical authority it seems now to be admitted by a great many that an insulated pillar, more especially one borrowed from any of the orders employed in the construction of buildings, has no very great propriety to recommend it, it being offensive, because quite unmeaning, when detached from that of which it forms merely a portion, and apart from which it is consequently no more than a fragment, while, as the support of a monumental statue, it is most injudicious, because it necessarily elevates the figure so greatly that little is to be discerned of it, except its mass alone. Neither can this inconvenience be counteracted by increasing the size of the statue, because the column itself must be increased correspondingly, or else the other will appear out of all proportion to it, and extravagantly large. Thus in order to be properly seen at that height from the ground the statue of the Duke of York ought to be, at least, twice its present dimensions, more especially as, so placed, the object requires to be viewed at a distance exceeding its elevation from the ground, since otherwise it will be beheld too much foreshortened.

In regard to the column itself, it is the least eligible that could have been made use of for such purpose; because so far from having anything whatever to recommend it as an ornamental object it is utterly destitute of embellishment, not very pleasing in contour, and what few mouldings and members it has serve only to make us feel all the more sensibly the extreme dryness, stiffness, and poverty of the ensemble. Capital it can hardly be said to have any, the part intended as such finish being little more than a clumsy-looking square platform with an iron railing, above which the shaft of the column is continued, forming the cippus or circular pedestal, on which the statue is placed. The rails just mentioned may be termed light, but then so far from contributing to the idea of lightness, in the favourable sense of the term, they rather produce actual paltriness of appearance, having no more dignity nor beauty than the wires of a birdcage. Surely, in such cases, where an external gallery above the column is made a *sine qua non*, it would be infinitely better to deepen and hollow out the abacus itself, making its sides answer the purpose of parapets; or, which would be still better, there might be a gallery within the capital, the latter having ornamental apertures sufficiently large for a person to put out his head and look down while standing in perfect security. Certainly an external gallery, unless masked so as not to show itself, is a blemish, and in itself rather adds to than at all diminishes the general solecism of employing a column where it seems a tower is wanted. Otherwise than as a belvedere, from which the surrounding prospect may be beheld, a gallery upon the abacus is useless; for as to seeing the statue itself from that situation it is perfectly out of the question, while it requires some degree of nerve to attempt to get a glimpse of it by leaning back against the railing.

Another great disadvantage attending the practice of surmounting a monumental pillar by a railing, which though slight even to paltriness in itself gives the capital a strangely encumbered look, is that it requires the statue to be raised much higher above the capital than there would else be occasion for; and it would, I conceive, be greatly better in all such cases were the figure raised no higher above the capital than what would allow the whole of it to be seen from below, under an angle of 45 degrees, or, perhaps, somewhat nearer. Instead of being hoisted on an excrescence built up above the capital, the statue would then appear to stand almost immediately upon the latter, which it ought to be made to do as nearly as possible.

Although comparatively unimportant as to size, how imposing as to character and effect are the two granite pillars on the Piazzetta at Venice, and how greatly would their dignity be impaired were they surmounted by anything besides the figures they respectively support. In fact, those are veritable columns; not hollow constructions, made to resemble them, but solid monolithic pillars, and inferior only, perhaps, to such enormous monoliths as Pompey's Pillar and the Alexander Column at St. Petersburgh, whose heights are respectively 80 and 84 feet, but the latter of far greater magnitude than the other, owing to its diameter being so much stouter.

Whatever be its appearance to the eye, a tower built to resemble a column can hardly affect the imagination so strongly as a solid shaft of equal or even lesser dimensions; it would, therefore, be perhaps advisable not to let the hollow shaft proclaim itself as such, but to omit, as far as possible, every indication of its being so, and not to let it be seen that that it is a lofty circular tower, surmounted by a square, overhanging platform. If there must be an abacus, or something answering to it, surely, instead of the usual square member, it would be better to substitute a circular one. In columns, the square abacus has great beauty and and propriety, its office being to afford a broad surface, on which the architrave rests; but, with regard to a monumental pillar, the case is widely different, that having no horizontal mass to sustain. I may here quote Hosking, who speaking of the Monument and the lofty shot-tower by the south-west angle of Waterloo-bridge, says—"They are both of cylindrical form; but the one is crowned by a square abacus, and the other by a bold cornice which follows its own outline (i. e., of the tower); the greater simplicity and consequent beauty of the latter, is such as to strike the most unobservant." The contrast here objected to between the shaft and abacus, is certainly not unpleasing in itself, quite the contrary; yet although such combination is both agreeable and appropriate, where the abacus is no more than a member of detail, it becomes almost an incongruity, when the whole is so magnified that the single square stone slab placed on the column to receive the architrave, becomes a terrace or platform, whose angles overhang the the circular structure on which it is raised.

The utmost that can be urged in extenuation of such enormity is, that it is in strict adherence to classical precedent. The York Column, however, might very well have been allowed to deviate from precedent in that respect, since it differs most widely from its prototype, precisely where resemblance to it would have been a merit—namely, its monumental character as an historic trophy. While it is, architecturally, an imitation of the Trajan column, it is utterly devoid of all that gives magnificence and grandeur to this latter; neither does it offer anything whatever in lieu of the embellishment thus omitted by wholesale. Instead of having anything ornamental in its character, of displaying richness of any sort, or in any degree, it is stamped by the most chilling blankness, the most parsimonious plainness. Consequently, it is little less than a positive absurdity; for surely absurdity it must be allowed to be, to erect what, as a structure, is perfectly useless, and, at the same time, mean, and so far disgraceful as a work of art. Yet ugly Brobdignagian columns of this description are now stuck about in many parts of England and Scotland; and Glasgow and Edinburgh have their full share of them. To say that we build as fine things of the kind as the funds raised for them will permit, is no excuse, although our inability to erect anything better than what we hitherto have done, would be a most sensible plea for not building anything of the kind again. Nothing is more contemptible or more ridiculous than the blundering mixture of prodigality and parsimony we generally witness on similar occasions. With just enough to provide a statue and its pedestal upon a scale of grandeur, our ambition is satisfied with nothing less than hoisting up the figure, and perching it upon a gawky, unmeaning column, as plain as a post. Supposing the shaft of such column to be fluted, that does not at all mend the matter; because, when so preposterously enlarged, the fluting itself becomes only an absurdity. Almost as well might we think to decorate the front of a building by striating or fluting it with channels, as to adopt them quite contrary to what taste or propriety would naturally dictate, for a cylindrical shaft forming a slender tower; surely the far more sensible mode would be, to form narrow, slightly projecting *striæ*, having the appearance of strengthening the shaft, instead of scooping out hollows to weaken it.

As far as the York Column is concerned, no fault of the kind can be alleged against it, it being *totus, teres, atque rotundus*, without channel or wrinkle, hollow or projection to break the uniformity of its surface. It is perfectly innocent of fancies or whims, of bas-reliefs, twisted *à la* corkscrew, after the fashion of both Rome and Paris; that is, of the Trajan and its two imitations, the Colonne Vendome, and the Colonne de Juillet.

So far from having any decorations, it has nothing whatever to indicate its purpose. To be sure, there is a figure on the top of it, which may be that of the Duke of York, but then it might serve as well for the Duke of Wellington, or for Sir Walter Scott, since there are no symbols nor other marks by which this monument can be recognized as that of a military man. But what most of all surprises me is that those fastidious critics who discern such outrageous absurdity in the fine campanile of St. George's Bloomsbury, on account of the statue which forms so picturesque and graceful a termination to the whole mass, can so quietly put up with the infinitely greater absurdity of sticking what is not intended as an ornamental accessory, on the top of a pillar, without any pretensions to beauty in itself, and erected, it would seem, merely, that the effigy of the person so honoured, may be seen to the utmost disadvantage. Wherefore their taste should be so excessively scandalised by the lesser absurdity of the two, it is for them to explain.—But stop; a young critic, only five years old, at my elbow, has solved the mystery, by observing—"How very funny to see a man on the top of a church, where you know they always put a *weathercock!*"

CANDIDUS'S NOTE-BOOK.
FASCICULUS III.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. I do not know how our scrupulous copyists of Grecian architecture can reconcile it to their consciences, or to their taste, to omit, as I may say they are in the habit of invariably doing, those decorations that enter into an order, which, if not absolutely indispensable to the building itself, are, nevertheless, quite as essential to the effect and character of the ensemble,—or I might say, very far more so than those subordinate mouldings and other niceties to which such extreme —even superstitious—attention is paid by them. Like many other folks they strain at a gnat, yet can swallow a camel. Therefore, though they would deem it absolute heresy to make any alteration in the form of a base or a capital, they allow themselves to leave out what, not being uniformly the same in all specimens of the same order, is not considered as inseparably belonging to and forming a part of it. Look at any or all our modern imitations of the kind, and you will find them, almost without an exception, entirely to lack that richness and finish which the buildings of Greece itself exhibited, and which, so far from being at all superfluous, are indispensable to the due effect of the style itself, since deprived of those qualities, it becomes one chiefly marked by both disagreeable baldness and monotony. At first, perhaps, it might be considered a sufficient achievement to produce fac-simile copies of Greek columns; but the time is now past when any degree of merit can be imputed to such feats. They have ceased to be prodigies—in fact, have begun to pall upon us—yet we still persist in continuing the same mill-horse round, without advancing a single step. Is not our Anglo-Grecian architecture precisely where it was when we first took it up? Do our later works in it manifest greater mastery over it—such increased knowledge of its æsthetic principles as to be able to proceed with the the same spirit and feeling, wherever we are at a loss for actual precedent in the models furnished by Greece itself?—or rather, are we not as bungling tyros and apprentices just where we were at first? *Circumspice:* let any one compare some of our first attempts in that style with some of the last, and prove, if he can, that the latter exhibit great mastery over the same elements of design.

II. It is very possible for a building to be free from any thing that can be alleged against it as a positive fault; it may, to a certain degree, be even pleasing, and yet so far from being particularly creditable to its author, may chiefly serve to show that he is devoid, not only of invention, but of the ability to communicate any thing whatever of spirit and expression to his design. It may be correct, but then it is also *géné.* It resembles a lesson got by rote, or, as it is generally termed, got by heart, although except when a man's heart happens to lie where his tongue should be, the heart has no concern in the matter; which seemingly very impertinent remark is here *apropos* enough, for I mean to say that there is no heartiness, no cordiality, no feeling in such lukewarm productions.

III. I met the other day with an account of St. Andrew's Hall, at Norwich, which describes it as "a neat, grand, and elegant" building. Neat and grand! In the name of fire and water, oil and vinegar, cat and dog, were ever the two epithets so tacked together before? In addition to which odd character given of the architecture, we are further enlightened by being told that the columns are all uniform, "being covered with lead!" If that be true, no doubt they are very extraordinary columns, but how they should on that account be more uniform is not explained. *Quære:* Was not the writer thinking at the time of his own *columns,* which seem to be overlaid with plenty of that metal?

IV. Of my contributions to the Architectural Magazine, the "Literary Gazette" is pleased to say that I am "clever and caustic," than which I desire no better praise. I abominate your water-gruel style of writing, fit only for literary milksops and those excessively cautious "by your leave" gentlemen, who invariably make use of the most sugary expressions. Palatable or unpalatable medicine must be administered, and should the patient's case require bark it is of no use attempting to render it agreeable by mixing it up with flummery. Yes, but some folks cry out, your bark is sometimes downright *barking.* Assuredly; and, after all, one had need have the three heads of Cerberus himself to bark loud enough and long enough to produce any effect—to rouse up the sluggards and the slumberers, the good people who sit comfortably dozing and nodding over art, though all the while tolerably wide awake to—their own interest.

V. It is greatly to be wished that some of our Greek architects would bite some of our Gothic ones, because, in that case the latter would no doubt also become infected with that scrupulous precision and preciseness which constitutes the *rabies* of the others. Yet no such rabies discovers itself in the rage for Gothic architecture. *Tout au contraire,* your modern Goth makes no scruple of paring down the mullions of his windows until they are scarcely thicker than the bars used to be in our old sash frames. But your Greek will not bate you a hair's breadth in any one of the dimensions of a column: he is as inflexible on that point, as Shylock himself in regard to his bond. Perhaps I shall be told that, for such matters of detail, no such strict rules have been laid down for the Gothic style, as for the other; assuredly not; but then it does not exactly follow, that, because there are no precise rules, there are neither any laws whatever to be attended to. Truly, there are no precise rules to teach people how to walk in the streets, yet should you choose therefore to thrust your fist into a man's face as you went along, he would soon convince you that if there be no rules, there is not only such a thing as law, but a confoundedly plaguy deal of it too.

VI. Although not so intended, it is a far greater compliment than they deserve, to compare some of our recently-erected churches to barns. A barn is neither a disagreeable nor a ridiculous object. On the contrary, it is generally a pleasing, ofttimes a picturesque one, while of the other class of buildings not a few are the most anti-picturesque things conceivable; as architecture, vulgar, —not simple, but paltry, pert, and mean; without elegance, without solemnity, without soberness, without even the negative merit of unpretending homeliness. Dapper formality, and spruce insignificance are, for the most part, their distinguishing qualities, and awfully bad is the distinction they confer.

VII. Somehow or other there is a most obstinate prejudice in favour of admitting as much light as possible into rooms. To be sure, the upholsterer does his best to exclude half of it by his ample window draperies, without which most apartments would have a particularly dreary, chilling appearance; no shadow in any part of them, and, consequently, very little architectural effect, since to that shadow is almost indispensable. It is for this reason that vestibules, corridors, and such places, where the light is generally admitted far more sparingly, and frequently confined to nearly a single spot, are apart from anything else in their design, so much more pictorial than apartments, splendidly furnished perhaps, yet without any contrast of light or shade. To an artist's eye—and it should be so to an architect's—the one is as requisite as the other. Light there must be, but there should also be shadow: in other words, there should be just as much and no more light than effect demands. A few gleams of sunshine glancing into a room, give a far more brilliant and and delightful appearance than a blaze of it does. But then there will be dark corners; so much the better; there is no occasion to sit in them if you want to read; and as few people sit, like sentries in their boxes, all over a room at the same time, a person may place his chair in the light as well as out of it. A room which is not too strongly lighted, has also a great recommendation in its favour: it is, next to candlelight, the very best thing imaginable for a lady's looks and complexion. If you doubt it, ask Mrs. Candidus; and, however much we may differ on every other point, she agrees with me, heart and soul, on this.

ON THE GENERAL THEORY OF THE STEAM ENGINE.
No. 2.

BY ARISTIDES MORNAY, ESQ.

In resuming the investigation of the theory of the steam engine we feel it necessary, in the first place, to define clearly in what we consider that theory to consist. It is unquestionable that there are certain fixed laws, based on the principles of natural philosophy and mechanics, which determine and modify the development of the power of steam, and its action when applied through the medium of the steam engine to produce any required mechanical effect. The ensemble of these laws constitutes, of course, the general theory of the steam engine, and no theory which excludes any one of them can claim that title. Our present knowledge of the above mentioned sciences is sufficient to enable us to point out the various phenomena which take place during the working of the steam engine, and on which its action depends. These phenomena may be divided as follows:—

1. The generation of steam in the boiler and the circumstances

attending it, viz., its temperature, elastic force and density, and the caloric absorbed during the evaporating process.

2. The transmission of the steam from the boiler to the cylinder, and the changes of state which it undergoes during its transmission.

3. The pressure exerted by the steam against the surface of the piston at every instant of its stroke.

4. The nature and intensity of the resistance, which consists in general of the useful effect and the various resistances arising from the mechanical construction of the engine, including the resistance of the steam during its efflux from the cylinder.

We have already stated that M. De Pambour, in his proposed theory, entirely disregards the laws of the transmission of steam through pipes, which the following quotations from his pamphlet will prove. He says (page 44), "Let us, however, remark that, mathematically speaking, the pressure P′ of the steam in the cylinder can never be quite equal to P, which is the pressure in the boiler; because there exist between the boiler and the cylinder conduits through which the steam has to pass, and the passage of these conduits offers a certain resistance to the motion of the steam; whence results that there must exist on the side of the boiler a trifling surplus of pressure, equivalent to the overcoming of the obstacle. But as we have proved elsewhere, that with the usual dimensions of engines, this difference of pressure is not appreciable by the instruments used to measure the pressure in the boiler, the introduction of it into the calculations would render the formulæ more complicated without making them more exact. For this reason we neglect that difference here."

It should be observed that the above remarks are only intended to apply to the case of the minimum velocity of an engine, or its maximum of useful effect; in every other case the author not only neglects the excess of pressure necessary to force the steam through the conduits, but rejects altogether the supposition that any relation whatever can exist between the pressure in the boiler and that in the cylinder. In page 19 of his pamphlet he uses the following argument:—

"Finally, in looking over our experiments on locomotives, it will be seen that the same engine will sometimes draw a light load with a very high pressure in the boiler, and sometimes a heavy load with a very low pressure. It is then impossible to admit, as the ordinary calculation supposes, that any fixed ratio *whatever* has existed between the two pressures. Moreover, the effect just cited is easy to explain, for it depends simply on this, that in both cases the pressure in the boiler was superior to the resistance on the piston; and it needed no more, for the steam, generated at that pressure or at any other, satisfying merely that condition, to pass into the cylinder and assume the pressure of the resistance."

We alluded to this opinion in our first paper, when we also stated our acquiescence in that part which relates to the pressure in the cylinder, but showed at the same time, in a general manner, that the pressure in the boiler is not perfectly indifferent, the piston acting in some measure as a safety valve, and thus having a greater or less influence over the pressure in the boiler, according to its velocity.

With this exception, the ifluence of the above mentioned circumstances on the action of the steam engine is generally acknowledged. The two first depend on the nature and properties of steam, which should, therefore, be understood before we proceed any farther.

Steam is an invisible elastic fluid, similar in its physical properties to common air, or any other permanent gas.

It is well known that if water at 212 deg. fahr. be exposed to a higher temperature under a pressure of 30 inches of mercury, which is about the ordinary pressure of the atmosphere at the level of the sea, the caloric absorbed by the water will not raise its temperature, but will convert it gradually into steam of the same temperature, viz., 212 deg. The caloric thus absorbed without raising the temperature of the water is called *latent heat*, and its amount is estimated at about 1000 times as much as would increase the temperature of the same weight of water by one degree. The latent heat of steam at 212 deg., is, therefore, said to be equal to 1000 degrees; and from experiments made by Watt and Southern, it appears, that a certain quantity of water, at any given temperature, requires an addition of the same quantity of caloric to convert it into steam, whatever may be the temperature of the steam generated, so that the latent heat at any temperature t will be $1000+212-t$, and the sum of the sensible and latent heat will be a constant quantity, viz., 1212 degrees.

When steam is generated in a limited space, that space will shortly become saturated, provided there be a sufficiency of water present; and the quantity of water which a given space can contain in the form of steam varies with the temperature. When any given space is thus saturated with steam at a given temperature, the steam having then attained the greatest density which it can acquire at that temperature, is called *saturated steam*, which term originated in the idea that steam which is not in that state, if brought in contact with water at the same temperature as itself, will, with the assistance of heat, *dissolve* a certain portion of the water; which action will cease as soon as the steam has attained the maximum density corresponding to its temperature, whence it is then said to be saturated with water.

From what precedes, it follows that if a certain space were filled with saturated steam at a given temperature, and the space were suddenly extended without the admission of steam or water, or any gain or loss of heat by radiation, the increased space would be no less filled with saturated steam, but, of course, of less density, for there would be the same quantity of water in the gaseous state and the same quantity of caloric contained in it. The temperature of the steam would, therefore, fall to the degree corresponding to its diminished density.

The most important property of steam is its elastic force, being the source of all the power obtained in steam engines. We have mentioned that steam is generated at a temperature of 212 deg. under a pressure of 30 inches of mercury: this steam, therefore, exerts a pressure equivalent to the weight of 30 cubic inches of mercury, or about 14.7 lbs. on every square inch of surface with which it is in contact.

It would be extremely inconvenient if we only knew the elastic force of steam at those temperatures at which it had been determined by direct experiment, nor should we be able to judge of the accuracy of experiments made for that purpose without reference to some law, whether founded on reasoning, and coinciding in general with the best experiments, or deduced from the experiments alone, of which they serve to correct the irregularities, and so complete the series by interpolation. It is, however, very improbable that a formula constructed by the latter method should be applicable far beyond the limits of the experiments from which it was drawn.

Mr. Southern proposed the following formula, which he derived from the results of his own experiments:—

$$f = \frac{(t+51{\cdot}3)^{5{\cdot}13}}{87344000000} + {\cdot}1,$$

or by logarithms,

$$\log.\,(f - {\cdot}1) = 5{\cdot}13 \log.\,(t + 51{\cdot}3) - 10{\cdot}94123,$$

in which f is the elastic force of the steam in inches of mercury, and t its temperature by Fahrenheit's thermometer. By this formula we arrive at too low an elastic force, for all temperatures except 212 deg. and by Tredgold's formula,

$$f = \left(\frac{t+100}{177}\right)^6,$$

or

$$\log. f = 6\ [\log.\,(t+100) - 2{\cdot}24797],$$

we obtain too great an elastic force for all temperatures above 212 deg. and too little for those below it.

The following, which was adopted by M.M. Arago and Dulong, in their report to the Royal Academy of Sciences at Paris, agrees very well with their experiments between 4 and 24 atmospheres, above which their experiments were not carried; but gives too high a result from 212 to about 300 deg., and too low from 212 deg. downwards. This formula is

$$f = 30\ [1 \times {\cdot}003974\ (t - 212)]5.$$

Dr. Ure remarked that the elastic force of steam at 210 deg., being 28.9 inches, that of steam at 220 deg. would be found by multiplying the former by 1·23; that the coefficient for the next interval of 10 degrees would be 1·22, and so on, diminishing the coefficient by ·01 for every ten degrees that the temperature is raised. The equation would thus be

$$f = 28{\cdot}9 \left[1{\cdot}23 \times 1{\cdot}22 \times \ldots\ldots \times \left(1{\cdot}23 - \frac{t-220}{1000}\right)\right]$$

This formula is in every case inconvenient, and is besides obviously inapplicable at high temperatures, for it gives the same elastic force at 440 deg. as at 450, and would show that above the latter temperature the elastic force diminishes with every rise of temperature, which is absurd.

From a comparison of Dr. Ure's experiments Mr. Ivory derived the following equation:—

$$\log. \frac{f}{30} = {\cdot}0087466\, t - {\cdot}000015178\, t^2 + {\cdot}000000024825\, t^3.$$

This is also rather difficult to apply, and becomes very erroneous at high temperatures.

The formulæ devised by MM. Arago and Dulong, and by Tredgold, are simple enough; but these, as well as all others hitherto proposed, contain some one or more constant coefficients, whose origin cannot be pointed out, for which reason no one of them can be regarded as representing the natural law. We therefore propose in the ensuing paper, to present a formula which may possibly be the expression of the law sought to be determined, as it contains no coefficient of which the origin cannot be traced.

IRISH RAILWAY DEBATE.

Parliamentary measures on that pernicious invention, the Irish railway job, commenced on the 1st of March, by Lord Morpeth moving the appropriation of £2,500,000 for this purpose. The subject was very appropriately preceded by some sparring relative to the partiality of the government. Mr. Lucas forcibly called attention to the injustice of the proceedings to the Central Irish Railway Company, and claimed on their part that they should be heard by counsel at the bar of the House against the recommendations of the jobbery. He pointed out the elastic rule by which they measured traffic, extending it in one instance, and reducing it to the narrowest limits in others. Mr. Hodgson Hinde called attention to the report of the committee on railways, and the proceedings of government on the Morecambe Bay and the Scotch railways, when they refused even to appoint a commissioner to decide on their relative merits. Mr. Hinde observed there was certainly one species of justice toward this country, and another species of justice to Ireland. Colonel Perceval called the attention of the House to the notorious change of the clause with regard to joint stock companies on the renewal of the commission. Lord John Russell and Viscount Morpeth both replied to this charge, that the ministry were unconscious that the change was made, and thus afforded a glorious proof of the system of ministerial responsibility.

The business of the evening was then commenced in earnest by Lord Morpeth, and never did ministerial hack have a more unfortunate cause to plead, or pronounce sophistries so palpably diaphanous. He boasted of the unanimity with which all parties in Ireland had hailed this measure, and called upon the House to grant money to those who proved their worthiness of it by their readiness to receive it. Henceforth a gift is not to be determined by the willingness of the donor, but by the openhandedness of the recipient! The noble viscount gave a fearful state of the poverty of Ireland compared to England, and pointed out the solitary railway in one, and the sixty millions' worth in the other; that Ireland had only 400 miles of water navigation, and England 4000; and upon this he attempted to base a claim for the deficiency being supplied at the national expense. If this system be indeed adopted, it is one to which no limit can be assigned but the entire destruction of the resources of the empire, and establishing Ireland as a pet farm of the imperial government. We begin by making all the railways, and it will be but justice to make up the deficiency of canals, and what will follow next heaven knows; but there can be little doubt that, were this system once pursued, there would be no falling back in the *merits* of Ireland, and that we should be saddled with a perpetual premium for their poverty. If such claims be but admitted, it must be recollected that England herself has millions of acres of waste land, of which the interests of a pauperised population imperatively demand the cultivation, and that Scotland has abundance of barren hills and glens, which would look more beautiful with forests raised from English gold. The next claim is, that large sums of money have been spent on the Caledonian and Rideau canals, and with a want of merit surpassing that of Irish misery, the ministry dare to appeal to measures which are the most convincing proofs of their incapacity and extravagance. Belgium was again brought forward, and the apparent success of the government plans was triumphantly relied upon; but it would be a silly act to be allured by even the most attractive examples to place in the hands of government the controul over the whole traffic of the country. By the poor law, the administration hold the working population of the country at their command, by the police they keep them in coercion, and by monopolising the means of transport, they would then obtain an equal power over the whole traffic of the country, and all the resources of the farmer and the manufacturer. Instead of a government suspension of bank payments, let us have another William Pitt stop at once the whole communication of the country, and we shall then see how the industrial classes will be paralysed by the weapons they themselves have forged. Lord Morpeth most strongly acknowledged the resources of Ireland, and the manner in which they repaid the exertions of public enterprise: and yet, with manifest inconsistency, he subsequently endeavoured to depreciate them; the ancient satyr would have felt horrified at this blowing hot and cold. The unfortunate lord favoured the whole House with a recitation of the sentiments of the open-mouthed candidates for the 'tin,' passed at their public meetings, and thus adopted them as his own. One of these sets of suitors 'in forma pauperis' urges that—

"Capital would be obtained at a much lower rate of interest, and the enormous law costs, and those consequent upon parliamentary investigations, almost entirely saved; while the professional assistance to be obtained in the several public departments would be calculated materially to lessen the general expense."

This is, verily, Tom Thumb's making giants and then killing them; and our Government Glumdalca first oppresses the railway companies by the standing orders, and then urges against them the misery produced—like as we enslaved the negroes, and then degraded them for the results of our oppression. The noble viscount did, however, acknowledge that the country was immensely indebted to the energy (!) the skill (!!) and the enterprise (!!!) which those companies (the English) had displayed.

Still farther "going the whole hog" in this stream of inconsistency, it is not wonderful if the unlucky animal should give a few digs against its own throat. Attacking the English railways (*quod et eundem est* as the future Irish jobbery), he says:—

"It is now beginning to be ascertained, that great as are the advantages which have resulted from these undertakings, there are to be found among them some of those *abuses* and *imperfections* which MONOPOLY and IRRESPONSIBILITY seem, as it were, by the law of nature, to bring about in time!!!"

Taking advantage of the experience gained by the failures of the early English attempts, the self-denying minister is not contented with employing the results of their labours, but he blames them for the very imperfections which by their exertions he is enabled to avoid. We should like to know if, as a part of the ex-Irish Secretary's advocacy of Belgian principles, he is prepared to carry out their system in all its admirable details, particularly that part on which he dwells, of the *non-interference of private interests*, which it is well known no foreign government ever allows to *interfere* with its object, as the noble lord might learn from some of the proprietors on the Belgian lines. Most pathetically did Lord Morpeth recite the expenditure to which the English railways had been subjected, and never did crocodile so bemoan its victims:—

> One of the great items of expense regarding railways was that of conducting them through Parliament. That expense alone, even in very long lines, exceeded 1,000*l.* per mile. (Hear, hear.) The parliamentary expenses of the London and Birmingham line were 72,868*l.*: of the Great Western, 88,710*l.*; of the London and Southampton, 39,000*l.*; of the Midland Counties' Railroad, 28,000*l.*, which (with some others mentioned by the noble lord) amounted to 2½ per cent. on the gross expenditure. Another great expense was the enormous amount of compensation given to individuals possessing large parliamentary interest. The statement which had been made by the Member for Leicester touched upon that point. He stated that cases were known in which individuals possessing large parliamentary interest received ten times the amount of compensation that did other individuals in precisely the same circumstances. In one case, which had been made the subject of trial in the Court of Chancery, it appeared that a nobleman had withdrawn his opposition to the bill in consideration of receiving 100,000*l.* for injury done to his estate.

And yet for all this, the jobbery advocate talks of the expense of lines executed by private individuals, and talks as if the same results would be produced in Ireland. He can best tell how far the Irish companies will be subjected to the Parliamentary screw; but as to the value of land, or that of wages, there is an immense difference in favour of Ireland. He speaks with great unction of the *generous* gifts of land by Irish proprietors; but, if the noble lord be reported correctly, the same thing has been done in England, where in one county donations were made to the extent of 50,000*l.* The noble lord could not, of course, omit that beautiful argument about private companies screwing the profits to the highest pitch, and the devoted conduct of Government, which never asks more than the lowest farthing. He forgot, however, to furnish any illustrations of this; but we are happy to supply this deficiency by alluding to that admirable institution, the Post Office, which does not indeed take the lowest farthing, but, by a beautiful metonymy, realises the words of Scripture as to the *last farthing*. Lord Morpeth cited one fact with regard to Belgium, which might impress upon many of our companies the policy of a reduction in their fares:—

> The returns from Belgium showed that in 1837 a population of 232,000 made five trips per annum. In England there was an increase over the travelling by the former modes of conveyance of 218 per cent. In Belgium, previous to the formation of the railway, 80,000 persons passed on the old road, paying 4s. and 2s. 6d. With a change to 2s. 6d., and 1s., these being the railway prices, the travellers amounted in the year 1837 to 781,000, which was an advance of 876 per cent., being an increase 9½ times greater than the former amount of travelling.

After having made a great deal of palaver about those wicked dogs, the Joint Stock Companies, choosing the best lines for themselves, in the first instance, and leaving others only the bones to pick, and eulogising the conduct of the government in taking fat and lean together; lo! we find at the last moment, that the teetotals do not like bone-picking any more than any one else, and that their measures in the first instance are to be restricted to the grand trunk lines! The good-natured lord very candidly admits that the line now proposed to be adopted is of sufficient magnitude to test the value of the intended experiment. Yes! no question of that, for choosing one of the best lines, the government will appeal to its productive results prepared to spend money, and the non-paying lines also. With equal generosity and with all forgetfulness of his former story, that "Jack Sprat could eat no fat," he now very kindly expresses his intention of leaving a portion for private enterprise. A work of true charity, stealing an ox and giving the hide among the poor! As an encouragement to the English farmer, and an inducement to the corn law supporters, he informs them that the most striking benefit would be, the agricultural produce coming from Tipperary, Cork, Limerick, Clare and Waterford. A very striking feature truly, and one which may well prevail upon John Bull to disburse the money for the procession, although to vulgar minds it might appear more equitable, that if such landholders are so fond of giving locomotive powers to their cattle, that they might do it at their own expense. The principal inducement to commence the first line, the ridiculous line from Dublin to Cork, is that there are neither canals nor navigable rivers in that part of the country! Perhaps the acumen of another twenty-thousand-pound commission might enable the noble lord to find a still more eligible site, one in which there would not be even any people at all! As a bonus to the Liverpool people, Lord Morpeth informs them, that his plan will open a communication between the Lancashire manufacturing district, and the south of Ireland; but in the dregs we find that, as Cork is much resorted to by vessels trading to America, it will be in effect facilitating the communication with the United States. Cold comfort this for the Liverpuddlians, and it is very doubtful whether this piping will have any effect in conciliating their sweet voices. We should like to know, however, why Cork is to be made an American port at the national expense, when no interference was exercised in the recent instance of Atlantic steam navigation, which by the means of private enterprise is so much promoting the American trade of Bristol, and so competing with London and Liverpool. We hear nothing either in these plans about any benefit which is to accrue to the South of England by these splendid plans, or what possible inducement can be urged on them for their promotion. Surely the Munster people might be satisfied with their agricultural trade through Bristol, without forcing us to pay through the nose for giving them an outlet to the north. The noble lord vaunts the disinterestedness of ministry, and their non-interference with the patronage of the Irish Board of Works. We shall leave others to decide how this may be, but it is a strong argument against the nonsense of superior responsibility. The various ministerial arrangements would have the effect, he trusted, of preventing a profuse expenditure of public money. We should be very willing to believe this, but "wolf" has been cried so often, and we have so many instances of their extravagance before us, that we regard them with the same eye that we do a prodigal son, applying to his parents for another supply of money. It will be a very great consolation to those companies, the merits of which have been disparaged by the job-ation, that Lord Morpeth believes that the operators have purposely underrated the amount of profits. A silver plate on their coffins, or a statue to a poet dead of starvation, are just about as gratifying as this testimony of the resources of Ireland, which have been ruined in the eyes of all capitalists. The noble lord concluded by developing a plan, which he had very probably received like the armour of Achilles from his goddess mother, or perhaps from Queen Mab as a specimen of the manufacture of Messrs. Cobweb, Peasblossom, and Mustardseed. England is not to advance one farthing, she is only to accept the bills, and the security is most eligible, for if the drawers, *i. e.* the railways, do not pay, the amount is to be reimbursed by the Irish themselves. It is needless to say, that this most flimsy contrivance will only ensnare people who like to be robbed with their eyes open, for there is no great genuis required to foresee that the railway grants must go the way of the tithe million, and so many other sums which wander like ghosts on the Stygian shore, far from the land to which they owe allegiance. We do not think it necessary to state the impression which this speech made upon us, for in truth it was none at all, and we rather think that our comments will make the greater impression of the two.

Mr. Redington acknowledged that the committee were very candid in their report as to his part of Ireland, for in page 45 they state, that with respect to railways westward they had not thought it necessary, under existing circumstances, to make any enquiry; being doubtless engaged in the consideration of their jobs elsewhere, and not being desirous of executing the purpose for which they were alleged to be appointed, viz., to examine and decide upon a general system of railways.

Sir Robert Peel combated the measures of the ministry with his natural talent, and the aptitude he had acquired from his commercial connections. He pointedly remarked the scramble among the approved candidates as to who should have the first finger in the pie, and urged that if begun, the plan could only end in an extravagant expenditure of English money. The principle, he said, was neither more nor less than to take the capital of individuals in different parts of the country, for the purpose of sanctioning one particular scheme. He asked why, if poverty were to be admitted as a claim, Wales should not put in her demand, because her customs returns were even smaller than those of Ireland? The real question, said he, is

Whether or not it would be for the benefit of the country to teach it to rely on the intervention and support of the government, or leave competition free, and allow Ireland to follow the example of her neighbour, trusting for the same prosperity, and the same facilities of communication, to precisely the same means which had insured them in England. He found in this report ample proofs that if individuals in Ireland were enterprising and intelligent they would succeed. What said the report with respect to a single individual having every difficulty to contend with? In order to convince him that it would be proper for government to interfere in a case of this kind, a report was produced having for its object to show how enormously profits and prosperity increased by opening railway communications. That was one object of the report; and it did prove that position most conclusively. It took the case apparently the most surrounded with difficulties, the least tempting speculation any one could well imagine another individual to enter into; it took the case of a native of Milan with very little capital, who determined to settle in the county town of Tipperary, undeterred by all the accounts of violence, and all the prejudice which might operate against him—a foreigner, single, unsupported, ignorant of the language, bringing intelligence and industry to individual enterprise, and acting by that love of profit which actuated all speculators; and what was the result? "With a capital little exceeding the expense of the outfit, he commenced," says the report, "running a car between Clonmel and Cahir,"—then in a disturbed state. "Fortune, or rather the due reward of industry and integrity, favoured his first efforts, and he soon began to increase the number of his cars, and has now 94 public carriages in constant work, and the distances traversed by them exceed 3,000 miles per day." "These results," said the report, "are the more striking and instructive, as having been accomplished in a district which has been long represented as the focus of unreclaimed violence and barbarism, where neither life nor property can be deemed secure."

As to the absurd claim of deficiency of public works, Sir Robert justly observes, that they might as well call for the establishment of cotton factories in Ireland, because England has a great many, and Ireland none.

It really was a great insult to the people of Ireland to suppose that they were not capable of appreciating the benefits of railroads, and that it was necessary for a public department to introcuce among them all the improvements which had taken place in that mode of communication. He knew how plausible it appeared at first sight to advance English credit in support of such an undertaking; but, although he took no objection in point of expense, his firm belief was, that the moment government interposed and supplied its credit, it must inevitably disparage native intelligence, industry, and enterprise, besides being a most unfair interference with the capital already in the field.

The introduction of government capital, he said, was an unfair competition, which no private individual could sustain, although he might be ready to abide the consequences of fair contest with individuals or public companies. Sir Robert calls on the landholders of Ireland themselves to execute these lines, if they are so convinced of their advantages, and boldly urged the moral bearing of the question.

When they shall have done that, the moral improvement produced upon the people of Ireland, from its landowners relying upon their exertions, will exceed tenfold that which would be produced by a Government Board with enormous patronage, interposing in such a concern, and proceeding on the old assumption, so much deprecated on the other side of the house, that the inhabitants of Ireland are an inferior people. He called upon the government consider well what they were about to do. They were reversing all the principles on which they ordinarily relied. They asked the house to grant municipal corporations to Ireland, on the ground that it would enable its inhabitants to superintend and manage their own concerns, and yet, in the present instance, they called upon the members for, and indeed upon the whole people of Ireland, to consent to their own disqualification in so important a matter as the formation, construction, and supervision of their railroads, and to abstain from doing those things for themselves, which had been done in the poorer districts of Great Britain.

The political consequences, and the manner in which the working of this plan might be used as a cat's-paw, are shown with equal force.

They would convince him that this measure would be for the permanent improvement of Ireland he would at once withdraw his opposition to it; but if the employment which it was to give to the people of Ireland was only to be temporary, and was merely meant as an adjunct to aid the operation of the new system of poor laws recently introduced into that country, then he was convinced that even if it did not work immediate harm, it would not work any permanent good. The employment, which arose from the natural course of events, and from the spontaneous application of capital, would confer more permanent advantage upon Ireland than the application of countless millions, which would only give employment for a time to the people of Ireland.

Mr. Spring Rice followed in a lame-duck speech, in which he called upon the House to persevere in the erroneous system, which, for the last forty years, they had adopted; and because they had hitherto spent so much money on Ireland, be called upon them to disburse more. He would have done better to have shown what had been the industrial and moral results of this system, to have pointed out that while Ireland had been deprived of its energy, and induced to depend upon the government leaning-stock, that she has only 400 miles of canals instead of 2,000, and that she is in arrear in all public works. The right honourable gentleman very wisely confessed that he did not wish to defend the Caledonian and Rideau canals, which his colleague had so unnecessarily conjured up before the presence of the house, as if to call witnesses from the dead to expose the incapacity of the government and the inanity of their strongest promises. With regard to temporary employment, he observed, that he believed

That temporary employment of such a character would be productive of more evil than good to Ireland. He believed that the temporary employment which the formation of the Caledonian canal created in Scotland had not done any good to that country. He had been informed that it had rather introduced into Scotland a number of Irish labourers, than given any additional employment to Scottish labourers.

Mr. O'Connell expressed his sentiments in a rambling speech, rather at variance with his original sentiments. We can, however, in consideration of his anxiety to pocket so much money for Ireland, forgive his inconsistency, but that does not induce us to place any confidence in his opinions. Mr. O'Connell is not Aristides, or he might acknowledge that, although a measure may be very advantageous to his country, it may be very unjust. He however enforced the importance of private enterprise, by pointing out that, in the case of Mr. Bianconi, he had received no support from government. Mr. O'Connell, of course, urged the example of Belgium and other states, and proved his knowledge of the subject by asserting that *there is not a freer constitution in existence than that of Belgium!* He forgot, however, to allude to one feature of government administration of public works; that in time of war governments become incapacitated, and augment, by all means, the revenues derived from these sources, while private enterprise has been so deadened, that, like poor Smike, it can never get out of its leading-strings.

Mr. H. Grattan made a noble exhibition of Irish patriotism; he said that—

They did not wish in Ireland for English money; all they said was, "Give us back some part of the sums drained from us by absenteeism." He could prove, by documents which he held in his hand, that the amount spent out of Ireland in this way was not less than 273,000*l.* per annum. This was what the Irish wished for; but if they could get that, they would be content with the assistance of government in the undertakings now under discussion.

Thus, admitting this calculation of the loss by absenteeism to be correct, and making no allowance for its annual diminution, nor for the difference made up in England by agricultural produce exported, Mr. Grattan very kindly, by way of instalment, proposes to take ten years' annuity in advance, or, instead of 273,000*l.* per year, 2,500,000*l.* As a part of the compensation question, this gentleman consistently concludes by saying that—

It was indispensable to have English capital. The English capitalist would lose nothing by the outlay; while that outlay, at the same time, would repay the Irish for some part of what they had suffered.

Mr. Lucas called upon Government to come to some decision as to the two western lines, which, however despised, were ready to carry out their plans with their own money. This gentleman proposed that if government were determined upon the general job system, that they should require that one half of the outlay should be disbursed by the landowners of the line, and the government expenditure thus reduced. Mr. Lucas lauded the arrangements of the French government:—

France also was in advance of us in this field, having found means of obtaining security for the public against those effects of monopoly which so many here complained of. In every act (if he might so speak) which passed the Chambers, he was told there was a provision inserted for imposing upon the the company a *maximum* of fares—that was to say, they were forbidden to exceed in their charges from 20 to 25 per cent. over and above a remunerating price. For instance, if 7s. would barely defray the expenses of carriage, they were unable to ask more than about 9s. for their fare.

This certainly appears at first sight a useful and economical provision; but nothing in its operations can be more injurious, for the maximum adopted in France is so low that while few undertakings can keep up to it, even those which do, offer no inducement for the further prosecution of such designs. While in England, however the public may appear at first to suffer, the large dividends obtained act as a stimulus even for the formation of non-productive undertakings, and this is the true cause of the great number of canals and other works in England, and their paucity elsewhere. Mr. Lucas might also have told the House that the French Chambers rejected last year the principle of government administration, and that so far from this principle having made progress, it received a check.

Mr. Wyse wished to know why the line proposed should stop at Clonmel and go into Waterford?

Mr. W. Roche inferred that the expenditure in Ireland, in the way of improvements, had met with most abundant returns, and he relied upon the increase of traffic which must result from the promotion of public works. Indeed the jobationists, in their ridiculous and variable calculations of traffic too often forget its certain increase, but treat it like ore raised from the mine, as if it were independent of the gold which is to be extracted from it.

Mr. Joseph Hume delivered a quantity of his usual twaddle, in which he appeared very much in the position of a tame tiger, which is expected to exhibit its ferocious propensities, and is yet kept in order by a sop in the pan. He vibrated like a pendulum, between his old notions and his anomalous Irish position, and a most strange harlequinade was the result. Among other things he confessed that the house was for the first time called upon to undertake a general work for a mercantile speculation, and it behoved them to ascertain well to what extent the plan was to be carried. Among the useful matter which could be extracted from his soporification, he assured the house from his personal experience that Belgium was no example to this country, for instead of government administration being admitted as a fixed principle it was only adopted on an emergency, and that most of the state works in America were executed with English capital, and that consequently it was quite different in this country which supplied the money to itself. He believed also that England had hitherto been burthened by Ireland, and not as Mr. Grattan said, was indebted to her.

Sir Robert Inglis said:—

As one who took also into consideration the interests of England, he should be glad to learn from the Hon. Member for Dublin, if he should succeed in obtaining a repeal of the union between the two countries, what security would be given for the repayment of the proposed advance. (Hear, hear, and a laugh.) If there should be distinct legislatures, it was natural to expect that the finance department of the two countries would be separate. In that case, he should like to know what security this country would have for the repayment of the money, when the new Parliament should be sitting in College-green!

To this Mr. O'Connell replied that he would give him his own.

Sir Edward Knatchbull observed, that he very much feared that as to the security offered by the learned Member for Dublin, that when the matter came to be considered in Ireland, some flaw would be found by which the engagement would be considered void, and, as he had said, not one penny of it would be repaid.

Mr. Slaney showed the advantages of Ireland as to the price of labour, by stating that men were glad to get employment for 8*d.*, 7*d.*, and even as low as 5*d.* per day.

Sir George Strickland deprecated the government interference in railways; and said that if they did this in imitation of France and Belgium, he did not see why they might not be called upon to imitate them in other respects, by setting up monopolies in particular trades. All government speculations in public works had been failures; they had proved so in roads and canals in Scotland and Canada, and would equally fail in Ireland.

Lord Sandon remarked, that while agricultural produce was depended upon as traffic in Ireland, experience had proved a contrary result in England. There were many works of great public utility which could be carried on in Ireland, by the aid of government, with much more advantage to the country than railroads. Some few years ago it was proposed to grant a sum of from 150,000*l.* to 300,000*l.* a year for opening the resources of ten counties of Ireland, by improving the navigation of the Shannon, but the Chancellor of the Exchequer threw every obstacle in the way of the grant, and now he supported the present very large sum without any thing like the same prospect that its application would be successful. If government wished to improve the resources of Ireland, let them extend its water communications—let them give their aid in opening the navigation of the Suire, the Barrow, and the Shannon, and he was sure that the house would not be backward in affording the necessary pecuniary aid; but he did not think that it ought to support an experiment arising out of the mania for railroads. Unless the present plan was part of a whole scheme for carrying on railroads by government aid in all the British islands, he thought they ought not to take this step without due consideration. If they carried this, he did not see how they could resist the claims of Scotland for aid in similar works.

A discussion afterwards ensued as to the conveyance of goods on railways, in which Mr. Ashton Yates denied the correctness of Lord Sandon's views, but most unjustly, for it is a matter of notoriety to all connected with railways.

After a parting address from Lord Morpeth the discussion ended by the House dividing on the motion, which was carried by 144 to 100, or by a majority of 44; but it is considered that the success of this experiment is not such as to induce the ministers to persevere. All farther measures are now delayed until after Easter.

We need scarcely say that nothing has occurred in this debate to alter the views that we have maintained throughout the discussion of this question, in which for a long while the *Times* and ourselves were the only parties engaged in opposing its injurious consequences. Every thing has tended to confirm us in the impression that it is as unwise as it is uncalled for. This is not a question of money, but of principle; not one of so many millions, but of the moral prosperity of the empire; and while we may regret any support which we may give to this innovation. Ireland, however apparently benefited, cannot fail to be injured by that genuine deprivation of resources, the incapability of availing herself of them. Indeed, if we wished not to treat Ireland as an equal, but as a subsidiary province, we could not do better than to imitate the old Roman policy of enervating those whom we wish to keep in chains. *Quem Deus vult perdere prius dementat.* As regards its financial bearings, experience has but too well impressed upon us the frailty of the proposed security, and the much more probable contingency of having to disburse the money from our own sources. Ireland can urge no moral claim to this participation in the general revenues, for instead of bearing an equal degree of taxation, she is free from many of the burdens to which England is subjected for the advantage of the sister country; and we cannot but impress both upon Irish and English the impolicy of a measure which, both in its moral and financial bearings, is equally unsupported by sound reasoning or compensating advantages.

MODELS AND DESIGNS FOR THE NELSON MONUMENT.

If not particularly satisfactory in itself, this competition has been attended with one exceedingly important result, one that is likely to prove an effectual step towards a better and more trustworthy mode of proceeding in future upon all similar occasions. The designs for the Houses of Parliament were exhibited subsequently to the final decision on the part of the commissioners; those for the Nelson Monument after the premiums had been awarded by the sub-committee—but, fortunately, in time to admit of their judgment being reversed, when, instead of ratifying it, the public voice protested against it. So far there is very great room for congratulating ourselves on the precedent thus furnished, and which we may reasonably anticipate will henceforth be followed, with this improvement upon it, namely, that the public will be admitted to view the models and drawings before any premiums be awarded or any selection made. Gladly, therefore, do we hail what has been done in regard to the present competition as a most favourable augury. If, in the first instance, no very great judgment was shown, there has been no unfairness, no obstinacy, no selfish determination to abide by the choice originally made; or if such determination existed anywhere, it has been quashed by a counter-determination emanating from some higher and more honourable quarter. But for the circumstance of the designs being exhibited, and public opinion attended to, the whole business would have been settled, as hitherto, behind the curtain, and almost the first positive information we should have had in regard to the matter would have been the preparations for carrying into effect the design to which the first premium has been awarded.

In regard to the premiums which have been bestowed, we will say nothing, except that that part of the business holds out a most wholesome caution against any similar precipitancy for the time to come; because it is in itself hardly worth a moment's consideration in comparison with the most important point—the laudable resolution evinced to obtain, if possible, such design as shall be in every respect creditable to the arts in this country.

Sincerely do we congratulate professional men, both sculptors and architects, on what has now for the first time occurred. It is true they have been turned back like schoolboys, and sent to get their tasks better; and so far it must be allowed to be somewhat mortifying to the actual competitors. Still we congratulate the profession as a body; because that very circumstance affords proof how much importance the public attach to the matter, whereas the time has been when the public would not have troubled their heads at all about it. Farther we most heartily congratulate them, because should the system thus begun be—as we devoutly hope it will—persevered in, there is now an end to all favouritism, all jobbery and jobbing. There will be fair play for talent, because when manifested it must be recognised—at all events, it cannot possibly be thrust into the background by any manœuvring; to say nothing of the responsibility which those with whom selection rests, would find attach to them. Hitherto such responsibility has not existed; we may in many cases suspect that there has been either a very great want of judgment, or else very undue partiality, unless we choose to suppose that, unworthy as it may be, the design adopted was nevertheless the best among those offered for selection. Could we behold all the designs sent in for various buildings, and compare them with the buildings respectively executed, we should, no doubt, in many instances be filled with utter astonishment. For all general competitions the invariable rule ought to be a public exhibition beforehand, whence a certain degree of responsibility on the part of the judges would follow as a matter of course; while for limited competitions, that is, where a certain number of architects are applied to for designs, each competitor should be separately examined before a committee, and called upon to explain thoroughly all his drawings, and his ideas of the subject, and also to answer whatever questions may be put to him.

We have spoken somewhat more at length than we intended, upon what, after all, does not belong to our subject as that of the exhibition itself. In considering this we shall be comparatively brief, because, even were the whole matter not now in abeyance, and were it not therefore likely that many of the designs will come under our notice again in an amended form, we are not prepared to give our readers what we should consider a full and accurate review of the majority of subjects after repeated examinations of them. We therefore profess to do little more than record our impressions at one or two visits, singling out for mention a few of the *notabilities*. Now, although we do not mean to deny that several of the models and designs exhibit great merit, many good ideas, and much beauty, in parts, we must be allowed to acknowledge there is hardly a single one we should wish to see adopted without some further modification. Among the models there are some very beautiful, considered as models, and as these consist chiefly of sculpture, they would be novelties, for at present we have no public embellishments of the kind, except single statues, and those for the most part on a very moderate scale. On that account we should be inclined to give the preference to something of the kind; more especially as it would be least likely to interfere with the surrounding buildings. As far, however, as regards adaptation to the particular site, we are not furnished with any means of judging what the effect would be except in one or two instances, where a perspective view accompanies the model, showing what would be its appearance when executed on the proposed scale, and beheld with the actual architectural back-ground there would be to it. Now, we think it ought to have been made a condition that every model should be accompanied by such view, both because models taken by themselves, except of mere pieces of statuary, are apt to be fallacious, and because they overpower drawings, and render it exceedingly difficult to judge fairly between two designs shown by such very opposite modes of representation. It was, besides, a very great error not to establish one uniform scale for the designs—perhaps one for the drawings and another for the models; had which been done much inconvenience might have been obviated. It has been suggested in some newspaper—if we mistake not, the "Atlas"—that with regard to the models it would have been advisable to have had them on the same scale, and then placed successively for examination in the centre of a model, showing the fronts of the buildings around Trafalgar-square. This would certainly have afforded a most satisfactory test of their effect, and their adaptation to the site itself; while it would, we suspect, in more than one instance have saved the competitors considerable expense, incurred by the models being on a considerably larger scale than would then have been admissible. And in regard to the expense which the competitors have been at, we will here remark that we do not see what that has at all to do with the matter. Some one has computed that the gross amount cannot be much less than 7,500 guineas. Be it so—what then? each individual contributes towards it not one farthing more either of money or time than he would have done had it been only a tenth part of that sum. Therefore, as an individual, he has infinitely less reason to complain than if he had fewer associates in his misfortune. Every one knows beforehand that but one design can be actually adopted, and surely it cannot be one whit more galling to be one of the hundred and forty-nine out of a hundred and fifty, than one of the nine out of ten. Talking of the aggregate amount, the "sum TOTTLE of the whole," as Hume says, is all stuff. Besides, there are not a few designs which we think could have cost nothing at all, except a shilling's worth of paper and couple of hours' of time.

Among the models, that by Mr. T. Woodington, No. 8, struck us as recommending itself by its graceful simplicity, and the pleasing contrast in composition produced by the four recumbent figures upon lofty socles, projecting out diagonally from the central mass or pedestal. Executed upon a commanding scale, this design would form an imposing object in the centre of the square, without at all interfering with the surrounding buildings. Nevertheless we conceive it would have been greatly better, would have been more appropriately characteristic, and possessed withal greater novelty of form, had there been only three figures, emblematical of the three grand victories of the Nile, Copenhagen, and Trafalgar, forming the three points of a triangular plan below, the principal one of which, or that allusive to the battle of Trafalgar, should be facing towards Charing-cross; which disposition would accord exceedingly well with the oblique line of the houses, right and left, forming the embouchure into Parliament-street. To say the truth, we were not a little surprised at finding that in not one of the designs—not one, at least, which we observed—has the idea been adopted of indicating the three memorable victories, by a corresponding number of points in the composition; although it might have been accomplished various ways, and apart from its significancy, with exceedingly good effect.

On the subject of Mr. Baily's model we need not say much, as we agree in the opinion generally expressed as to its merit as a graceful assemblage of sculpture, save to remark that, though abstractedly considered, it is exceedingly tasteful, it seems deficient in energy of meaning. A similar remark applies to that by Pitts, which, while it exhibits much talent and mastery as a piece of sculpture, is too enigmatical for the intended purpose. No. 38, by Westmacott and Nixon, has great merit as it is, yet would be improved by being somewhat simplified. And in No. 40, by C. H. Smith, there is considerable cleverness and originality; yet this, too, would, in our opinion, be improved by hollowing out the blank arches on three sides of the basement, so as to convert them into recesses for the figures, which are now merely placed before them. Very likely this would require some further modification of the whole of the lower part, so as to obtain sufficient depth for the purpose, yet very little difficulty, we conceive, would attend such alteration. Mr. E. J. Papworth's design, No. 36, a column on a perforated rock, within which are figures, would, on the contrary, have been better, had only the sides of the rocks been hollowed out.

We do not profess to understand Mr. Patrick Park's model, nor have we seen his explanation of it, wherein, we are informed, he speaks at length of the "principles" which directed him in designing. Very possibly it may be replete with meaning, or what is intended as such, but it is certainly far too recondite; and therefore, as a design, it struck us chiefly as a strange array of figures posted about, which jumbled appearance is further increased by a number of huge lions walking in a circle round the whole. Whatever ingenuity there may be in the ideas intended to be thus expressed, the result is any thing but a happy one, which remark applies to several other designs wherein parts or ornaments, intended to have a symbolic meaning, produce more or less awkwardness of form. However appropriate the ideas attempted to be conveyed may be in themselves, they had better in all such cases be abandoned, if they cannot be reconciled with beauty of form—with either picturesque or architectural effect. It is poor satisfaction, when we look upon incongruous whims, to be told that they are intended to indicate such or such qualities and circumstances, especially as, after all, merit of that kind, unless accompanied with refined artistical feeling, is of too fantastical a kind. Most unquestionably the mind ought to be satisfied, but at the same time the eye ought to be satisfied equally well—certainly not offended.

While considered as a model, that by Salvin and Smith, is one very striking in point of size, and exceedingly beautiful in execution; it is very far from recommending itself as a design, being an ornamental structure in an exceedingly florid but impure style of architecture, and, therefore, on that account alone would be highly exceptionable for such a situation as the centre of Trafalgar-square, where it would be altogether out of keeping with the other buildings, and would cause them to appear more naked than they do at present, while they in turn would occasion it to look whimsically grotesque in taste. The same observation applies even still far more forcibly to the design, No. 44, with the motto, "England expects every man will do his duty." In this drawing extraordinary diligence has been employed in producing an assemblage of all the most licentious caprices of the Italian school, at its most corrupt period. It is an Italianized pagoda, bedizened out from top to bottom with as much architectural finery—such as it is—as could be crammed into it. It is the very quintessence of that gorgeously bad taste which is now gone out of vogue, even in Italy itself; and as a monument to Nelson, Gibbs's church in the Strand, would be about as appropriate.

There are others who have proposed buildings, and not merely ornamental structures, but such as, if executed, would totally change the character of Trafalgar-square. Among the rest is Mr. Haydon, whose design—forming a most singular contrast to the one we have just been speaking of—is for a plain Grecian-Doric building with a portico, and forming, within, a large hall, divided into two separate compartments by columns, each of which would be lighted from above, and decorated not with fresco paintings on the walls, but large historical pictures in frames, commemorating different events in the life of the hero. Whatever else may be thought of such ideas, it is characteristic enough:—"Vous etes orfevre, M. Josse, et votre conseil sent son homme qui a envie de se defaire de son machandise." What may be the proposed dimensions we are unable to state; yet either it would be an insignificant little edifice planted by itself in the centre of the square, or if as lofty as the buildings around it, so large as to block up the square, and cut off the view of St. Martin's church, and the National Gallery, from Cockspur-street and Spring Gardens.

No. 89 is another whimsical piece of absurdity, the author of which, however, has had the discretion not to reveal his name; which is the only sensible thing he has done, for the design itself is neither more nor less than a square campanile in the Italian style, divided into several stories; but whether a statue of Nelson is imprisoned in any part of the inside, we have not the means of saying.

There are not a few other extravagances—things without the slightest mark or likelihood, and which are only curious as displaying poverty of invention, sterility of imagination, and exquisitely bad taste; things, in short, at which the sub-committee must have stood aghast; although their oddness must, at the same time, have extorted from them cordial smiles, though not of approbation. Not so No. 116, that being, at all events, no laughing matter, for a piece of more egregious dulness than that strange house-front design does not present itself in the whole exhibition.

Well, of course the authors of all these deplorable performances will now retire; and many, we have no doubt, will now be able greatly to improve their designs, should not entirely fresh ideas occur to them. One of the best of those in which a column forms the principal, if not sole feature, is No. 102, by Marsh Nelson, the perspective drawings accompanying which are remarkably clever. This design proposes that the whole of Trafalgar-square should be raised to a uniform level, forming a balustrade terrace, with a spacious flight of steps towards Charing-cross. Still we are of opinion the better mode would be to obtain a level by sinking the ground on the north side, instead of raising it on the south, so as to convert the road in front of the National Gallery into a terrace, elevated above the area of the square, by which means that building would acquire apparent loftiness, at least of situation, while the view of the square would not be obstructed, as by the ground being raised it would be, from Charing-cross. If we mistake not, this is proposed by Mr. Goldicutt's design, which is so far worthy of being adopted; though, as for the design itself, which is for a huge globe, with Nelson standing on the top of it, we cannot say that it is at all to our taste. Among the more eligible designs is No. 36 by T. H. Nixon, a bold, sepia drawing—hung rather too high—exhibiting a statue and richly-ornamented pedestal. There is also much to admire in No. 42, by T. Bellamy, for simple elegance of taste, although it perhaps falls as much too short of adequate decoration, as a great majority of the other designs err in being overloaded and crowded with it.

The subject itself is undoubtedly not a very easy one; nor is it the least difficulty attending it, that artists are left entirely to their own ideas, without anything to guide them, upon an occasion where the only existing precedents are confined to insulated monumental columns; still we trust that, though repulsed, they will not sit down in despair, but that some one will yet produce a design that shall obtain the general suffrages of the public, and of artists themselves.

SCHOOL OF THE ANTIQUE,

MARGARET STREET, CAVENDISH SQUARE.

We took the opportunity of attending some of the lectures on anatomy, by Mr. S. T. Fisher, now in course of delivery at the School of Design, in Margaret street, and we cannot but express our unfeigned gratification at the manner in which they are conducted.

We have never heard a lecturer on this branch of the arts, who, possessing even greater talents and acquirements, afforded such a clear view of the subject as was presented by Mr. Fisher. He seemed to give up all that deep research and extensive knowledge, which he evidently possessed, to devote himself to the inculcation of his instructions in the plainest manner, and the youngest student could not have left the lecture-room without having understood a subject, which men of greater name can only embarrass and confuse.

These instructions were illustrated by most able drawings, casts, skeletons, and the living model, and were conducted with a completeness worthy of an institution, which both in system and material advantages has hardly its parallel in London.

ON THE MEANS GENERALLY EMPLOYED FOR REMOVING RUINOUS BUILDINGS.

We possess many books which contain every information regarding the construction of buildings—from the laying of their foundation-stone up to the completion of their minor details. We are, however, not so well informed as to the method of taking these buildings down when they become ruinous, although it is often a more difficult operation than their erection; and the advantage of being possessed of information on this apparently *out-of-the-way* subject is really greater than a general observer is inclined to believe, more especially when it is considered that many of the houses lately erected have sprung up in an incredibly short space of time, and have been constructed of materials not calculated to withstand the vicissitudes of our tempestuous winters, nor to resist the effects of any sudden accident. It seems to us that the authorities of all large towns should be prepared with means for removing the walls of such buildings when they happen to be suddenly deprived of their usual support by fire, or the failure of any of their parts: and yet, so far as we are aware, no attention whatever has been devoted to this subject—and it is on these grounds that we venture to offer a few remarks on the methods generally employed on such occasions.

In situations where the erection of scaffolding is inexpedient, the methods commonly resorted to are those of pulling down the walls *en masse* by means of chains, and of blasting with gunpowder.

We have seen the first of these methods often put in practice, but never with such signal want of success as about two or three years ago, where a gable wall of rubble masonry, about 50 feet high, 150 feet broad, and perhaps 2 feet thickness, had to be removed. Although forty or fifty persons were engaged pulling and tugging at the end of the chain, prefacing each effort with a *nautical shout*, which they seemed to expect would materially contribute to the efficiency of their exertions, they seldom pulled down considerable masses, and never succeeded in disturbing the equilibrium of the whole mass. There was, indeed, one cause that operated strongly against the success of the experiment, which was, *the want of keeping time with the oscillation of the mass.* Whenever the wall was thrown in the least degree from the perpendicular, the chain should, of course, have been pulled in *concert* with the vibrations, which, being always increased, would at last have thrown the centre of gravity of the greater part without the base, and the whole fabric would then have fallen to the ground. But instead of being pulled by a band of trained men, the rope was subject to the controul of the whole mob, who, by never pulling in concert, rendered their exertions worse than useless. After much time had been lost in these fruitless attempts, *blasting was tried with perfect success.* To those who had never witnessed the effects of gunpowder employed in such a way the plan appeared more hazardous than experience afterwards proved it to be, for *not a stone was thrown ten, or, at most, fifteen feet, from the bottom of the wall,* and in no instance where it has been tried have we ever seen stones scattered to a greater distance.

From this account it will be seen that blasting is by far the most efficient and safe agent that can be employed in levelling ruins. Had the wall been thrown down by a system of pulling, the stones, from the impetus acquired in falling from a vertical to a horizontal position, would have been scattered and thrown to a great distance, at the manifest risk of those who were below, and of the neighbouring houses.

In blasting, the lower courses of the masonry are shattered, and a shock, sufficient to disintegrate, and, sometimes, even bodily to lift up the superincumbent mass, is propagated from top to bottom. The dangers to be apprehended are, first, the possibility of one or more of the stones being thrown to some distance; and, second, the possibility of only some part of the lower courses being blown out, while the remainder is left; so that the wall is apt to turn on that part as a centre; in which case it may appear probable it would fall in the direction in which there was no support.

First.—The danger of one or more of the stones being thrown to a distance seems a probable one; but, in so far as *our* observation has gone, this has never occurred. The action in blasting a solid mass of rock, is different, we think, from blowing up an artificial concrete-like masonry; for, in the one case, the gases formed by the explosion have no room to expand themselves, unless by rending the compact rock, whose particles are cemented in the closest union; while, in the other case, there are numerous fissures, affording much greater room for expansion.

Second.—The second danger is little to be dreaded, as the whole of the lower courses are always either completely removed, or else so shattered as to yield to the slightest pressure. But in every case which has come under our observation, the wall itself has been *at least* perfectly disunited from top to bottom, by the shock resulting from the blast.

Although we can easily conceive the possibility of either or both of these accidents occurring, still we think ourselves perfectly justified in decidedly recommending blasting in preference to the other methods we have alluded to. We do so, not because we have arrived at that conclusion by any reflection on the subject, nor yet because we have heard it praised by those whose opinion, as practical men, is to be valued, but because we have ourselves been witnesses of its effects.

It must, however be observed, that without judicious superintendence, this powerful instrument (like all others) may, from incautious application, prove in the highest degree destructive in its effects. Prudence in the selection of situations for the bore, and caution in charging and firing are indispensable requisites for safety; and even where attention is paid to all these essentials many unforeseen circumstances may, no doubt, occasion what all possible care could not prevent.

We may state, in conclusion, that although some may consider the removal of ruinous walls as not an operation in which engineers or architects are ever, or at least often, to be engaged, we think that ought in no way to make these remarks the less important; for any sudden accident *may* render peremptory measures necessary, and upon the success of these measures valuable property, and even human life, may depend.

PANORAMAS OF ROME AND THE COLISEUM.

The two subjects now exhibiting in Leicester-square have claim upon our notice, as being of considerable architectural interest; the one as a general representation of Rome, showing all the buildings visible from the tower of the Campidoglio, on which the spectator is supposed to stand; the other, of that wonderful fabric, the Coliseum, whose interior, with its arena, is shown as beheld from the top of its walls at its southern extremity, whence the eye also looks down upon the neighbouring arch of Constantine, and several other edifices. Although the smaller of the two, and of less variety of interest in its subject, this painting is more striking and captivating than the other, in regard to scenic effect and the illusion it produces. It conveys a most perfect idea—at least as perfect as can be obtained from the single spot to which the spectator is fixed—of the structure in its present state, of its prodigious massiveness, and of the ancient Roman brickwork of which it is composed. The look of reality is quite astonishing, and the more we contemplate the building, or parts of it, the more does it increase. Yet it is puzzling to account for the extraordinary relief, there being little of positive shadow, since even the parts on which the sun does not fall are shown as distinctly as in ordinary daylight, owing to the strong reflection which renders their local colouring visible in all its hues. The other view is not so remarkable for this deceptive quality, for though admirably executed it has not so vivid an air of reality, being apparently painted in a lower key. Perhaps, too, something may be owing to the subject itself, as being less favourable to illusion. Still there are parts of prodigious effect—for instance, the two side buildings or wings of the Campidoglio, immediately beneath the spectator, seen as he looks down upon them from the tower in the centre one. Again, the dome of the small church, close by Trajan's column, is of most forcible relief. By specifying these instances, we do not mean to say that the rest of the picture is not so well painted, but the two buildings we have mentioned, being much nearer than most of the others, of course show themselves more distinctly. St. Peter's is too remote to be a principal architectural object; but in a view taken from the Castle of St. Angelo, both that and the Vatican would be very prominent objects, and occupy a considerable portion of the scene. In our opinion, such other general view of Rome would be —we will not say worthy of Mr. Burford's pencil, since of that there can be no doubt—but eminently attractive to the public; nor at all the less so, because preceded by the one he is now exhibiting.

ISOLATED HARBOURS OF REFUGE.

In the last number of the Engineer and Architect's Journal, p. 85, Mr. Rooke remarks that, as there is no tidal scour provided for the interior of Mr. Tait's isolated harbour, although shingle could be disposed of along shore, " might not," he says, " silt eventually choke up such a harbour ?"

Why, the very same remark might, with nearly equal propriety, be applied to a wet dock. Water admitted into a dock or harbour, must be pure indeed not to deposit while there, in a state of comparative rest, a sediment of earthy or other matter in twenty or thirty years time. This of course was to be anticipated. It is obvious, however, that there can be no difficulty in removing such silt by dredging, or otherwise, at no great expense, whenever it shall be found to be inconvenient; and it is important to observe here, that the process of dredging can be carried on in the harbour during all hours and during all times of tide, until finished, without interfering, in any shape whatever, with the essential purposes of the harbour.* Vessels are neither interrupted by it in coming in, nor in going out. The mouth of the harbour, if properly carried out, as it ought to be, into deep water, is kept free and open, and accessible at all times and in all weathers. It would be a very different affair, however, if, instead of the scouring power being confined and directed towards *the rear of the harbour*, as designed by Mr. Tait, it were allowed to cross the mouth or entrance of it, as at Dover, &c., and a bar of shingle or sand allowed, in consequence, to be formed there.†

Mr. Tait's principal object is to prevent the shingle moving, as it does, along shore, from getting into, or even near the mouth of his harbour. This he proposes to accomplish by facilitating the passage of the shingle along shore and in the rear of his harbour, and as far as possible from its entrance. He has, therefore, studiously avoided all tidal or any other scour whatever within his harbour.

Mr. Rooke next says, "The uncertainty of the plan," (Mr. Tait's isolated harbour,) "its obvious expensiveness, its distance from the shore, and an exposed locality, however ingenious and able the scheme may be, involves objections which are more easily started than answered." If these remarks have special reference to the formation of a harbour at Hastings, they may perhaps be, in part, true. It is quite impossible, however, to form any decided opinion on this point, without being well acquainted in the first instance with the whole *locale* of a place: its tides, currents, prevailing winds, soundings, line of coast: its exposed projections, or sheltered indentations, &c.

In order to have the mouth of an isolated harbour in a sufficient depth of water, so as to be accessible at all times of tide, such a harbour at Hastings, would, very possibly, require to be carried out to some distance from the shore, and consequently to an exposed locality; attended, of course, with a certain proportionate increase of expense. But, as to its "certainty," Mr. Rooke may be assured, that its certainty would depend entirely on the strength and distribution of the materials, and workmanship, &c. used in its construction; and would be totally independent of the principle upon which the harbour is designed. The "certainty" involves a mere matter of judicious calculation of the strength and disposition of certain materials capable of resisting certain permanent and probable forces. As to the "expensiveness" of such a harbour. Mr. Tait has never upheld his harbour on the score of its cheapness. Quite the contrary. But at the same time, there might be situations found, perhaps, (were that an object,) where an isolated harbour could be constructed as cheaply as any other. However, it must be allowed that in ordinary circumstances, his harbour is much more likely to exceed, than to fall short of the expense, at which harbours, at the debouchure of a stream, might be constructed on the old and exploded system of scouring by means of backwater, &c. Cheapness is not, in fact, the object aimed at. The chief object, in view, is to have a harbour, at a fair adequate expense, which shall not be liable to be closed up by a bar at its entrance, and be thereby rendered inaccessible in the hour of need; but such a harbour as shall be open to receive, and shelter, and protect vessels, in distress at all times of tide, and during all kind of weather.

ZERO.

[The result of Mr. Tait's advocacy of the doctrine of isolation, vol. i., p. 337, has certainly been to insure its general reception as a principle of science, and we have no doubt that it will eventually be employed both extensively and beneficially. Mr. Rooke's communication has suggested a new feature, the construction of a harbour by a series of experiments, and it presents many useful points. There is little doubt that in Mr. Rooke's plan, vol. 2, p. 85, S. W. winds would produce a ground swell, or as it is called in the Channel Islands "a race;" but that is only one side of the question, for harbours are in this respect of two kinds, either of general refuge, or shelter against prevailing winds. To provide shelter against the S. W. winds, we should recommend that in the harbour F, the entrance N should be stopped, and another opened at B, and if necessary the east groin A might be removed to G. With regard to the question of the silt, we cannot take upon ourselves to decide, as that will vary according to position; the facts brought forward by Mr. Hyde Clarke prove the accuracy of the principle, although we have not yet sufficient data to ascertain whether the same results would be obtained upon the sandy coasts of England as in the depths of the ocean. By the progress of science, the engineer may be furnished with power greater than is conceivable at present, and we have pointed out in our present volume, p. 38, the manner in which the success of Mitchell's screws may be brought to bear on this important subject. One useful lesson we may learn from this discussion, that engineering is not a mere matter of bricks and mortar, and that as there is no book from which we cannot learn something, so there is no fact, however trivial, which does not belong to the domain of science.—Ed. C. E. & A. J.]

* This is very material to be kept in mind.

† Every time that such a bar is formed, it is obvious that the harbour becomes thereby useless; and such a bar may be formed in one tide; and no sooner removed than formed again by the very next tide. But it cannot be removed at all at Dover during the whole period of neap tides. It can only be removed during the height of spring tides. So much for depending on the effect of culverts. The harbours on the South Eastern coast of this great maritime nation ought to be independent of any such trumpery.

NELSON MONUMENT.

Sir, — Having carefully observed the marvellous inequality of talent manifest in the designs sent in competition for the Nelson monument; and that, with a few splendid exceptions, those men who take anything like rank as artists or architects in general estimation, have considered this contest of skill as beneath their notice, and left it for those who have higher feeling and less conceit, as well as for mere aspirants to engage in; I have asked myself how or why it has happened that a call which ought to have aroused the most torpid, has, upon the whole, been so unproductive? And I cannot but think, that, gloze it how they will, a mean and sordid pride, a trembling, lest, by some mischance, an unknown man should pluck the honour from their brows; or, mayhap, a more selfish spirit still, has actuated them.

As an Englishman, I deplore that talent, which is known to exist, should thus miserably extinguish itself; and whatever be the result of this competition—be the design which is to have the first premium executed or not—as an Englishman, I do hope that some more adequate mode of eliciting the talent of the country will be devised.

In this case, the committee began by acting with the best and noblest feeling. They advertised for designs. Their only error—and pardonable indeed it was—consisted in not at once defining what species of monument they wished. Still, they left the road open; and so fair an invitation would have lured many to try, confident that if their designs were best, they would not only have the honour, but the profit of its execution. Some evil spirit, however, affected the committee, and their first right step was followed by a wrong one. They again advertised, *and offered premiums*. This was bad enough, but they made it still worse, by adding, "but no further reward will be given;" thus distinctly and unequivocally giving the professions occasion to infer, that, however good the design, however honourable the successful man might be, he was not to execute his own work, but that some other man was to be fattened on the honey which his labour was to create.

I, sir, have not the honour of being an artist; I may not be so sensitive as men of genius are apt to be, but that was my interpretation of the words immediately that I saw them; and I doubt not that others felt the same, and that their emulation was palsied by it. Had not this been done, and had ample time, in the first instance, have been given, instead of driving artists to work upon the crude first conceptions, that their designs might be ready in about *two months*, and then adding *six months* more, I quite expect that a greater number of good designs would have been sent in. Rely upon it, sir, the wreath of fame has more and better followers than the purse of wealth; and be assured that many of the competitors were more incited by the hope that, notwithstanding the ill omen, they would be chosen to conduct their own design, than by the expectation of so much cash in hand. I cannot and will not doubt that the committee were actuated by the best motives in what they did. I only point out what I conceive to be the evil of their so doing; and, having done so, may I venture to propose, through you, to the public, that, in the event of other competitions being required, a middle course should be taken; which, while it may, to a great extent, secure the efforts of men of high rank, will not shut out others who may be equally talented and equally honourable, although not equally known to the world; and thus I would say:—Let a committee select a dozen artists or architects of good repute, and covenant to pay each some certain sum, sufficient just to cover the manual labour of making their designs, and engage to employ the successful artist to execute his work. In addition to this, let them advertise for designs, offering no definite premium, but promising that, if one of such designs be chosen, they will reward the author; and, if he produce proof of his constructive skill and integrity, they will also employ him to complete the work. It appears to me, sir, that, by so doing, a committee would not only secure good designs from men of high standing, but have a fair chance of eliciting unknown genius, and that, in such a manner, as no man of good feeling, however high his professional rank, could object to. There is one point, however, I would beg to impress upon committees—that, on no account should they admit drawings finished in any other than Indian ink or sepia. They should be neatly outlined, and the shades lightly washed in, and free from any of those dabs and touches, which are not only untrue to nature, but give a meretricious effect to designs which are in themselves valueless. If it were not so, how do these very dabs, stainings, and sharp touches make "a landscape of a post?" I would next follow the example of the committee on the designs for the Nelson monument; first adjudicate upon them, and then admit the competitors and the public to view; for I am quite assured that, let artists say what they will, the public, as a mass, are the best judges. Individuals may think oppositely, but a large number of conflicting opinions in some strange way neutralise each other, so that in the result the decision of public opinion is generally that which is most consonant with propriety and justice: and even if public opinion were erroneous, such a course would tend much, if not altogether, to remove those suspicions of favouritism, and forestalled judgment, which in many instances, it is to be feared, have been but too well-founded. I am quite aware that other practices than those of prejudgment exist, and practices against which nothing can guard but the utmost care that committees shall consist of men of honour. It is quite within their power to give one public set of instructions, and privately to give some favoured artist more detailed information. It is quite practicable to send for an artist after the designs have been sent in, and direct him to make certain alterations which shall improve his drawings or his model. These are dishonourable acts which, like other dark deeds, often betray their perpetrators; and they fall deeper than ever they rose higher in consequence of them.

Such practices must in process of time prove their own correctors, and so that artists be but true to themselves, and every individual strive to keep his own honour immaculate, it will not be long before generous competition shall raise this portion of the repute of Britain, and rank her as high in art as the efforts of Nelson and Wellington have placed her in naval and military renown.

I have the honour to be, yours, &c.,

OMEGA.

BIRMINGHAM AND GLOUCESTER RAILWAY ENGINES.

Worcester, 8th March, 1839.

Sir,—In No. 18 of the "Civil Engineer's and Architect's Journal" for March. 1839, at page 116, you volunteer an editorial paragraph, conveying reflections upon the Birmingham and Gloucester Railway Company.

Had you referred to the reports of the last half-yearly meeting of this company, held on the 12th February, which reports were published in the Birmingham and also in the Gloucester journals of the same week, you would have seen a correct statement of those facts upon which your comments referred to have been erroneously made.

The facts are, that Mr. Norris, a locomotive engine-maker of high reputation in America, has engaged to send upon trial to England a locomotive engine, which shall perform a much greater amount of work, under certain specified conditions, than engines of similar class and expense are at present performing upon the railways of this country.

If this trial succeed, agreeably with the stipulations and to the satisfaction of the company's engineer, the company purchase the engine.

If the trial does not succeed, Mr. Norris pays the expenses attendant on the trial, and the company remain in the same situation in point of expense as that which they held before the trial was made; that is, they pay for nothing.

The company engage to take ten engines in all under the above conditions, which are applicable to each engine, as each arrives from America.

Having now given you the facts, allow me to add, in reply to your comments:—The Birmingham and Gloucester Company do expect that Englishmen will support their projects so long as those projects bear out the principle of procuring the best possible article at the least possible cost,—no matter whether the cost be paid to an American for engines, or to a Norwegian for timber, the latter being a process by which (to use your own phrase) "the money subscribed goes out of the country," under the sanction of numerous railway companies, who appear hitherto to have escaped your condemnation.

The Birmingham and Gloucester Company do not "expect that the public will have any confidence in the safety" of these American engines, until they shall have been subjected to the trial above referred to, which will fully prove this point; but the public may probably be aware of the broad fact, that safety, so far as the results of *locomotive engines* are concerned, is upon a par in both countries, and both the public and yourself will, I have no doubt, cordially rejoice in the advancement of practical science, which the results of these trials, if successful, will evince.

I apologise for trespassing thus on your space, and am, Sir, your obedient,

W. S. MOORSOM, Engineer.

THE ROYAL EXCHANGE.

Sir,—Is it possible that there can be any truth or approach to truth in the following paragraph, which I quote from the "Sunday Times," where the "Morning Advertiser" is named as the authority for it? "We are happy to learn that Mr. Baily's design for the New Royal Exchange is that which is to be adopted. The Gresham committee have at length yielded to the views of the Chancellor of the Exchequer on the subject. Mr. Baily is the most distinguished artist of his day in his own peculiar walk; and the admirers of genius must be grateful to him for asserting its rights in the person of Mr. Baily." Whether this be intended seriously, and merely a blunder, or whether it be intended as a joke, it is difficult to guess. It certainly would be very odd that Mr. Baily's, or Mr. Anybody-else's, model should be chosen before anything was known when designs were to be sent in. The writer of the paragraph, however, may know a great deal more of the matter than any one else, for he knows, it seems, and is willing to let the world know, that "Mr. Baily is *the most distinguished artist of his day*, in his own peculiar walk." Nevertheless, I must confess, I never heard the name before as that of an architect; therefore if distinguished at all, it must be by the obscurity in which it has been shrouded. Neither have I any idea what can be this most distinguished Mr. Baily's own peculiar walk, unless it is meant that he has been in the habit of attending Change, and showing himself in one particular *walk* there. Another puzzle is to know to whom the admirers of genius—that is, of course, all of us, have to be grateful to for asserting its rights in the person of Mr. Baily; is it to the distinguished artist himself, or the Chancellor of the Exchequer?

Pray endeavour to unriddle the whole of this enigmatical matter, if only that we may get out of debt at once, by paying our gratitude in the proper quarter.

In the mean while I remain,
Your most undistinguished
READER.

SAVERY AND TREVITHICK.

Sir,—Several periodicals, last week, gave an analysis of an essay, that had been read by Professor Regaud, before the Ashmolean Society, on some circumstances in the history of Captain Savery, the inventor of a steam engine. I read the analysis in the *Literary Gazette*, the editor of which observed, that Savery wrote the *Miner's Friend* to draw attention to his engine, and that this book "is now a very rare volume. It is in the British Museum, and we believe a copy will be found in All Souls' College Library. Surely in the present day of science, and of scientific mining in particular, a *republication* might be very useful: and would be infinitely more valuable if the professor of astronomy (the only person we know who is calculated, from his love of minute research, and the vast accumulation he has made of materials, to do justice to scientific biography,) would prefix his notices of the author and his invention."

From the recommendation in this paragraph, it is clear the editor of the *Literary Gazette* has never seen the *reprint* of the *Miner's Friend*, made in 1827, by Mr. Robert Meikleham, from a copy of Savery's book in his possession. The first edition, dated 1702, is in 12mo, and has one large folio engraving, showing a perspective view of the engine. This engraving was either borrowed from Harris's Lexicon Ledinicum, or Savery gave the plate used in the *Miner's Friend* to Harris. The impressions are identical. Mr. Meikleham's edition is in 18mo, and when compared with the original, it has some pretensions to elegance: it has three engravings, and eighteen ornamental vignettes. A small number only were printed, which were purchased, I think, by Mr. Reid, bookseller, Charing-cross. Some of the copies had a portrait, designated as that of Savery. This, however, is a misnomer, occasioned by the letter-engraver affixing the name to a wrong portrait; and the mistake was not discovered till it was too late to rectify it. Mr. Meikleham had an original portrait of the Captain, which he procured in 1816 from a Mrs. Boughton, of Boughton, who was connected with Savery by marriage. At that time she was very aged, and having outlived some benevolent relations she had fallen into great poverty. Mrs. Boughton knew nothing of Savery's history; she remembered her father-in-law speaking of him as having had the reputation of being a very self-willed and passionate man; very niggardly and selfish; and that he had been sheriff of Devon. This, however, was a palpable mistake. The portrait in her possession had been painted with considerable freedom, and when Savery might have been between thirty and forty years of age. Although much mutilated, the face was perfect; so was the upper part of the peruke, and a part of the cravat. It had not been preserved from a feeling of its value, but for its convenience as a piece of furniture. The effigy had served as a chimney-board. On cleaning it, there was found written on the canvas frame: "No. 7. Mr. Savary, ingineer." It had certainly at one time been in some inventory, perhaps in a sheriff's. An engraving was made from this portrait for my compilation, but, the artist not having made a passable transcript, his copy was cancelled.

Professor Regaud also mentioned, that no trace of Savery having been a partner with Newcomen is to be found in the Rolls Office. This may be. In a search made twelve years ago, to ascertain the point, I could not find even Newcomen's patent. Perhaps I inquired in the wrong quarter, in the Patent Office of Extortion. I gave, in a note, Swebre's account, which he wrote twelve years after Savery's death. In the text I said that, "His (Savery's) interest was consulted by associating his name with that of Newcomen and Calley in the patent." Mr. Richard Lovel Edgworth had used the same words in a letter to the editor of a periodical, in some discussion on the history of the mechanism. But after all, Savery may have been a sharer, as Switzer says, in the profits, without his name appearing (as I, perhaps, wrongly express it) in the patent. The date of Newcomen's death has not been ascertained. In 1730, he is spoken of as the "late Mr. Newcomen." Calley died two years after Savery. The professor styles Savery a "military engineer." I know not what that profession was in Savery's time. He assuredly was a civilian. Sir Isaac Newton, who knew him, calls him "Mr. Savery." When I was engaged, in 1825, in the preparation of the "Anecdotes of Steam Engines," Mrs. Broughton became an object of great interest. I anticipated being able, with her assistance, to get into some channel of information respecting Savery, but all my enquiries *then* to learn where she was, or if alive, were unsuccessful; every trace was obliterated.

I was highly gratified with the memoir of Mr. Trevithick in your Journal for March. I believe, but I speak from an uncertain recollection, that the late Dr. Tilloch, editor of the "Philosophical Magazine," had some share in the project of sending high pressure steam-engines to Peru. He lost money by his adventure, for the most magnificent Spanish promises would not "take up" the smallest acceptance on the silver mine-engine account, in London. Among Mr. Trevithick's inventions was an elegant machine for producing a reciprocating motion by a fall of water, without losing the effect of a single *drop* of the fluid!! He exhibited a model of his machine of which I have a drawing. The water acted on the piston like the steam on the piston of his engine. It was a kind of *pet* project among mechanics at this period to supersede water-wheels! Trevithick's column, a *thousand feet high*, would be just the thing now in Trafalgar square. It would be a worthy monument to a truly great man, designed by one much greater. Some account of this, I doubt not, would amuse your architectural readers. Your correspondent, who, in his memoir, has done such good and acceptable service to all mechanics, *must* be in possession of many anecdotes concerning his friend, and he will indeed do great injury to his memory if he fail to chronicle them. The slightest incident in the life of such a man as Trevithick is invaluable, for his name is an historical one, and his fame is interwoven with that of the greatness of his country.

I am, sir, your most obedient servant,

19th March, 1839. ROBERT STUART.

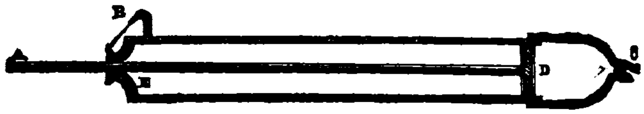
THE DYNAMOMETER.

Sir,—Having never seen an instrument of this kind which I conceive well calculated to prove the draught of a plough or road carriage in a satisfactory manner, I beg leave to trouble you with a description and sketch of one which I think might answer the purpose.

The common Dynamometer is deficient, as it only shows the strain *at a particular moment*, and is constantly varying during the trial, so that at the end of the experiment the *average strain* cannot be calculated. To ascertain this it would be necessary during a trial to note *every variation* indicated by the instrument and *its time of duration*, which sometimes might amount to several, in one second of time.

Such being the case, the desideratum seems to be an instrument that will *sum up in one* the whole force exerted during the performance of a piece of work, or during a given time, at a certain rate of speed. Suppose, for example, the plough to be tried, I would have the instrument to show what strain was exerted in drawing a furrow from one to the other end of the ridge, taking care always to *note the time* in which this was performed. If tried upon a carriage, either upon a rail or common road, take, for instance, a mile or two, at any rate of speed most convenient, the instrument wanted is *to collect into one, and exhibit at one view* the power expended during the trial.

My plan is as follows:—To make a strong brass tube, of any convenient length, bored perfectly smooth within, and of such a diameter as might be found to answer; this tube to be open at the one end to admit a tight-fitted piston with a polished rod, which would go through a collar or small opening at the other end; the apparatus would, in fact, be a model of the cylinder, piston, and piston rod of a steam engine. The following sketch will better explain it; the tube is meant to be filled with water, which, by the draught at A, is to be ejected at the small bent tube B, at a very small orifice.



This arrangement being made, the instrument is yoked to the plough or carriage at C, and the power applied at A, the piston D advances slowly towards E, forcing out the water in a very small jet at B, the discharge of which will always be in proportion to the strain applied at A, to overcome the resistance at C. Now, at the end of any *given time*, or *given distance*, the water discharged would be the measure of the force exerted in drawing the carriage or plough, and which of the machines in competition that performed the work in the *same time*, with the least discharge of water in a *given space*, would be that of easiest draught, in other words, the best plough or carriage.

As there would necessarily be a considerable degree of friction in this instrument, on account of the tightness of the piston and collar, required to keep the water from escaping, it might be proper to ascertain the amount of this, which could easily be done by putting the instrument to a balance or steelyard when emptied of the water, which would soon determine the friction in pounds.

The strain exerted in any trial of any machine might also be determined, and an average in pounds taken, by attaching the instrument in the same manner when full, to a steelyard or balance, and by loading it with such a weight as would cause it to discharge *the same quantity of water in the same time* as was done in the experiment with the cart or plough. The friction, as a matter of course, would be to take from each to determine the positive strain.

A scale might easily be attached to the instrument to determine the exact distance the piston might move in any trial.

There may, perhaps, be some difficulty in making the instrument perfectly water tight at the piston and collar, but in my opinion a slight leakage would be of little consequence as this would always be in proportion to the strain to which it might be subjected, and, therefore, not affect the result.

I am not aware that such an instrument has ever been tried, excepting what I have myself done, and that was upon a very small scale; but I humbly think that were such an instrument perfected that it would be highly useful for the proving of plough and carriages of every description, as then the merits of two competing machines might be proved and determined in such a manner as to prevent all cavil, being, in fact, brought to a mathematical demonstration.

Should you think this communication worth a place in your excellent journal, I may, perhaps, trouble you again.

I am, Sir,
Your most obedient Servant,
N. H.

Roxburghshire, Scotland, March 15, 1839.

RAILWAY CURVES.

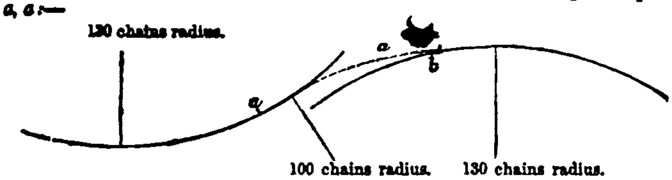
Sir,—Having made use of the plan recommended by "A Sub." in your January number, and being convinced of its practical utility, I make no apology for forwarding you a few remarks upon the objections urged by your correspondent R. W. T. Your correspondent's observation "that if the curvature is not equable some part of it must be *sharper* than if the same radius were used all through" is incorrect, the object being (if I understand correctly the plan of "A Sub.") to begin curving sooner, and make the radii of portions of the curve *greater*. I must also dissent from the assertion that when an engine is entering upon a curve it will not be affected by the nature of the path it was previously describing; for if this be the case, why is the effect of wear and tear of the outer rail at the commencement of a sharp curve *less* when the previous path is a curve in an opposite direction (forming an S) than when it is a straight line? Again: Gravity acts upon a locomotive with the same effect as upon a projectile, viz., to bring it to a state of rest. Now althought an engine cannot, like a cannon ball or other projectile, approach nearer the centre of the force acting upon it, yet, *prima facie*, the vertical pressure upon the rails increases as the squares of the velocities decrease. The cases, therefore, are not so dissimilar as I was at first led to believe from your correspondent's observations.

March 15, 1839. J. ELY.

RAILWAY CURVES.

Sir,—As a subscriber to your truly valuable journal, I trust you will not deem me too presumptuous in seeking for the following information through your journal :—

Query.—The most correct mode for placing a curve of 100 chains radius between (? to form) an *S* curve, as in the following example, *a, a* :—



would it not be desirable to reverse the curve towards *b* ?

Mr. Bruff's mode for setting out half-widths (when sidelong) for a line of railway is *very tedious.* I wish he would inform us if there be not a shorter mode than working, as he says, *from every centre peg.*

Query.—Which is the most correct mode of setting out railway curves?

The method adopted on many lines of railway for determining the offset of curves at every chain is thus—tangent squared, divided by radius, will give the versed sine.*

For example—160 chains radius $\frac{t^2}{r} = \frac{1^2}{160} = \cdot 00625$, the decimal proportion of a chain = versed sine at one chain. By reducing the decimal to inches will give 4·95 inches for the versed sine.

This will be, I believe, 1 foot 8 inches for 2 chains. If I am correct, thus, $2^2 \times 4{\cdot}95 = 19{\cdot}80$ inches, or nearly 1 foot 8 inches.

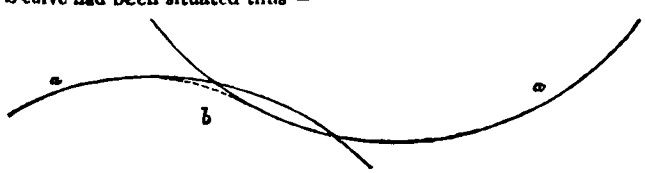
Hoping to see these matters explained in your next number,

I remain, your very obliged servant,

15th March, 1839. An Assistant Engineer.

[We have altered our correspondent's communication, so as to make it better understood by our readers; and we also referred his letter to Mr. Bruff for an explanation of that part relative to setting out "widths," and have received the following reply; and we have also obtained Mr. Weale's permission to copy from his "Scientific Advertiser" Mr. Charlton's communication on setting out railway curves, which we have given below.—Editor.]

Sir,—In reply to your correspondent, "An Assistant Engineer," as to the most correct method of carrying into effect the question he propounds, I am not sufficiently in possession of the case to answer it with satisfaction to him or myself. From the hurried glance I have given at his letter, I presume the two curves *a, a,* were intended to have met, and he now proposes to effect a junction, by laying out another curve of 100 chains radius. If this is the case, why not connect them with a tangent? or if this is not possible, with a short tangent and a curve reversed; but if he is compelled to connect by a *S* curve, most undoubtedly it should be reversed as your correspondent suggests. If the *S* curve had been situated thus—



a, a, the two curves, and *b* the point where the junction was desired, it could easily have been connected by adopting a single curve of less radius, having a common tangent at the connecting points.

With respect to your correspondent's complaints of the method I have communicated of setting out widths on sidelong ground being tedious, and requiring a shorter method, "I have no help for him." On ground that is at all variable, even a distance of 100 feet is too great for cross sections, and I often take one or two intermediate sections in that distance when in cutting; in embankment I consider such nicety of little moment. I have for some time past had charge of a railway contract of something less than five miles, the whole of which is on sidelong ground of a very abrupt character; and, after trying various plans for taking the cross sections, (which was here absolutely necessary in determining the extent of ground to be taken,) I was fully satisfied that the method I have detailed in your journal was not only the most correct, but the quickest and most easy of execution of any that I am aware of or have seen practised. I have levelled centre stakes throughout this distance, and determined the widths as I have described, and as a great portion of the works have now been carried into execution, (the cutting in some places being as much as 50 feet,) I can speak with increased confidence of the accuracy of the method.

The methods adopted for laying out curves are various. Your correspondent, by referring to the "Railway Magazine" for January, February, and March of last year, will find several excellent methods detailed, as also in "Weale's Scientific Advertiser" for May last.

I remain, yours, very truly,

Peter Bruff.

Charlotte-street, Bloomsbury, March 21st, 1839.

The following communication we extract from "Weale's Scientific Advertiser :—

The all-important subject of railways seems to engross the almost exclusive attention of both the scientific man and the practical mechanic. Railways at present are only in their infancy, and probably many of the methods now in use for laying down rails, setting out curves, &c., will in a short time give way to other inventions better adapted for practice, and of more general utility. The different methods adopted for setting out curves seem to demand much more attention than engineers have bestowed upon them. To have a curve on a railway, is at best a *misfortune*, and ought never to be resorted to unless to avoid some greater evil. Admitting the curve to be a true circular arc, and correctly set out, each carriage in a train will have a continual tendency to fly off, and that tendency will be increased or diminished in proportion to the diameter of the circle of which the curve is a segment. The distance between the wheels on each side of a carriage is a straight line, but the wheels and carriage are forced to move in a curvilinear direction ; the friction, therefore, between the wheels and the rails, especially in an arc of a small circle, must retard the progress of the train, wear the materials, strain the carriages, and greatly increase the chance of accidents, from the trains being thrown off the rails. All this will necessarily take place when the curve is correctly set out; but what must be the consequence when the curve is not uniform in its curvature? Probably some portion of it nearly a straight line, another portion of a four-mile radius, another a segment of a quarter of a mile radius, and another of no known curve whatever. A train forced along a line thus formed with the usual speed, runs a great risk of being thrown off, besides the incalculable injury done to the carriages. It is, therefore, of the deepest importance that engineers and surveyors should have a true method of setting out curves, and it is worthy of remark that the methods founded on true principles are *easier* than those founded on false ones, and require much less trouble in practice. The foregoing renders a theodolite unnecessary, nor does the surveyor require any instrument except a chain and two or three poles. In hilly countries it is only necessary to ascertain the elevation or depression of any place above or below the point where the curve commences, and that will be the side of a triangle, the ratio of whose sides are given. To illustrate this without a diagram, suppose the slope in a cutting rise 2 feet in 3, and that the elevation of a hill above the point of commencement, or the last point found by the surveyor, should be 10 feet ; then, having ascertained a point on the hill as if it were explained according to the foregoing method, say as 2 : 3 : : 10 : 15 feet ; this 15 feet must be measured back from the point already found in a direction perpendicular to the line of railway, and thus a true point in the curve in its progress over the hill will be readily ascertained.

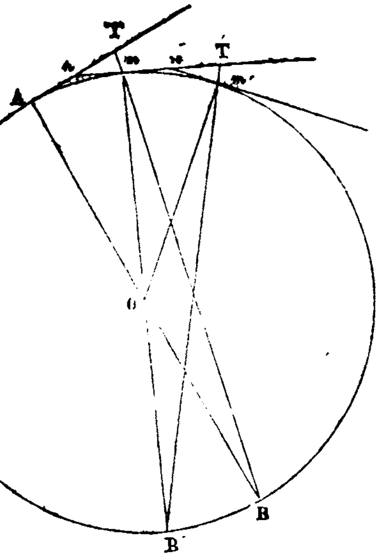
The rule made use of in several railways is, *to divide the tangent in inches by twice the radius of the circle* ; or, which is the same thing, *divide the square of the tangent by the diameter of the circle, and the quotient will be a perpendicular offset to the curve !* To any person at all conversant with geometry, this method will be seen to be manifestly erroneous : however short the tangent, it is not true ; but if, as mentioned by Mr. Terry, in the "Railway Magazine," a few months back, the tangent should be five chains, then this method of finding an offset is *grossly erroneous*, and, in a matter of such consequence, ought at once to be abandoned, and a true method substituted. It was lately decided by the Chancellor, in a railway case for libel, that the *acquirements* even of the secretary of any public company were legally subject to be fairly inquired into. If such then be law as it respects a secretary, surely the acquirements of the principal engineer of a railway, touching his mathematical and mechanical knowledge, are a subject of fair and legitimate inquiry, and more especially when it is considered that want of such knowledge on his part may affect the interests and property of the parties amounting to millions of money.

FOSTER CHARLTON, Weybridge.

* Nothing can be more erroneous.—Ed.

A PRACTICAL METHOD OF SETTING OUT A CIRCULAR RAILWAY CURVE,

WITHOUT THE USE OF ANY INSTRUMENT FOR TAKING ANGLES.



Let A be the commencement of a circular curve: perpendicular to the radius AO measure any distance AT, and from n the middle of AT measure nm equal to An or nT meeting $Tm = AT^2 \div \sqrt{AT^2 + 2AO^2}$, then will m be a point in the curve. Again, measure in the direction of mm' to T' making $mT' = AT$, and from T' the middle of mT' measure $n'm' = n'T'$, or $n'm$ meeting $T'm' = Tm$, then will m' be another point in the curve, and thus any number of equidistant points may be found.

Demonstration.—Because $Tm \times BT = AT^2$, and $TB^2 = \overline{AT^2 + 2AO^2}$, we have $Tm = AT^2 \div \sqrt{AT^2 + 2AO^2}$, then will m be a point in the curve. Again, join Om and Am, then since $Tn = nm = nA$, the point n is the centre of a circle passing through A, m, T; therefore Am is perpendicular to Tm, and nm a tangent to the curve at m.

The method of proceeding on the concave side of the curve is equally easy, and depends on the same geometrical principles. The foregoing supersedes the necessity of taking any angles. The methods given for laying out curves in the March and preceding "Railway Magazines," though founded on true principles, require either a theodolite or a table of sines and tangents, while this method requires neither, and appears simpler and more fitted for practice than any I have seen.

HISTORY OF PAPERHANGINGS.

Extracts from a paper by Mr. Crace, *read before the Royal Institute of British Architects.*

(Continued from page 100.)

In the former paper I endeavoured to trace the *history* of the art of paperstaining up to the present time, and it is now my purpose to describe the manufacture, and give some account of the modern improvements that have been introduced.

In that paper I showed, I trust satisfactorily, that the flock papers, or rather hangings, were introduced into England in the time of Charles I., and that a person named John Lanyer obtained a patent for the invention in 1634. I also cited an article from an old French dictionary of commerce, proving that the coloured paperhangings were made at any rate in that country in the seventeenth century, and referring to statutes relating to them even of the date 1586.

There were formerly three modes in which paperhangings were manufactured. By printing the outline with blocks and then colouring by hand; by stenciling; and by blocks alone.

The first of these methods is that described in my former paper, under the head of Dominoterie.

The second, stenciling, is performed by cutting out either in paper, leather, or other materials, the pattern intended to be represented, and then, placing this on the prepared ground, brushing it over with the proper colour. This mode gives an imperfect outline, and is now discontinued in paperstaining, and merely sometimes employed by plasterers to ornament coloured walls.

The third is the mode now almost universally adopted in this manufacture, whereby every colour is applied by a separate block, according to the tints and shadows intended to be represented.

I have before said that Lanyer's patent did not even mention paper among the substances on which flock could be applied, as it was at that period of too rotten and bad a quality to bear the weight of the woollen material. But paper has now been brought to so high a degree of perfection that it is the only substance employed, and has thus assisted greatly the operations of the paperstainer. Till within the last twelve years the pieces of paperhangings were formed of sheets, each about three quarters of a yard long, pasted together till the proper length of twelve yards was completed. This method was attended with many inconveniences, the joints rising, or being imperfect, and generally showing, all which evils are now remedied by the pieces consisting of one perfect length of paper, without any joints whatever; the width, too, can be enlarged to two or three times the ordinary size, as is now repeatedly done in France, as these examples will show, though we have not as yet adopted this plan.

The modern coloured papers are almost all worked in distemper, or colour mixed with size to bind it, instead of with oil or varnish, which was more employed formerly, and is now, in fact, used in the manufacture of the washable paperhangings; the effect of them, however, is not nearly so clear and brilliant as in those worked by the former method.

Distemper, or body colour, is generally thus prepared:—Whiting finely powdered and soaked in water is first well mixed, as stiffly as it can be worked, and then stained with the proper colours well ground in water; when the desired tint is produced, double size melted with about an equal proportion of water is added, till the colour is about the consistency of cream, and when chilled it is fit for use.

Commencing with the more simple papers, the first process is that of laying the grounds; to do this, the paper being placed on a bench about twelve feet long, the workman with two large brushes filled with colour, one in each hand, passes them over the paper with a circular motion, and as each piece is completed it is supported and carried by the attending boy on a stick, and placed on the rack to dry.

An ingenious machine has lately been invented, in which by three brushes acting, one with the other, the grounds are completely and evenly coloured, and in a much more expeditious manner than by hand.

The grounds being prepared, we will proceed with the printing, which is performed by means of blocks. They are carved most generally in pear tree, mounted on white deal; the design being first traced on the wood, the engraver or cutter, taking care to follow the exact outline, cuts perpendicularly to the depth of one-eighth of an inch, and then slopes off till he gets to the deal. I should add that where very sharp lines or dots are required metal is inserted in the block.

The colour with which the printing is to be performed, being mixed to the proper tint, is spread with a brush on what is called the sieve—a wooden frame covered with a blanket—the block is pressed on this and then applied to the paper, on which it leaves the impression of the design. There is a method of printing by a patent machine, invented by Messrs. Archer and Taverner, whereby, by placing the blocks on the sieve and then on the paper is performed with great exactness, with the labour of merely turning a lever handle, which is done by a boy. It was found, however, too cumbrous to move.

In the first case the pattern is given to the paper by a single block, but as in the second, where there are two shades of colour, two blocks are necessary. Now in order that the second block may be placed exactly in its proper situation, you perceive that there are pin marks in each block corresponding with each other, and on the marks printed by the first block the pins of the second block are placed, and the pattern is thus completed with the required correctness.

In another case a very delicate and shaded effect is given by a single impression, which is produced by what is called pin-work on a cylinder.

The pattern is formed by small brass pins of various sizes, fixed on a wooden cylinder at different spaces, according to the depth of shade required. This, fixed in a machine, is made to revolve so as to be supplied with colour from a blanket, and at the same time print the piece of paper very speedily without any interruption. This process, only lately applied to paperstaining, is derived from one much resembling it, in use in calico printing, only that the latter so far differs that the colour is contained inside the cylinder, and the pattern represented by holes pierced in it instead of pins fixed on it.

In other cases the pattern is worked on what is called a blended ground; this is also a modern invention, originating, I believe, in France. The blending is performed by a machine purposely constructed. A metal trough, the length of the breadth of paper, containing about twenty divisions, has in those divisions various tints of colour, according to the blending required; a long narrow brush is then dipped into the trough, and being filled with colour, applies it to a roller, from which it is collected by a large cylindrical brush the same length, which is made to revolve, and when it is properly supplied with colour it is then brought to bear upon the paper, on which it thus places the grounds, though in order to make it sufficiently perfect it is necessary to be done twice.

A common marble paper is printed by blocks in the ordinary way, and afterwards varnished with turpentine varnish, by which process it is enabled to bear washing, water not injuring it.

There is an improved imitation marble paper, made by Archer and Taverner, in which, if assisted by a few veins laid in by hand, the effect is certainly much superior to the last. The operation is considered secret, but it is easy to be perceived that the mode of making it nearly resembles that employed by the makers of the bookbinders' marble paper in which thickly gummed colours are made to float on the surface of water, and being stirred in various forms, are thus absorbed by the paper when applied to them.

In an imitation of wainscot the ground is combed as in the usual painted imitations of this wood, and the veins are afterwards printed.

The satin ground paper is a great improvement on the common grounds, and enables the manufacturer to produce imitations of silks and satins, which have a very elegant appearance. I have made every exertion to discover the date of the introduction of this improvement, but unfortunately without success. The oldest in the trade have never heard of it as a recent invention.

The satin ground is laid with satin white, a compound formed of lime and alum, and it can be coloured to almost any tint. After being laid like the common grounds, powdered French chalk is rubbed on it with a hard brush till the gloss is produced, and it is then glazed with clear size.

A process has been invented in England within the last five or six years which adds materially the beauty of the satin grounds; this is embossing, where imitations of watered and figured silks, stamped leather, &c., are produced. The embossing is performed by the paper being passed between two rollers, on one of which is the engraved pattern, and which also being slightly heated thus stamps the required design on the paper.

A kind of paperhanging in which the English designers seem to excel is called chintz, and has been introduced in imitation of the printed cottons and muslins, which seem to have been copied from Indian designs. There are in general several colours in these patterns, requiring many blocks and much delicacy in execution, though the number of blocks is sometimes much lessened by printing wash colours; such as yellow on blue making green, yellow on red orange, and lake on blue purple.

A manufacture of Archer and Taverner is one of the most creditable attempts in modern English paperstaining. It is an imitation of Chinese paper, and is composed of eighteen sets of blocks, each set containing four, altogether seventy-two blocks. It will be perceived that the flowers in that paper are shaded, which is effected by a process resembling that employed in blending the grounds. The long narrow brush is dipped in the trough containing the proper tints of colour and spreads these on the sieve. The block with the flowers engraved on it is then applied to the sieve thus arranged in shades, and afterwards prints the flowers in the tints, which are blended. This is a modern invention, first practised about five years ago by the Messrs. Harwood, the oldest firm at present in the trade.

Another important mechanical contrivance was invented about twenty years ago, whereby striped papers are executed with great exactness and clearness by a machine in lieu of blocks, which owing to the working always made an imperfect line. In this machine a copper trough, in which narrow slits of the required breadth are cut at the bottom, being filled with this colour, is applied to the paper, which is made to pass over a revolving cylinder, and draws the colours through the slits in the trough, by which the stripes are formed.

The ground of another specimen is crimson, and is laid with a staining colour instead of distemper. This colour, prepared principally from cochineal, is applied to the paper in the form of a wash, and is generally laid six times to produce a fine stain, the first coat being done with gamboge. In working the pattern it is printed before the staining is done, and thus acquires a much greater richness of colour.

The next example is a flock paper, a kind of hanging originally introduced as an imitation of the wove tapestries and velvet damasks. It has been employed in England more than 200 years, but about sixty years ago the art was almost lost, and only revived forty years since. The mode of working is very simple, although much mystery used to be observed respecting it. Flock is composed of the cuttings of white or bleached woollen cloth cut up in a mill to the necessary degree of fineness, and then dyed to various tints of colours. It is applied to the paper in the following manner:—The ground being prepared, the design is first printed with the block in size, in order that the oil may bear out when applied; when this is dry it is then printed with a composition of boiled oil and japan gold size, and while this is still wet the paper is laid on the drum (a kind of box about five feet by three feet, with the sides of wood and the bottom of ticking); the flock is then sprinkled over the paper, and the workman, with a cane, beats the under side of the drum, which causes the flock to spread evenly over every part of the pattern, to which it is fixed by means of the japan composition. Sometimes one flock is applied over another, this is easily accomplished by merely repeating the process after the first flock is perfectly dry.

In the next specimen a beautiful imitation of tapestry is produced by the introduction of flocks of various colours, and is done exactly as in the former examples, each flock being separately printed after the former ones are properly hardened and set.

I now take up the last of the three kinds of paperhangings, wherein metals are employed to produce imitations of gilt leather, rich brocades, or lightly etched ornaments. It is to these papers that our manufacturers seem now to devote their chief attention, and they work them with great beauty and richness, at a comparatively moderate price. I stated in my former paper that the gilt leather was employed in England even in the time of Henry VIII., and that the English were afterwards famed for its manufacture. I have every reason to suppose that gold and silver and metal leaf were introduced in the early paperhangings as an imitation of the more expensive leatherhanging, although I have not been able to discover the exact date of their first application. In addition to these there is another material of much more recent introduction, called bronze or imitation gold dust, which is now very extensively employed. This bronze is the invention of an artist at Nuremberg, named John Halitsch, who was born in 1595 and died in 1670, and his descendants have continued the manufacture to the present time. It is prepared by sifting the filings of different metals, washing them in a strong lye, and then placing them on a plate of iron or copper over a strong fire, where they are continually stirred till the colour is altered. Those of tin acquire by this process shades of gold colour, copper, red, and flame colours; iron and steel, blue and violet; and tin and bismuth, shades of a bluish white. The dust tinged in this manner is then put through a flatting mill.

A bronze paper is thus worked:—The design (as with flock) is first stamped with size, and afterwards with boiled oil and japan gold size; this preparation is allowed to dry, but while it still retains a tack the bronze is brushed over it with a hare's foot or soft brush; it thus adheres to the gold size, and the paper is in the state exhibited.

In another paper a much more splendid effect is produced by a metal, in imitation of gold leaf. A gold size, resembling that for bronze, is first applied, and while it has a tack the metal leaf is laid on. This metal, sometimes called mosaic gold or Dutch metal, is prepared in Germany, and is an amalgam of tin and copper. The effect of it on the paper is very much improved by embossing.

When coloured flocks are united with the metal pattern very splendid hangings are produced. The metal, too, is sometimes shaded, which is done by stains formed from berries, of which various kinds are used; and metal is also applied on a bronze ground, but the process is simply that already described. I need not add that in all cases where the metal is employed gold leaf may be substituted, but it is rarely used on account of the great increase in price. I have not described the washable paperhangings, or Delarue's patent paperhangings, because they are similar to those of which I have already spoken, with the exception that they are worked with japan gold size and turpentine instead of distemper, and the latter by being embossed in horizontal lines forms, by embossing alone, a pattern similar to that produced by printing.

I have made particular enquiries as to how the manufacture of paperhangings is conducted in France. I have visited the factories, and have the pleasure of being acquainted with the most eminent manufacturer at Paris, Monsieur Dauptain, and from all I can learn I do not find that the French employ other means than those known to us. In those papers of such large dimensions they have double sets of blocks, and in the decorative papers the mode of working is the same as our own; look, in fact, at what was done by our English manufacturers, Echardt and Sherringham, fifty years since; their works equal those of the French at the present day. Whence then arises our inferiority in this art? for that we are inferior all must confess. In the first place our manufacturers complain that, supposing they go to a great expense for an ornamental design it is liable to be pirated with impunity; and they say that were they protected by a patent right they should be able to bring out designs of much greater extent and perfection. This act of justice, I trust, will soon be granted to them; but even supposing this, I much fear we should still be behind our neighbours. In Paris the workmen have a better eye for colour than ours, they acquire, as it were, an imperceptible education in taste from the splendid works so continually before them; yet not depending on that alone the principal manufacturers there, constantly retain able artists, who, besides drawing the designs, arrange the tints and direct the working. Here, the task of the French artist falls to the hands of a mechanic, who, however able he may be as a workman, is still ignorant as an artist. What is the result?—the present mortifying comparison—can we now produce papers in which the flowers are so delicately tinted—can we arrange colours with the same science and harmony displayed? I repeat that though the French manufacturers use the same simple machinery, yet that their productions are far beyond our own—each tint, each shade of the numerous colours exhibited in the arabesques are stamped by a separate block. The expense of getting up these decorations is of course considerable, but instead of every year bringing out as we do, some fifty patterns, they are content to produce, perhaps, only one, or two, or three, each of which will always attract by the beauty and taste displayed. What I now write, I have often said to our manufacturers themselves, and some of them have replied; supposing no other obstacle, where can we get artists of the class to draw for us the designs you speak of? And here indeed is the difficulty—at present an insuperable difficulty, for, truly, there is not at this time in this country a class of decorative artists available for the paper-stainers. Those of any talent are so very few that they demand too high a price for the manufacturer. And yet of what consequence is it, not only in this, but in other manufactures, such as printed cottons, wools, figured silks, china, ornamental metal work, that we keep pace with other nations in regard to the taste displayed in these productions. How did the spirit and enterprise of Wedgwood raise the manufacture of porcelain in this country; where before his time we imported even for our own use—he caused his productions to be esteemed in all the countries of the globe for the elegance of their forms and the beauty of the designs which adorned them, and thus has enabled the manufacture to be carried to an extent never before anticipated. There are not many Wedgwoods. How trifling is the encouragement extended to our decorative artists, both for the true and proper education in their art and their employment afterwards! In any of the new palaces, in any of the modern grand national monuments, even in the national gallery itself, is there introduced any specimen of historical, allegorical, or decorative painting? Look at France, the new galleries of Versailles, where every room is decorated, the Bourse of Paris, the Madeleine. Look at Berlin—look at Munich. There the art is encouraged, the artists numerous. and their productions esteemed. It appears presumption in one so humble as myself to address thus the Institute of British Architects, but yet with them in a certain degree must rest the remedy. It is in your power to introduce in your designs the sister art of Painting. By encouraging that, the evils of which I complain would soon disappear—working schools, the only effective ones, would thus be formed, and besides adorning our buildings, you would be the means of more widely diffusing and perfecting a department, which, I think, all will agree is of such vital consequence to the character and importance of our national buildings, and to the success and well-being of our manufactures.

LUBRICATION.

(From Dr. Ure's Dictionary of Arts, Manufactures, and Mines.)

The following simple and efficacious plan of lubricating the joints and bearings of machinery by capillary attraction, has been kindly communicated to me by its ingenious inventor, Edward Woolsey, Esq. :—

Fig. 1. Fig. 2. Fig. 3.

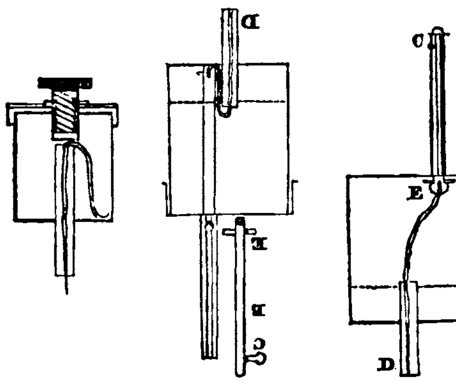


Figure 1 is a section of a tin cup, which has a small tin tube A, which passes through the bottom, as shown by the dotted lines. Oil is poured into the cup, and one end of a worsted or cotton thread is dipped into the oil, and the other end passed through the tube. The capillary attraction causes the oil to ascend and pass over the orifice of the tube, whence it gradually descends, and drops slower or quicker, according to the length of the thread, or its thickness, until every particle of oil is drawn over by this capillary syphon. The tube is intended to be put into the bearings of shafts, &c., and is made of any size that may be wished. If oil, or other liquids, is desired to be dropped upon a grindstone or other surface, this cup can have a handle to it, or be hung from the ceiling. It is frequently required to stop the capillary action when the machinery is not going; and this has been effected by means of a tightening screw, which passes through a screw boss in the cover of the cup, and presses against the internal orifice of the tube, preventing the oil from passing. As I find when these screw-cups are used upon beams of engines and moving bearings, that the screw is apt to be tightened by the motion; and also, as I think the action of the screw is uncertain, from the workman neglecting to screw it down sufficiently, it answers best to take out the capillary thread when the lubrication is not required; and to effect this easily, I have a tin top to the cup, with a round pipe soldered to it; this pipe has a slit in it, like a pencil case, and allows a bolt B to slide easily in it. In figure 2 the bolt is down; in figure 3, the bolt, which is a piece of brass wire, is drawn up, and there is no capillary action between the thread and the oil. In figure 3 it will be observed, that the bolt is kept in its place by its head C, resting in a lateral slit in the pipe, and it cannot be drawn out on account of the pin E. One end of the thread is fastened to the eye-hole at the bottom of the bolt, and the other end is tied to a small wire which crosses the lower orifice of the tube at D. By this simple contrivance the capillary action can be stopped or renewed in a second, without removing the top of the lubricator.

The saving by this plan, instead of pouring oil into the bearings, is 2 gallons out of 3, while the bearings are better oiled.

When you wish to see the quantity of oil remaining in the lubricator, the bolt must be dropped as in figure 2, and you can then lift the cover a little way off, without breaking the thread, and replenish with oil. The cost of figure 2, in tin plate is 9d. The figures in the wood-cuts are one-third of the full size.

CALEDONIAN CANAL.

We are heartily glad to see that a committee of the House of Commons has been appointed on a subject so important to Scotland, and to the commercial interests of the kingdom, as the improvement and completion of the Caledonian Canal. The report of Mr. Walker, to which allusion has been made, is an elaborate and valuable document. Mr. W. inspected the works of the canal by order of the Treasury, in consequence of some suggestions and statements made by Mr. May, the resident engineer and superintendent. After a careful survey, Mr. Walker was convinced that an extensive plan of repair and improvement was necessary, to give the undertaking *a fair chance*, and to carry out the original design of the late Mr. Telford. That design was worthy the genius and the fame of our distinguished countryman, but he was thwarted and confined by what now appears to have been a misplaced economy, and by that " ignorant impatience of taxation" (as Lord Londonderry used to term it) which manifested itself so strongly after the close of the late war. The government of the day was forced to yield to the reiterated opposition which was experienced in Parliament, and it was with the utmost difficulty that means could be obtained for putting the canal in such a state as to admit of its being opened for the imperfect accommodation of that small class of vessels to which the trade has hitherto been confined. [illegible] same niggardly parsimony, the works were hurried over in a superficial and perhaps careless manner, the result of which now appears in premature dilapidation, and in frequent obstructions, even to the present limited traffic. Mr. Walker proposes to increase the available depth of water to seventeen feet. This is short of what was designed by Mr. Telford, but is amply sufficient for the accommodation of all descriptions of commercial trading vessels. He also proposes (what has been often recommended in our columns) the establishment of steam-tugs, on the lakes and estuaries, by which the passage would be rendered certain and expeditious under every condition of the weather. Vessels would thus be enabled to pass from one side of the kingdom to the other in two or three days. If we consider the immense and daily-increasing traffic which takes place between these extremities, such a facility of communication must be reckoned an important national benefit.

The leading object of the Caledonian Canal is, briefly, to save in the communication between the opposite parts of the kingdom, the present circuitous and dangerous passage by the Pentland Frith and Land's-end, on both of which the most serious delays and losses are well known to occur. This range of internal navigation includes on one hand the intercourse of the eastern ports of England and Scotland with America; and on the other hand it embraces the traffic of the western ports with the Baltic and the east of Europe. A similar object is attempted by the Forth and Clyde Canal, on which the trade is very extensive, but only for small vessels, and these subject to heavy rates. Yet high as the rates are, they are not considered an obstacle when compared with the safety and certainty of the passage, for vessels not exceeding eighty or a hundred tons burden. Now, it is precisely to extend the same advantages to *all classes* of maritime traders that we desire to see the Caledonian Canal completed. Mr. Walker calculates that in order to accomplish these objects effectually an expenditure of nearly 150,000*l.* would be necessary. This is a large sum, but it must be remembered that the works absolutely require repair, and the completion of the design would be attended with great and permanent public benefits. Indeed, the money already laid out must be considered as entirely thrown away, if the objects which the canal was designed to secure be not realised to the public. It is like building a house without roofing it in: however magnificent be the outline—however excellent the original plan—the superstructure is useless, and must crumble to decay. Another important consideration is adverted to by Mr. Walker: from the extensive changes in the physical condition of the valley, caused by the construction of a canal of so unprecedented a magnitude, and its connection with the extensive inland lakes, it would be attended with nearly as great an expense to shut the canal as to complete it! It would be necessary, in fact, to undo almost all that has been done. " Dams and outlets," says Mr. Walker, " would have to be made, permanent bridges to be built, the locks filled up or fenced, other works done, and compensations to be made which it is extremely difficult to calculate, and which might equal in amount the expense of a proper repair"—and all this independent of the public inconvenience, the cessation of intercourse and traffic in the west Highlands, and the breach of faith which such a proceeding would involve. Mr. Walker adduces various reasons in support of his decided opinion that the canal, if properly finished and supplied with the requisite facilities, would realise all that its most sanguine supporters have anticipated. One of these illustrations is to be found in the case of the Forth and Clyde Canal, of which the expense also far exceeded the original estimates, and which for thirty years remained in that unfinished and unserviceable state in which the Caledonian Canal is at present, until a public loan of 50,000*l.* was eventually obtained, by means of which it was completed and brought into beneficial operation. This sum has long been repaid with interest, and the undertaking has proved one of the most profitable concerns in the kingdom. May we not fairly hope for the same result in the case of the Caledonian Canal? Mr. Walker expresses himself with the utmost confidence on this head, and we agree with him in the favourable opinion he entertains of what the canal is likely to be at a future period. It has never been placed in a condition to insure success—it has not had even a chance—and all its bearings and prospects are completely altered by the introduction of steam. " The evidence given previous to its formation, and much less its workings since it was opened," says Mr. Walker, " have but little to do with its present prospect"—an opinion so reasonable in itself and backed by the high professional character of Mr. Walker, that it must have considerable effect on the committee, and on the nation at large. We shall rejoice to witness the full completion of a design so honourable to the country, and to the eminent engineer by whom it was planned, and so likely to be fraught with permanent national advantage.—*Inverness Courier.*

The Treffry Viaduct.—On Wednesday, the 6th ultimo, the first stone was laid of the intended viaduct, which is to cross Rocks' Mill Valley, it was performed by J. T. Treffry, Esq., in the presence of a large and highly respectable company. The viaduct is for the purpose of carrying a line of railway across the valley from the termination of the Par canal, (which canal is about three miles long from Par breakwater,) to Roche, a distance of about seven miles; and the whole is undertaken at the sole expense of Mr. Treffry, whose public-spirited exertions in works of utility to the county at an extraordinary outlay of private wealth and individual sacrifice, are the theme of every one's praise and admiration. This viaduct will extend across Rocks' Mill Valley, in the parishes of Lanlivery and Luxulian. Its length is to be 640 feet between the abutments, and it will consist of 10 arches, the span of each of which will be 40 feet. The height from the foundation will be about 96 feet, and the width of the base of the piers will be 26 by 10 feet 6 inches. The top of the viaduct will be 10 feet wide; and the whole, when complete, will present a very beautiful appearance, and be a great relief to the otherwise rugged but exceedingly picturesque and romantic valley which it is intended to cross.—Mr. Pease is the engineer, and Messrs. Bennett and Rowe are the contractors.

REVIEWS.

A Letter to Lord Viscount Melbourne on the Rebuilding of the Royal Exchange. By THOMAS HOPPER, Architect. London: Weale, 1839.

Professing to be upon the rebuilding of the Royal Exchange, this pamphlet bears quite as much upon the Post-Office, or, in fact, the latter is the principal subject, being that which is here illustrated by five plates, wherein the present edifice erected by Sir R. Smirke, and Mr. Hopper's competition design for it are compared together, for the purpose of showing how matters were managed on that occasion.

Respecting competition generally, the writer says: "No modern work stands sufficiently high in public estimation to warrant the appointment of any architect from his previous works, and competitions have been so unfortunately conducted as to raise a strong feeling against them; and yet, that seems the most reasonable way of proceeding, if sufficient precaution were used to prevent intrigue and jobbing."

Now, in regard to intrigue and jobbing, we are of opinion they might be effectually prevented, at least rendered almost next to impossible, by adopting a properly devised system—the chief difficulty is how to enforce such a system; or, we may be wrong in calling that the chief difficulty, when another most perplexing one remains, not to be got over by all the fairness in the world; for, supposing every thing to be conducted in the most open and honourable manner, without either the slightest wish to show favour to any one, or the possibility of doing so, still with the very best intentions, and the determination to choose entirely according to merit, the selection must depend upon the taste and judgment of the umpires. So far there is a very great chance of error after all; nor will there be any remedy for it, until architecture itself shall become, a branch of the fine arts, which is a very different thing from its being taken up as a professional pursuit, one of the studies included in a gentleman's education. Then, and not till then, can architecture be properly encouraged, because, not till then, can talent manifested in it, be appreciated by a sufficient number whose voices can be admitted as those of a public competent to express their opinion, and to decide between merit and mere pretension. In the mean while, and the sooner a beginning is made the better, something may be done towards establishing a fairer and more effectual system of competition. Perhaps, were the following regulations adopted, the evil now complained of would be in a great measure removed:—First, it should be imperative that all the designs should be drawn to one scale, and merely shaded; and that all perspective views accompanying them should be taken from the same station or stations. Next, that in case of models, all should likewise be made to one scale, and each accompanied with a perspective view, showing what would be its appearance when executed, and seen in combination with the buildings or other objects belonging to the proposed site; because in themselves models are most fallacious, and moreover captivate and delude the eye by a certain *prettiness* that would not belong to the buildings erected from them. Next, it should be made an invariable rule that the designs should be publicly exhibited BEFORE any one be selected, or any premiums awarded. This would save an immense deal of trouble to the Selecting Committee, inasmuch as they would be able to compare the designs more leisurely, and also have the benefit of learning public opinion in regard to them; not that they need, therefore, be absolutely dictated to by that, should they have sufficient reasons for dissenting from it. This parliamentary ordeal being gone through, the next step would be to select a certain number of designs of the greatest mark and likelihood, and closely investigate their merits, throwing out from time to time such as appeared less eligible, until only two or three remained for final choice and decision, after diligent inquiry into their respective claims. Nor ought such decision to be reported to the public merely in its result, but the votes—Ayes and Noes—ought to be specifically recorded; since each individual would then feel himself responsible for his own opinion, while another advantage would be that incompetent persons would be rather more shy than at present of putting themselves upon such committees, more especially if each member were compelled to allege his reasons for his decision, in writing.

Like many other excellent schemes, this of ours may be too Utopian to be adopted, neither do we recommend it with any such expectation, but simply with the view of showing, that, were there a sincere disposition to manage such matters fairly and honourably, and not only honourably, but without even any suspicion of intrigue, it would not be quite so difficult to devise an effective system as is now generally imagined. The public exhibition of the designs for the Nelson Monument, by showing the utility of affording the public an opportunity of expressing their opinion, while it can be offered in the shape of remonstrance instead of unavailing reproach is a case in point. Another, and not the least advantage which might fairly be anticipated from the system above recommended, is that incompetent persons would be deterred from entering into competition, being tolerably aware that there would be little chance of success for them, were it made an inviolable rule to exhibit all the designs publicly beforehand; or even of any notice, except for their decided inferiority. On the other hand, it would operate as a stimulus to men of talent, because, whether ultimately successful or not, they might distinguish themselves with *éclat*, and obtain numerous suffrages from the public.

But we seem almost to have forgotten Mr. Hopper; therefore let us now resume, by saying that he holds up as a warning the proceedings connected with the competition for the Post-Office, for which building he himself sent in a design. Wherefore he should now for the first time bring that matter thus publicly forward, is easily explained. In fact, the secret belonging to it has been recently divulged by no other than Mr. Sidney Smirke, the architect's brother, and the author of the account of the Post-Office, in Leeds's new edition of the Illustrations of the Public Buildings of London, where it forms one of the new subjects, and the only one of them not described by the editor himself. In that account Mr. S. Smirke has very incautiously made a disclosure, that while it shows how unfairly all the competitors were treated, reflects no very great credit on Sir Robert himself, because, we are informed that he did not gain the preference by any superiority of talent he had manifested; but, none of the designs sent in being found exactly suitable, "to relieve themselves from this embarrassment the Lords of the Treasury commissioned Sir Robert (then Mr.) Smirke, who had not himself hitherto entered into the field, to make himself thoroughly acquainted with the business of the Post-Office, and to make the experience so acquired the foundation of a plan for the new building." Coming from such source the truth of this admits of no doubt, but it is a most extraordinary instance of sincerity. We certainly do not mean to insinuate that Sir Robert himself was reprehensible on that occasion, but it is clear enough that he was favoured to injury of others; since, surely if a fresh design was absolutely requisite, the proper course would have been to have commissioned the author of the best one that had been sent in, "to make *himself* thoroughly acquainted with the business of the Post-Office;" and then, either modifying his first plans accordingly, or else laying them aside, to prepare an entirely new design.

Whether accidental or not, there is certainly a strong general resemblance between Mr. Hopper's façade and the one erected. The order is the same, and the chief difference is that the former has a much greater number of columns, the portico being octastyle, the end pavilions hexastyle, and the intermediate parts decorated with half columns; the pavilions also form porticos, with an entrance in each of them. Still, as regards the centre portico, we prefer the one executed, because no windows are introduced into it; but, as to the respective plans, we think that more might have been made of Mr. Hopper's, where a wide central corridor runs through the centre of the building from wing to wing transversely, to the great hall, in passing through which a fine architectural vista would have presented itself on each side, provided, that avenue (upwards of 300 feet long) had been suitably embellished and the light thrown down from above at each extremity of it.

We presume that the other elevation by Mr. Hopper, here published "in the style of a favourite design," is intended, whether satirically or not, to allude to Mr. Barry's design for the terrace-front of the new houses of Parliament.

The London and Birmingham Railway. By THOMAS ROSCOE, Esq. assisted by PETER LECOUNT, Esq., F.R.A.S., Civil Engineer; *with a Map of the Line, 18 fine steel plates, and numerous wood engravings.* London: Charles Tilt. Birmingham: Wrightson and Webb.

We have several times made extracts from this very interesting work, which is of that sterling character that it may be read with pleasure either by the professional or general reader. The description of the immense works carried on during the progress of the railway shows the vast expense, great outlay, and antagonist difficulties with which railway companies have had to contend from the first projection of the company to the conclusion of the work. It also shows with what great perseverance it was necessary to combat the bigoted prejudices of various parties, some even interested in the progress of railways. We have read the work with considerable pleasure, and doubt not that it will be perused by our subscribers with equal interest, while, to give a specimen of the general character of the volume, we shall occasionally give a few more extracts.

The plates and wood engravings (we ought perhaps to have mentioned before) are particularly deserving of notice, as they illustrate the description and show some of the stupendous works on the railway, the map at the commencement, reduced from Cheffin's large official map, will be found particularly useful to the traveller. Before we dismiss the work we must call the attention of the reader to consider the vast talent and discrimination that has been bestowed on the works of the railway by the several resident engineers on the line; and it would afford us much pleasure if we could see on the various parts of the railway some tablet or inscription stating the names of the individuals to whom the works were intrusted by the engineer in chief, Robert Stephenson, Esq. To this engineer, however, no inscription is necessary, for the railway alone will be a sufficient monument to hand down to future ages the name of ROBERT STEPHENSON.

Roscoe's Book of the Grand Junction Railway, from Birmingham, Liverpool, and Manchester, with sixteen Engravings, and four Maps. London: Orr and Co.

During the progress of this work through the press, we have had occasion several times to speak of it, and its conclusion fully justifies what we have before said in its praise. The various engravings are beautifully executed, and present faithful representations of some of the principal works on the railway, together with views of the adjacent country. The letter press contains much useful and interesting information connected with the progress of the railway, and descriptions of the towns and villages in the vicinity of the line.

Certainly, however much authors may regret the destruction of the picturesque by railways, they must admit that these works have not been without some benefit to the literary world, for on the Birmingham road alone a hundred guide books must have been written, and some, as in this instance, uniting the highest resources of the sister arts.

Popular Instructions on the Calculations of Probabilities; translated from the French of M. A. Quetelet, by R. BEAMISH, Esq., C.E., F.R.S., &c. London: Weale, 1839.

The doctrine of probabilities is one which has for a long period occupied the attention of philosophers, and the work of M. Quetelet is the latest, and at the same time, one which assumes the merit of a popular form. M. Quetelet has certainly not shown a very great power in effecting his object, and from the skill displayed by Mr. Beamish, we should have preferred an original work to this translation. Indeed the whole work wants a recast to adapt it to English habits and English social progress, and in its present state while some parts seem redundant, others require explanation. Mr. Beamish leaves several things to be wished for with regard to style, and there are many points which he has left unelucidated, where a simple note would have cleared up the subject. It ought to be explained that a pack of cards on the continent, as for piquet in England, consists of 32, rejecting all cards under the seven except the ace. The questions at the end of each chapter are a superannuated process which had better be dismissed; the first and second chapters are too diffuse; in the treatise on lotteries Geneva is confounded with Genoa: and the chapter on assurances is almost inapplicable to this country, as is that on the decisions of tribunals, where we have no judges of facts.

Mr. Beamish has in the notes exhibited an ability which we should have liked to have seen better employed than as a satellite to M. Quetelet, and indeed his labours confer on the work a value independent of its original merits. The bearings of the law of probabilities on hypothesis is an important department of mathematical philosophy, and one which no one engaged in study or investigations should neglect, while in this small volume may be found useful information delivered in a clear and plain manner, which, while it cannot fail to be beneficial to all classes, to most readers must be highly valuable.

The Year Book of Facts in Science and Art. By the Editor of the "Arcana of Science." London: Simpkin and Marshall, 1839.

The Editor of this work had in the course of his labours on the "Arcana of Science," the opportunity of acquiring an experience, which he has happily devoted to carrying out the same plan on a more extensive scale. In the small space of this duodecimo the onward progress of science and art is chronicled, and both the practical and theoretical student can appreciate how far the wheels of the triumphant car have been driven in their successful course. The new inventions in mechanics, and the useful and speculative arts are registered from the most authentic sources, and we feel happy to see that we ourselves have been able to contribute in some degree to the general store. The editor has long laboured in the school of cheap and good literature, and he has in this instance produced a work worthy of his former exertions, and propitious to his future career.

Theory, Practice, and Architecture of Bridges. The Theory by JAMES HANN, of King's College; and *the Practical and Architectural Treatise by* WILLIAM HOSKING, F.S.A., &c. London: John Weale, 1839. Part 1.

From the specimen number before us, this promises to be an invaluable work, and one that was much wanting. It is surprising that England, which can boast of having the grandest bridges in the world, has not a single treatise on their construction. We regret that we have not space in the present number to enter into the character of the work, but in our next will enter into it more fully, by which time we hope to see one or two more parts published. The first part contains an admirable engraving of George Stephenson, besides three outline engravings of an American timber bridge; a bridge over the Calder and Hebble navigation; three plates of the Wellington Dean viaduct bridge; two of the Ouse-burn viaduct; one of the Victoria bridge on the Durham junction railway; and a bridge on the London and Croydon railway. We must impress on the attention of both the editors and the publisher, the necessity of giving full specifications and estimates of the bridges as far as possible, for to the profession they will form the most valuable part of the work. The unusually low price at which each part is published, and the excellency of the engravings, must ensure it a large sale, which there appears every endeavour on he part of the publisher to merit and obtain.

Illustration of Mechanics. By the Rev. H. MOSELEY, M.A., F.R.S., &c. London: Longman and Co., 1839.

We hail with pleasure the first volume of a series of "Illustrations of Science, by Professors of King's College, London." Such works will do more to enlighten the student than any works with which we are acquainted; they will form invaluable references and assistance to those who may attend the lectures of the professors. In our next Journal we shall enter into a more minute enquiry into these works, and the system of education adopted in the class of Civil Engineering at the college.

Observations upon the Report of the Irish Railway Commissioners. By GEORGE LEWIS SMYTH. London: Hooper, 1839.

This is a most able summary of all the arguments on the moral and political bearings of this nefarious job. Mr. Smith fully proves that the government, from all past experience, is totally incompetent for such a trust, and that, even if they were, that their interference has been attended with the most fatal results to the Irish people, inducing a blind dependence on the government, and deadening all their enterprize and exertions.

The subject is treated clearly and efficiently, and there is such a collection of documentary evidence as might even convince one of the principal jobationers. We are happy to hail the co-operation of Mr. Smyth, and cannot but express our sentiments of the service which this work is calculated to do in exposing that ridiculous abortion of selfish interests and public jobbers.

LITERARY NOTICES.

We have reserved our notice of Mr. Hay's work *On Colour* until our next number.

The Popular Lecturer is the title of a periodical published by Paul, which for the price of a penny weekly, gives lectures delivered at the different institutions by men of eminence. The parts before us contain lectures by Messrs. Bowring, Birkbeck, Col. Thompson, Grainger, &c, and the subjects are illustrated with numerous wood-cuts. Like a buoy floating on the sea, this publication shows the state of things below the surface, and is an excellent omen of the progress of literary institutions in the metropolis, and of the manner in which they are diffusing popular information.

The Sepulchral Monuments, by Carl Tottie, we noticed individually on the appearance of the first parts, and those since received maintain the same character. The plates are beautifully engraved, and the designs are infinitely superior to anything of the same kind which has yet been presented to the public. Their merit is simplicity, but this we regret too often degenerates into nakedness; the artist is evidently deficient in a correct eye for proportion, leaving large spaces unrelieved, or when this fault is remedied, it is often by the introduction of some extraneous feature which is an equal disparagement to the design.

A Letter to the Shareholders in the Great Western Railway, by Edward Ryley, is an undigested pamphlet, from such sources as the Irish Railway Commission, and Wood and Hawkshaw's reports, brought forward a prop to Kollman's patent railway. The writer's motto, from Virgil, is *Tros Tyriusve mihi nullo discrimine agetur*, which, translated, signifies, "I care neither for Trojan or Tyrian, but for *egomet*,—I, by myself."

ARTESIAN WELLS.

[This subject is, once again, exciting a good deal of attention. The old schemes have been revived, for supplying considerable districts, indeed whole parishes, of this thirsty metropolis, with water, by sinking wells through the London clay. When the project was heretofore under discussion, we brought together such evidence as appeared to us conclusive against it. But as the importunate appealers to our breeches pockets are not easily to be got rid of, we thought, under these circumstances, that our readers might desire to hear the opinion of a geologist; and as Mr. Webster, who is at present delivering a course of lectures on Geology at the Russell Institution, fully considered the question last week, in a lecture on the tertiary formations, we present an abstract of so much as referred directly to this subject.]

Mr. Webster observed, that an Artesian well is produced by boring through strata impervious to water, down to another stratum containing water, and so placed that this fluid will rise up through the bore by hydrostatic pressure; that is, by the pressure of another part of the water on a higher level. He then pointed out what he considered to be the true source from whence the water found below the London clay is derived. We must first imagine a geat depression in the chalk stratum that covers the chief part of the south-east of England, the boundaries of which depression or basin is marked by the North Downs, Marlborough Downs, and the Chilton Downs, where the chalk is on the surface. Within this depression, we must, then, conceive a great stratum of sand, lying in the chalk, but less extensive,—or rather several strata of sand alternating with several beds of coarse pipe-clay, but in a very irregular manner. This bed is named the sand and plastic clay; and this sand contains a large quantity of water, so as to be, in some places, almost of the nature of quick sand. Over these last strata lies a very thick one of dark blue clay, called the London clay, which being less extensive still than the sand, leaves a portion of the latter exposed in a belt or outcrop all round the basin. Now when rain falls upon the chalk downs, it descends the slopes in streamlets towards the centre of the basin; and when it meets with the sand uncovered, it sinks into it, passing downwards below the London clay. In course of time, from this cause, the whole of the sand stratum has become full of water, and must continue to be so, except the latter should be drawn out; and it is evident that this water stratum can be exhausted only by raising out of it a quantity of water greater than the supply it receives from the hills all round. The rain which falls upon the London clay cannot add to the water beneath it, since this clay is impervious; and, therefore, landsprings only are found on the top. If a boring be made anywhere through the blue or London clay, down to the stratum of sand containing water, the latter will rise in the bore with considerable force, to the same height or level as the outcrop of sand between the London clay and the chalk. If this boring be made at a spot which is on a lower level than this source, the water will spout up like a fountain; but if the boring be made in a place where the surface of the ground is higher than the source, then the water, though it will rise, will not reach the surface· and this accounts for the various heights to which the water ascends in various Artesian wells. (We omit the description of the mineralogical characters of these strata, and of the fossils they contain, and confine ourselves to the circumstances connected with the water.) During the last twenty years, a great many perforations have been made through the London clay, from its having been found that simple boring with an auger is sufficient when a small supply only is required: and enough has been done, fully to establish the truth of the geological principle, that the sand stratum bearing water extends all under the London clay; and that the metropolis stands upon a chalk basin containing an immense quantity of pure soft water, sufficient for the supply of many breweries, and numerous private houses, &c. But now comes the question: is this pure soft water sufficient in quantity, not merely for the consumption just mentioned, but for the supply of the whole metropolis, or of several parishes, or of a single parish? With respect to the actual quantity of water in the basin, it is impossible to calculate it with any certainty; for although we can estimate the extent of the sand and water stratum from the map, yet we cannot ascertain its thickness, since this varies in different places. In by far the greater number of borings the thickness has not been taken account of, because the work generally ceases at the top of the sand, when water appears: to say nothing of the impossibility of knowing the proportions of water and sand. Mr. Webster went on to prove that the stratum of sand and water is extremely irregular, and that we cannot have a clear idea of its actual nature, except a much more accurate account of the borings were kept than had been the case. The sand stratum is subdivided, in all probability, by bands of clay: and it is incorrect to assert, as has been done, that it is possible to predict success in sinking in one place, because a successful boring has been made in another; or that the supply of water will be the same in all places. All mention has been omitted, when speculating on this project, of the well-known failure of many Artesian wells: and it is certain that, in several cases, one well has taken the water from another, proving that the supply in that locality was limited. Mr Webster next adverted to an experiment which had been made by the New River Company, in endeavouring to avail themselves of the water below the London clay, by sinking a large shaft or well at their reservoir in the Hampstead Road. At a depth of 170 feet they came to the stratum of sand and water, which rose up together, as is usual, into the well; but finding that they could not sufficiently separate the water from the sand, which is the chief difficulty in forming wells on a great scale in the London clay, they passed through this running or quicksand, by means of cast-iron cylinders, at an expense of 4,000*l*., independent of the 8,000*l*. which the well cost, hoping to obtain water by sinking into the chalk below. They found water in that stratum, but in quantity too inconsiderable for their object; and hence this well has been represented as a failure. Mr. Webster stated, that, considering this experiment as an important one, he applied to Mr. Mylne, engineer to the New River Company, for information respecting it, and received from him all the information he required. A remarkable discrepancy had appeared in the public statements respecting this well; on one side it having been termed a failure, whereas information was given to the vestry of St. Pancras by one of the workmen who had been employed, that water had been obtained at the rate of 6,350,400 gallons weekly; this Mr. Mylne explained by stating that the term *failure* had been used, not as implying that they had not got water, but that they had not procured it in sufficient quantity to answer their purpose as *matter of trade:* the actual quantity being only 650,000 gallons per week, instead of 6,350,400, less than one-ninth part of what had been reported! Mr. Mylne likewise stated that, so far was the supply from being constant, they were able to work the pump in raising the water only one-third of their time; because, when they had procured what water trickled in slowly through the chalk, they were obliged to wait until a sufficient quantity was again collected. Mr. Webster seemed to consider the idea of a certain supply of water in the chalk, independently of that in the sand stratum, as a fallacy, or at least extremely problematical; and that the water found there had proceeded from the sand stratum resting upon it, and which had forced its way downwards through numerous minute fissures in the chalk. He observed that the procuring much water at a number of points considerably distant from each other, by no means demonstrated, as had been asserted, the certainty of raising the same quantity by means of a single large well; and he further observed, that since it was a manifest and great advantage which the inhabitants of London now possessed, and which was unknown formerly, that they can have numerous supplies of fine spring water only by boring, it was well worth consideration whether the sinking large shafts, and employing powerful machinery to raise water, might not disturb the sand and water stratum to some distance, so as to destroy or injure the subterranean channels by which water reaches those wells, which are already the property of individuals; while at the same time no reliance can be placed on the continuance, without interruption, of a supply on so great a scale as is contemplated from this source. Upon the whole, Mr. Webster gave it as his opinion, that proper and sufficient data had not yet been collected, to establish, upon good authority, the existence of water in sufficient abundance to afford a constant supply to the metropolis, or even a considerable district, by raising it in a single place from below the London clay, notwithstanding borings or Artesian wells, dispersed through London, fulfil their object in furnishing manufactories and many private houses with water.

With respect to the present supply of water to the metropolis. Mr. Webster observed, that although the subject did not come properly within the scope of his lecture, he would just state, that a considerable degree of misapprehension still existed on the subject. The Thames water is often represented as of bad quality. There is no doubt, that in its progress through the capital, it is rendered very impure; but it has been abundantly proved by the accurate analysis of the most eminent chemists, that when the supply is taken sufficiently high up the river, and conducted into the town in a proper manner, it is of great purity. At present the parishes of Marylebone, St. George's, St. James's, are supplied from parts of the river much beyond the influence of the London drainage. Possessing this, and other excellent sources, we cannot be said to be unfavourably situated by nature respecting a necessary of life of the first importance.—*Athenæum.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 12, 1839.—The PRESIDENT in the chair.

The following gentlemen were elected:—Robert Hawthorn, Nicholas Harvey, and William West, as Members; J. R. M'Clean, as a Graduate; E. W Brayley, as an Associate; and General Sir John F. Burgoyne, R. E., as an Honorary Member.

"On the Properties and Composition of the Peat and Resin Fuel." By C. Wye Williams, A. Inst. C. E.

The nature of the fuel being of great importance in the manufacture of iron and the arts generally, it is interesting to inquire into the value of peat for these purposes. Peat may also be used for railroad engines, and with peculiar advantage, being free from many of the impurities of gas cokes: it may also be used in combination with resin, or other bituminous substances, as a fuel for long voyages. The bogs of Ireland were, nearly thirty years ago, designated by a Mr. Griffiths as mines above ground; who remarked, also, that the iron founders in Dublin might probably, ere long, be supplied with turf-charcoal, which is superior to every other for their purpose. The attention of the author was directed to the use of peat for the steamers on the Shannon, where coal is necessarily dear, and peat was at first used only for economy; the impediments to its use, from its bulk and dampness, being great. The property of holding and absorbing moisture is also a great impediment to its use, particularly in wet seasons, the only remedy for which is great care during the process of drying and in its subsequent preparation, any care being amply repaid by the diminished consumption. The evils of its bulk and low specific gravity may be obviated by compressing it when dry; when compressed perfectly dry, and kept free from moisture, it will preserve its bulk. From some observations of Tredgold, respecting the earthy impurities and odour of peat when burnt, it is obvious that he experimented on peats from the lower strata; but the author, in opposition to several eminent philosophers, maintains that turf coke may be made more effective than wood charcoal. The author, in his first experiments, came to the same conclusions from using the lower though impurer strata, simply because they were the denser, and rejecting the lighter kinds. The lower strata sometimes contains peat of a tolerable purity, but generally the upper and lighter portions are superior in the purity of the carbon, the intensity and quality of its heat, to those portions which have acquired density by time and natural pressure. When the density is acquired by artificial pressure, we have a substance superior to any other for all purposes of metallurgy.

The difficulty in the conversion of turf into coke has hitherto lain in depriving it of its volatile substances so as to make a pure carbon, and in avoiding waste by partial combustion. This is effected by an union of the distillatory with the stifling process; the volatile substances are expelled in the oven, and when sufficiently charred the stifling process is adopted. Turf for the forge must have a greater density than that acquired by this process. This is effected by pulverising or bruising it, so as to destroy the fibrous character, and bring the component parts into closer and more permanent contact. By the union of these processes, any density may be given to the fuel which will combine the purity of vegetable charcoal with the density of mineral coke. The specific gravities of the turf hard pressed (water being 1000) is 1160—of the coke from the hard pressed 1040. Thus, the hard pressed turf is denser than the densest wood, and the turf coke double the density of charcoal and equal to coal coke.

The test adopted by the author, after Berthier, of the calorific power, or relative power of absorbing oxygen, is the quantity of metallic lead reduced from its state of oxide by giving weights of the several fuels. Pure carbon gives 340 grains, wood charcoal 307, turf coke 277, best coal coke 277.

Thus we have a measure of the relative quantities of heat; but intensity of heat is often of more consequence than quantity, and intensity depends on the density of the fuel. Berthier remarks that the superiority of coke to wood charcoal is owing to its density. In the above comparison, no account is taken of the impurities of the fuels; consequently, turf coke, being free of sulphur, has great advantages. The author finds that iron worked with turf coke is sooner brought to a welding heat, works softer, and comparatively free from scales.

The author then describes the resin fuel as an artificial coal produced by imitating the process of nature, in the best combinations peculiar to coal. Natural pit coal consists of bituminous, carbonaceous, and various foreign ingredients, of which sulphur is in abundance, and very injurious. The resin fuel consists of resin, the purest available bitumen, and turf coke, the purest vegetable carbon. Thus, the greatest heating power exists in the smallest bulk, and the excess of bitumen and deficiency of carbon, as in cannel coal, or excess of carbon and deficiency of bitumen, as in anthracite, may be avoided. Resin, notwithstanding its price, is used in steam navigation, but very disadvantageously, in combination with cinders, as it melts and passes off in a state of vapour, not entering readily into combustion with the oxygen of the atmosphere. But in the resin fuel, in consequence of the extraordinary attraction which subsists between carbon and oxygen, the resin has its full combustible and calorific effect. In the furnaces of boilers, a solid cinder is requisite, which may be produced by adding some of the inferior bitumen, as pitch and tar. The fuel is manufactured by adding turf coke, in a state of powder, to the bitumen in a melting state, and in such quantities as to saturate each other. The average price of the fuel is 30s. to 40s. per ton. Its use was fully tested in the voyages of the Royal William, in which 20 cwt. of coal, with 2 cwt. of the fuel, did the work of 26 cwt. of coal. The suddenness of the action and the great increase of heat for a small increase in its consumption, render it of great value in cases of emergency. The author concludes by expressing his conviction, after ten years' experience, that the turf bogs of Ireland may be rendered available for many important uses in the arts.

Feb. 19.—The President in the chair.

The following gentlemen were elected:—J. A. Galloway, as a Member; E. Birch, as a Graduate; G. Moore, C. Robinson, and S. Reed, as Associates; and Captain Sir E. Parry, as an Honorary Member.

"On Railways in America." Communicated in a letter to the President. By S. W. Roberts.

The writer describes the various methods which had been adopted of laying down Railways in America during the last twelve years. First, timber rails with light flat iron bars were tried; these were found cheap, but not durable. Next, stone rails, or sills similarly plated. Next, heavy iron rails laid on blocks of stone; the violent vicissitudes of the seasons soon deranged the foundation of these, and caused the track to spread. The heavy iron rails were next laid on a foundation of timber. The Alleghany Portage Railroad was laid four years ago by the writer with hewn white oak timber, 10 inches square, imbedded in the ground; upon these cross sills of locust timber, 6 by eight inches, and 7½ feet long, notched and trenailed. On the top of these cross sills, and directly over the longitudinal timbers, the cast-iron chairs which supported the rails were bolted. The track was thus effectually prevented from spreading. The rails are from 45 to 60 lbs. per yard, from 3 to 3¾ inches in height, and from 3½ to 4¼ inches on the base. On roads with difficult curves "bogie" engines are used. Each locomotive has six wheels. The hinder part is supported by a pair of driving wheels, 4 to 5 feet in diameter, and the front part rests upon a bolster on the bogie, which has four wheels of about 33 inches diameter. Each passenger car is 36 feet long and holds fifty persons, and warmed by a stove. The long cars are adopted as less likely to upset than those on six wheels. The average speed, including stoppages, is 15 miles per hour.

"Manchester and Leeds Railway Section." By Francis Whishaw, M. Inst. C. E.

This section, prepared under the direction of Mr. Whishaw, is designed to afford a novel and useful method of embodying a great mass of the details required by an engineer when giving evidence before a Parliamentary Committee. This section was constructed before the last standing orders, and the author had here anticipated them in putting upon this section much of the detail now required. By sections thus prepared the engineer can always answer any questions which may be put to him.

"Account of Boring for Water through Granite." By Frederick Holland. Communicated by Apsley Pellatt, A. Inst. C. E.

A hole, 6 feet wide and 7 feet deep, was first dug, and a wooden cylinder lined with bricks inserted. Two pieces of cast-iron pipe, 6 feet in length and 8 inches in diameter, turned smooth at both ends, and united by a wrought-iron hoop ring, so that when the whole number of pipes were driven, a continuous pipe, perfectly cylindrical, both on the inside and on the out, was formed. Nine lengths of pipe were connected and driven, and then the boring commenced, and continued through a hard rich species of rock or granite, having all the component parts but not the compactness of granite. The boring was continued to a depth of 175 feet. The supply has been regular at the rate of from 48 to 50 gallons per minute, a temperature of 48° F., the external air being 52½° F.

Mr. Brunel stated, that the advance of the Thames Tunnel was now at the rate of 3 feet per week; they were now 64 feet from low-water mark. He presented some specimens of sand, which, when mixed with a certain quantity of water, was exceedingly troublesome. They frequently push the poling boards before them: last night not less than 60 square feet was pushed before them. They fight their way on with difficulty, but continuously.

Feb. 26.—The President in the chair.

The following gentlemen were elected:—G. Grove, J. B. Redman, as Graduates; S. M. Peto, T. Grissell, and Rev. S. King, as Associates.

"On the Economy of working expansively in Crank Engines." By John Watt.

A letter from Mr. Watt was read on the economy produced by working steam in large steam engines expansively, in which the author details the result of some experiments on a high pressure engine, employed for blowing furnaces. The steam cylinder of the engine in question was 38 inches in diameter, the blowing cylinder 122 inches, length of stroke 9 feet, pressure on the piston 41 lbs., and in the boiler 45 lbs. per square inch, the number of strokes about 12 per minute, and the pillar of blast 2½. A large fly-wheel was attached, and on fitting the steam engine with an expansive apparatus and cutting off at half stroke, the performance was greater than at any previous time, with a saving of 25 per cent. of fuel. The author refers this to the fact, that all the moving parts, with the exception of the fly-wheel, are brought to a state of rest at the conclusion of each stroke, and that if the steam be allowed to enter throughout the whole length of the stroke, the piston will have to draw from the fly-wheel momentum sufficient to overcome its own momentum, and to alter the direction of its reciprocating parts; but the steam being cut off so that the momentum be destroyed by the time the piston terminates its stroke, the return stroke will be commenced without checking the unnecessary impetus which exists when the steam is admitted to the end of the stroke. Thus it is observed, that engines working expansively pass the centres more easily than when working full pressure throughout the stroke. The momentum which has to be destroyed is created at the expenditure of more than half a cylinder full of steam; and the checking this motion is also accompanied by a still further waste of steam. Mr. Watt had altered an engine driving rolls for rolling iron, and the result of cutting off at half stroke was here also attended with a saving of 25 per cent. of fuel.

March 5.—The President in the chair.

The following gentlemen were elected:—Thomas Chalmers, Andrew Burn, as Graduates; and John William Lubbock, as an Honorary Member.

"On the Comparison between the power of Locomotive Engines, and the effect produced by that power at different velocities." By Professor Barlow, Hon. M. Inst. C. E.

In this paper the author does not attempt to explain an exact method for computing the power of locomotive engines, but only one tolerably approximate. The method he pursues is this:—"If we know experimentally the number of cubic feet of water evaporated in any given time by an engine, the space passed over in that time, the length of stroke and the capacity of the cylinder, we hence know how many cubic feet of steam have been employed, and, consequently, the mean number of cubic feet of steam produced from one cubic foot of water: hence, again, by experiments that have been made by different writers upon the power of steam, we know the pressure per inch on the piston, and then making due allowance for the resistance of the atmosphere on the piston, the friction of the engine-gear, &c., we have left the force that ought to be effective. And this being reduced to the circumference of the wheel, it should be equal to the resistance opposed by the load, which, on a level plane, consists of axle friction, road resistance, and the resistance of the atmosphere to the engine and carriages. But this is assuming a perfect action to the engine without any waste, which, though much to be desired, is certainly seldom the case." The author then goes on to select some experiments from those made on the North Star and Harvey engines, as reported by Mr. Wood to the Directors of the Great Western Railway. He also gives such columns from Mr. Wood's Tables as are requisite, together with additional columns resulting from the computations above indicated. And after treating upon these at some length, he concludes his paper by making a few observations on the effect of gradients.

"The Description of a Floating Clough." By George Ellis, Associate Inst. C. E.

This machine was used for scouring a channel which leads from the Winestead Drainage and Haven of Patrington into the River Humber. It was constructed in the following manner:—The frame is made of timbers, 6 inches by 4, 12 feet long, 9 wide, and 6 deep. This frame is covered with planking, two inches thick, and through the middle of it a culvert is formed, with planks 2 feet 6 inches in width, with a small lifting door at the end. Connected with the bottom and projecting in front are two long beams called feelers, which keep the machine in its course; at the bottom in front are frames of wood, shod with rough iron like the teeth of a saw, and these are connected with racks which can be raised by a lever. At each side of the machine there is a wing which is made to fit the slope of the banks, to dress the mud from the sides and to keep up the water behind the machine.

At high tide the machine is moored in the middle of the channel, the wings are extended and kept so by ropes, and when the tide is at half ebb the plugs are taken out, and the water rises about 2 feet in the machine, which causes it to sink; the plugs are then replaced, and thus it remains till full ebb, when the iron shod frames are let down in front and the tide forces the whole machine, which is like a great dam, gently down the stream, scraping with it all the mud down to the river, where it is emptied, and floated back with the return tide, the whole distance, about 3 miles, is performed in two hours.

A similar machine has appeared in the 2nd vol. of the "Transactions of the Institution of Civil Engineers," p. 181; only the former was used for a drain, and the latter for navigable rivers.

March 12.—The PRESIDENT in the chair.

The following gentlemen were elected:—Philip Benjamin Scott, as a Graduate; Thomas Cubitt, Samuel Enys, and Robert Mallett, as Associates.

"A description of the Rhymney Ironworks," accompanied with a "Drawing of the Puddling Forge and Mill," from Mr. Richards.

These works were erected by the author for the Rhymney Iron Company; and he describes the various processes necessary for converting refined metal into finished iron. He states that each furnace receives 4¼ cwt. of refined metal as a charge, which is worked into six puddled balls in about a half an hour. These balls are then taken to a shingling hammer, weighing about 4½ tons, with a fall of 20 inches, and the balls are subjected to about twenty-five blows. Instead of this process the balls might be taken to the squeezer, but this method is not so effectual in removing the impurities of the iron; it is then passed to the puddling rolls, where it is gradually reduced to the required size, when it becomes puddled bars. These are then, whilst hot, cut into lengths, and subsequently piled into weights and sizes according to the description of the iron that is about to be rolled. The piles are then brought to a welding heat in heating furnaces, and passed through roughing rolls, till they are reduced sufficiently to go through the finishing rolls, where they are made into bars of the description required. The same operation of shearing, piling, and heating of these bars, and rolling through other rolls forms the railway bars.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

At an ordinary general meeting of the members, held on Monday, the 4th of March, 1839, P. F. Robinson, V. P., in the chair, the following gentleman was elected an associate:—George Ward, of 22, Penton-place, Pentonville.

The report of the Council respecting the adjudication of the medals for the prize essays was read.

Resolved,—That the recommendation of the Council be approved, and that Medals of Merit be awarded to the authors of the papers with the mottoes "Roma fuit," and "Respice ad Palatinum montem vasta rudera."

The letters, bearing the mottoes of the successful candidates, having been opened, the authors appeared to be as follows:—

William Willmer Pocock, Associate of the Essay with the motto "Roma fuit."—Edward Hall, 12, Brown-street, Manchester, of the Essay with the motto "Respice ad Palatinum montem vasta rudera."

The following papers were read:—Description of various specimens of metal sash-bars, manufactured by Mr. Clarke, of Lionel-street, Birmingham; forwarded by Mr. Jones.—Description of a superior quality of crown glass, manufactured by Messrs. Stock and Co., Birmingham.—Description of various sorts of stone used for building purposes in Belgium, by Mons. Serrure, Hon. and Cor. Mem.—Description of double gateway to the city of Pæstum, with a restoration and remarks illustrative of the military architecture of the Greeks, by T. L. Donaldson, Hon. Sec.

Mr. Donaldson read the following extract from a letter he received from Mr. Charles H. Gregory, engaged on the Manchester and Birmingham Railway.

Manchester lies nearly at the north of the red sand-stone district. In the immediate neighbourhood, on the north side, we come into the coal-beds and carboniferous limestone; on the west the sand-stone is continued throughout the greater part of Cheshire to Flint, where we pass through strata of limestone to the clay slate; on the east side, 10 or 12 miles bring us to the borders of Yorkshire and Derbyshire, and to that ridge of moor-hills which has been termed "The Backbone of England;" it is here that the summit-stones are obtained, being a strong grit, and the best building stones for ordinary purposes used in Manchester. The best of the summit stones for strength and durability comes from the Blackstone-Edge Quarries. This stone much resembles the Bramley Fall stone, and will bear nearly as much. The Saddleworth stone is another of the summit stones, but the quarry is not half worked, so that it cannot be so well trusted as the Blackstone Edge. The price of the summit stone at Manchester is from 10*d.* to 1*s.* per foot. Another stone, much used here for Ashlar work, is a red sand stone, obtained at Runcorn, on the Mersey, a few miles from Warrington. The Runcorn stone is rather cheaper than the summit stone (I think it is sold at 6*d.* per foot at the quarries); it works well, but there is a great deal of waste, the stone abounding in clay spots. For cornices, mouldings, &c., where much work is to be put on the stone, the Huddersfield stone is the best suited. This is a very fine sand stone, approaching in texture to the Yorkshire landings—it is very free, and good for tooling; it costs 1*s.* 6*d.* per foot here.

We leave Manchester (on the Manchester and Leeds Railway) by a viaduct, for about 1¼ mile in length; for a considerable part of this distance the piers are now up and the imposts laid, waiting for the spring weather before the arches are turned. In the midst of this viaduct there is to be one skew bridge of iron, of about 130 feet span (if I remember rightly).—The next large work along the line is the Stockport Viaduct, about 100 feet high in the highest part, and rather more than one-third of a mile long. The foundations are now being excavated for this work, and it will probably be in active operation in about a month's time.—The viaduct at Congleton will be a still larger work, and is to me more interesting, as I have been actively employed in the preparation of it. The length will be 3,078 feet, the greatest height to the rails 98 feet 6 inches; it consists of 42 arches of 60 feet span, each with piers 10 feet in thickness between them. It will contain about 62,000 cubic yards of brickwork, and 620,000 cubic feet of stone. I do not remember the precise amount at which it is contracted for, but I think it is about £113,000.

Monday, March 18th, 1839, P. F. Robinson, V. P., in the Chair. The meeting proceeded to the ballot for the removal of Sampson Kempthorne, Associate to the class of Fellows, who was declared to be unanimously elected.

A letter was read from the Signor Gaetuxo Beria, of Milan, acknowledging his election as honorary and corresponding member. Also from the S or Atberllolli, of the same place, and from the Signor Klangabe, Secretary of the Archæological Society at Athens.

It was announced by the Secretary that a copy of Professor Phillips's work on Geology, published in Dr. Lardner's Cabinet Cyclopædia, 2 vols., 8vo., would be presented by a member to the most ample and accurate abstract of the course by any associate or student.

The first of a *Course of Six Lectures on the Geology of the South East of England*, was then commenced by G. F. RICHARDSON, ESQ., of the British Museum, whose able treatment of the subject was admirably supported by the elegance of his style and the harmony of his delivery. The illustrations were most effective, and among them were a series of drawings of the caves of Adelsberg, near Trieste, which had never before been seen in England.

"Geology," said he, "is a science interesting because it is new, and as Columbus excited the strongest sensations in the old world, by discovering to them the new, so in our days we have, as it were, laid open to us a new creation in the re-discovery of the old. This science has been frequently defined, but never perhaps to sufficient extent, for it is a science which is not restricted to a few objects, but considers the past, the present, and the future, the living and the dead, the whole organic and the inorganic world. It may be divided into dynamical portions, or geology proper, which considers the operation of forces; and palæontology, or the natural history of the antediluvian era."

Geology is a science, which, while too many regard it as merely speculative, is a science of the highest practical utility,—one equally important in mining, agriculture, and the arts. It is by the character of the strata that we determine their mineral deposits, as in granite we find tin, in the transition series lead, and in the alluvial gold; so we have equally pointed out to us the positions, in which, as they are destitute of productions, research would be fruitless. Inattention to these has been too often attended with vexation and loss; and in one instance, within his own experience, the lecturer stated that the late Duchess of Dorset was induced to expend £10,000 in the useless attempt to find coal at Bexhill, in Sussex, although, now, any geologist could have told that the exertion would be as abortive as it is absurd. We regret that, from misconception, Mr. Richardson, in endeavouring to inculcate the utility of a Government school of mines, as on the Continent, stigmatized our present mining operations as the suggestions of avarice and ignorance, for the vilest purposes of jobbery, instead of recognising the wonderful power of that great principle which has enabled Joint Stock Companies to place England in a prouder position, as a mining country, than any of her neighbours, and which, not contented with the native field, has sought a new theatre of exertion across the great Atlantic deep. The importance of geology in determining the productiveness of soils is of paramount utility, and intervenes in all operations in draining; by attending to the fissures in the strata, if they are of a porous nature, we may, by directing branch-channels into them, save more extensive operations; while we can ascertain if the strata be impervious, by observing whether they abound in land-springs. The subject of Artesian wells is one of great interest in this particular district, and it is well deserving of attention in many places, whenever, in seasons of drought, numbers of cattle perish from the want of the great necessary of life. In road-making, in the vicinity of London, we had long pursued an erroneous course, by employing gravel and round pebbles, until, under M'Adam's direction, the use of angular stones was introduced, and new road-materials were furnished from the trap-rocks of Leicestershire.

On the profession, before which this lecture was delivered geology has a particular claim; for is it not from a neglect of its precepts that buildings erected only two centuries ago are severely injured by the weather! This arises from using a calcareous sand-stone, which, imbibing moisture, is decomposed by the agency of the carbonic acid in rain water; while the use of granite is not free from the same defects, the felspar, one of its ingredients, being an equally perishable material: in fact, it is only such stones as siliceous sandstone, which are capable of resisting that insinuating destroyer. The legislature has indeed recognised this connexion of geology with architecture, by sending Mr. de la Beche on a mission through the stone-producing districts of England, to ascertain which possesses the best stone, for the construction of the new Houses of Parliament. The sculptor is also interested in the qualities and durability of his material, and many are both the modern and ancient statues polluted by the iron stain, which spots some of the finest works. The painter cannot disregard this science with impunity; for what can be more improper, than in the representation of some historical event in the undulating scenery of the south of England, as the signing of Magna Charta, or the imprisonment of Charles I., to see it accompanied with the sharp peaks and straggling rocks of the primary or transition strata? A literary friend, a lady of some celebrity, had committed this error; she had described in one of her works the Isle of Sheppey, with the fanciful attributes of chalky cliffs and whitened walls; but, having occasion subsequently to visit it, what was her astonishment to see none of the things she had represented, but only shores bordered with mud! Nor, in its general relations, is geology less attractive than in its physical utility, for most truly does it show us the omnipotence of the Creator, and teaches us to find sermons in stones, and good in every thing. To the architect the whole world offers the contemplation of a kindred work, one mighty temple, reared by Nature to her great Creator: its details beautiful as they are regular; its grandeur towering to the clouds, and its chambers replete with all that can be useful to the favoured people who inhabit it; in truth, a worthy monument of the Great Architect.

In giving a limited sketch of geology, it is impossible to embrace the whole science, and indeed lectures may more truly be regarded as incentives to study, than as supplying the place of study itself. A geologist is indeed called upon to narrate, in the narrow space of an hour, revolutions of centuries, and the history of a million years. He is, in truth, like a traveller carried at railway speed through a delightful country, and has only time to enumerate the objects which he cannot describe.

In nature, as in revelation, all is regular, all is systematic, and every apparent divergence serves only to confirm the wonderful provisions of the whole. The dislocations which occur in strata, so far from being produced by confusion or blind chance, are purposely placed, like magazines, to supply us with the riches of the mineral world; and here we have stored up resources which otherwise would have been sunk far beneath our means of search. The terms used in geology, however difficult they may appear in name, are perfectly simple in their explanation; as, when we use the term *anticlinal strata*, we only express that formation which resembles the ridge made by the roof of a house. Many of these terms have no existence in nature, but are employed, as in other sciences, to assist the imperfection of our mental powers; thus—we say primary, transitive, secondary strata, as in music we use bars to mark the time, without any reference to the existence of such in the execution of the piece. Geology, however, is a science in which, like astronomy, we must doubt the evidence of our senses, and perpetually expect results for which on first impressions we are unprepared; like as in that we are taught that the sun, apparently ever moving, is yet a stationary globe, so here we are told that what was once land is now sea, and that the firm ground on which we stand was floated over by the monsters of the deep; that the hard and ponderous rock was once as soft and yielding as the quicksand; and that the very stones before us in former days walked the wind as things of life. The inquirer into geology finds himself like Aladdin in the cave; at first the rocks seem to close around him and shut out all hope, but no sooner has he gained the talisman of science, than a fairy land of wonder breaks upon his view. To the man of the world no science can be more practically useful, to the philosopher nothing more agreeable, and to the Christian nothing more satisfactory; for here he finds the fleeting existence of man chronicled as surely as in holy writ, and here he sees the eternity of the Great Creator, when he witnesses the successive destruction of rocks that almost seem to outvie time, and powers that seem as they could conquer it.

Monday, March 25th.—H. J. Robinson, Esq., V.P., in the chair.

Mr. Richardson gave his second lecture on Geology, in which he considered the rocks with reference to their zoological relations, and their adaptation to the necessities of mankind. The lecturer commenced by recapitulating the topics of his introductory discourse, and enforcing the definition of geology as a science which requires the investigation of every branch of organic and inorganic nature, which in the extent of its disquisitions is occupied with the past, the present, and the future. He again recalled its moral tendency, the manner in which it proves the perishability of matter, by showing the successive decay of every substance on the surface of the earth, and the powerful lesson which it teaches us of referring everything to its first cause, and looking to the great Creator as alone immutable, eternal, imperishable.

The greater portion of the crust of the earth, and the secondary and tertiary portions in particular, Mr. Richardson showed not only to be derived from the destruction of previous bodies, but absolutely from living beings. These remains are not confined to the gigantic relics which strike every eye, but they are to be traced in those minute organizations which are scarcely recognizable even by the microscope. Piles of rocks, beyond calculation and imagination, are formed by the infusorial insects and the coral tribes, and, as if to show the vastness of his power, it is by means of these tiny labourers that the Almighty has called into existence his most magnificent works. The pebble that we hold in our hands may once have lived in a thousand breathing forms, and seen the history of centuries; and, as Young says,—

"Where is the dust that was not once alive?"

The very rocks that now upheave their crests to heaven, once crawled in earliest forms upon the earth, and from insects which we should crush in the height of our fancied power, a greater Being has devoted to fabricate his nobler monuments. Even the primary rocks themselves have not been supposed to be exempt from the alloy of animal remains; and the observations of the Rev. Mr. Reade, of Clapham, have induced him to suspect their presence in mica and opal of porphyry. In mica he has perceived, by his microscope, annular or ringlike impressions, which he cannot but refer to the remains of infusoria, although, from the constitution of primary rocks, crystalized by heat to their minutest molecules, this result has been doubted by many. To the microscope, however, we must look for the elucidation of this subject, and even when we are far from having availed ourselves of its present powers, we may look forward to a period when it will have attained a greater perfection, while only recently its powers have been augmented 50 per cent.

In the primary rocks no well-defined organic remains appear, and it is not until we came to trilobitic schist that we obtain satisfactory testimony of their presence. This stone derives its name from the trilobite, an animal of the crustaceous tribe, most nearly allied to the king-crab, and which is chiefly remarkable for the beautiful structure of its eye. This organ, which has 3 or 400 lenses, Dr. Buckland, in his "Bridgewater Treatise," has adduced to prove the similarity of constitution between the atmosphere and ocean of the ancient world and that which now exists, proving that it has remained unaltered in its properties in all the immensity of time. The secondary rocks are indeed most important in their zoological character, and here it is that we meet those anomalous animals, the ichthyosaur, or fish-lizard, and its ally the plesiosaur. In the oolite, which is most important for its constructive uses, we find the megalosaur, or great lizard, shells, ammonites and other vestiges of its marine formation. It is from this class of rocks that we obtain Freestone, Bathstone, and Portlandstone. In the Wealden formation which succeeds it we find many interesting features. The Sussex marble is formed almost exclusively of snail shells, such as lived in the great river of which the Weald district was once the bed. This marble affords some most beautiful columns to Chichester Cathedral, and it is the material of which the archbishop's throne at Canterbury is formed. To the same class also belongs Purbeckstone. We now come to the chalk which is the boundary of the secondary formation, and is distinguished by the presence of the spirolimite, a microscopic shell, allied to the nautilus and the argonaut, for the discovery of which we are indebted to that eminent philosopher and amiable man the Marquis of Northampton, President of the Royal Society, who was present at the previous lecture. In the tertiary strata we find vestiges of the marine and freshwater animals which formerly inhabited the site of these deposits, and no district is more interesting than the London clay. In this and in the freshwater rocks of the Isle of Wight we find the nummulite, so called from its resemblance to a Roman coin, and it is of stone formed of this shell that the great Pyramid of Gizeh is constructed. Strabo noticed the appearance of this shell, and he attributed it to the remains of the lentils on which the workmen fed, and which he supposed, having been thrown on the spot, had been petrified. This nummulitic rock is one of the latest formations, and yet, as if to stamp man a parvenu on the earth of which he boasts himself master, the earliest of his works are but nature's last.

Having thus exhibited the manner in which the zoology of a rock demonstrates its character, the lecturer proceeded to illustrate the application of geology to the practice of construction. He truly observed, that this science, by showing the advantages and defects of strata, became of the highest importance to the architect and the engineer. It would be absurd, he said, for him, to teach architecture to architects; but, while on this subject, he might perhaps be permitted to make one cursory allusion bearing on this subject. In the 14th chapter of Leviticus, from the middle to the end of the chapter, there are some curious provisions, not generally observed, with regard to the leprosy of a house, as derived from defects in its position or construction, and showing the attention which the inspired legislator devoted even to this subject. With regard to the influence of strata upon foundations, he supposed those points to be well known; and as time did not admit a longer detail, he must run cursorily over some few points which he should have wished to have given at greater length. Rocks, he remarked, are divided into two great classes from their origin—the igneous from fire, and the aqueous from water or slate; and the different kinds of useful stone range from the primary strata upwards through every gradation—from primary limestone to slate, sandstone, magnesian limestone, and oolite. The main qualities for a good building stone are firmness and consistency, and one of the best empirical rules by which an architect can judge of the stone of a district is by observing its oldest buildings, which, if affected by the weather, are principally injured on its north and west sides. The best way to ensure the greatest degree of resistance in a stone is to place it in the same way as it is in the quarry, that is, horizontally; and this is particularly necessary in laminated strata and those of the tertiary formation, of which most of the buildings in Paris are constructed. Argillaceous limestong also, which comes soft from the quarry, and hardens afterwards, requires reat care and attention. Stones of unequal colour, spotted, or veined, arenot so strong as those of uniform colour, and should be avoided, as they are dangerous; and sometimes, as in the case of arches, one stone of this description will, from its failure, ruin the whole work. Spots of oxide of iron or of manganese are equally bad omens, as the stones on which they exist are liable to action from the weather. Argillaceous stones generally contain mica, and this is so susceptible of wet, as greatly to deteriorate from their qualities. Brown or black stones generally exfoliate in laminæ, from their ready absorption of moisture, so that they should only be used in places under cover, where they are secure from this dangerous agent. Moisture, indeed, from the compactness of its atoms when frozen, injures stones apparently of the strongest constitutions, and this is the weak side of granites, syenite, porphyry, and breccia, which frequently, from this cause, exhibit fissures. Stones, therefore, which are to be used above the surface, should not be of moist tendency, but such should be reserved for subterranean purposes. The consequence of absorption of moisture, as before observed, is liability to injury from frost; and, to ascertain this susceptibility, one of the simplest methods is to allow a piece of the stone to remain in water, and then to weigh it, to find out the quantity imbibed. Another method recently introduced is to take a small cube of stone, dip it in a solution of some salt, and then to hang it for a few days over the vessel containing the salt, so as to allow the salt to crystallize on its surface; this process is to be repeated for five days, and then, if the stone be good, no sand or fragments of the stone will be discoverable in the solution; but if it be liable to injury from frost, then corners of the cube or sand will be deposited in the vessel over which it hung. Wet stones, when brought from the quarry, should be dried, because it is found that the mortar will not adhere to them, and that if the stone be wet it will always remain so. Stones should also be left for twelve months before they are used, in order to see in what manner they are affected.

Granite formed of mica, felspar, and quartz, is liable, from its first constituent, to destruction by weather, although it is a material susceptible of the highest uses. Not to speak of the many magnificent works formed from this material in Egypt, we have noble specimens in Waterloo Bridge, and the King's Library in the Museum, in which latter four columns of Aberdeen granite cost each 1,500*l*., or 16,000*l*. for the set. Syenite is composed of the same constituents as granite, with the substitution, however, of hornblende for mica, and derives its name from the city of Syene, in Egypt, by the people of which it was much used. Gneiss is a slaty granite, and is, from this definition, not very useful. Quartz is principally adapted for subterranean localities, and is used for foundations. Porphyry was used most extensively by the Egyptians, and so was the striped stone called serpentine, of which even cups and vases were formed. The volcanic rocks are divided into basaltic and trachitic; the basaltic contain a portion of iron, and are used for fortifications, and also in the Cathedral of Cologne; the trachitic rocks are also used most extensively on the banks of the Rhine, even for the purpose of milestones. Of the white marble of the lias formation—that treasure of the British Museum—the Birth of St. John, by Albert Durer, is executed.

It seems as if, by Divine interposition, the very arrangement of the strata is made conducive to human convenience and advantage; from the primary and transition strata we derive our hardest materials, and from the secondary and tertiary, our limes and cements. All, indeed, leads us upwards to the Deity, through Nature to Nature's God; and our investigation of his glorious works is one of the best acknowledgments we can make of his power and love, and of the manner in which he has devoted the most wonderful agencies to be blessings to us during our stay on earth.

ARCHITECTURAL SOCIETY.

The following donations were announced:—

Milner's Treatise on Ecclesiastical Architecture in England, by H. Roper, Esq.

Chapman's Observations on Canal Navigation, by H. Roper, Esq.

Voyage Pittoresque ———— dans le Province d' Yucatan, par Frederick de Waldeck, by William Tite, Esq., President.

Letter to Lady Duncannon, by Thomas Hopper, Esq.

Sir Edward Cust's Pamphlet, by Thomas Hopper, Esq.

Mr. Brayley delivered a lecture "On the Chemical History of Cements, and of the Artificial Substances employed as Substitutes for Stone," being the third of a course now in progress of delivery.

The Chairman announced "That the next public meeting of the Society would be held on Tuesday evening, the 9th April, when Mr. Brayley would deliver his fourth and concluding lecture. The subject to be "On these physical and chemical properties of Building Stones on which their use essentially depends."

That the meeting to be held on the 23d April would be a public meeting for the introduction of visitors, and that Mr. Jeffreys, the inventor of a new grate for effectually warming rooms, &c. would read a paper "On the Warming and Ventilating of Rooms."

THE MANCHESTER ARCHITECTURAL SOCIETY'S CONVERSAZIONE.

The first conversazione of this society, in the present season, was held on Wednesday evening, the 6th ultimo, when the new rooms of the society, No. 24, Cooper-street, were opened. Mr. Andrew Hall, who had recently been elected president of the society, took the chair, and congratulated the members on their assembling together in their new apartments, under favourable circumstances. Mr. J. W. Hance, honorary secretary, stated that the rooms would, in future, be open from nine in the morning to seven in the evening, for studying from casts; and that the library would be accessible, from seven to nine o'clock, every Wednesday and Saturday evening. He had also great pleasure in adverting to a circumstance, highly gratifying to the society, and honourable to the individual to whom he was about to refer. A letter had been received from Mr. Thomas L. Donaldson, honorary secretary of the Royal Institute of British Architects, stating that the council of that body had awarded their medal to a member of this society, for his successful essay. Mr. Hance then read the following letter, addressed to Mr. Edward Hall (applause):—

"5th March, 1839.

"Sir,—I have the honour to inform you, that, the council having made their report upon the essays sent in for the medal of the institute, at the ordinary meeting, held last evening, the members awarded to you the medal of merit, for the essay bearing the motto,—'*Respice ad Palatinam Montem—vasta rudera.*' I shall communicate to you the day appointed for the distribution of the medals as soon as the council have appointed the time, which will probably be shortly.—Believe me, sir, very faithfully yours,

"THOS. L. DONALDSON, Honorary Secretary."

The subject and title of the essay, as fixed by the British Institute, is "An analytical investigation of the peculiar characteristics, in design and construction, which distinguished Roman from Grecian architecture, with particular reference to ancient Roman examples." Mr. Hance added that Mr. Hall, who was present, was, as they were all aware, a very young man; and he (Mr. Hance) trusted that his merit and success would stimulate others. He hoped that this society would in time be enabled to offer honorary rewards for drawings and essays; the council had wished to do so, but they felt that their exertions must first be directed to settling the society in their new premises. The chairman briefly acknowledged the kind wishes expressed towards his son, of whose success he had only heard a few hours before, on his own return from Ireland. Mr. Hance next expressed the pleasure of the society at the presence, for the first time, of resident artists. It would be seen by the walls that the conversazione was not limited to architectural subjects; and it was intended to place works of art, generally of standard merit, on the walls and tables, without distinction or reserve. He expressed his regret that another series of conversazione had fallen into disuse, and the hope that, with the aid and support of artists and amateurs, those of this society, proposed to be held quarterly, would assume a rank creditable to all parties. In conclusion he expressed the thanks of the society to Mr. Andrew Hall, its president, for his kind interest in and attention to its welfare. The greater part of the evening was agreeably spent by the members and visitors, in looking at the drawings and works of art upon the walls and tables. Mr. R. Tattersall contributed several interiors of halls, library, &c. and designs for a church, and for a club house. Mr. J. W. Hance had drawings of the pump-room at Cheltenham, the hall of the Manchester Royal Institution, a design for a new post-office, exchange, bank, and other public offices (which, it was stated, was about to be published), and a design for a picture gallery. Mr. J. W. Fraser contributed a number of pleasing landscapes in oil, and drawings; Mr. T. W. Atkinson, an interior of Sefton church, and an architectural design. Mr. Horner sent a large oil painting decoration for a room, and there was another very fine decorative piece in a new style. Mr. J. C. Grundy contributed a number of paintings and drawings, amongst which we noticed a fine landscape by Carmichael; and Mr. Agnew also sent some. There was a very neat isometrical view of Hardwick Hall, Derbyshire (a seat of the Duke of Devonshire), contributed by Mr. C. J. Julott. Mr. E. Corbett sent an elevation for a bank at Liverpool. There was a very good full-length portrait in oil, small size, of Mr. C. A. Duval, artist, painted by himself; and we noticed a pretty little oil-painting of a village inn, by Chester. Mr. Calvert and other artists also sent water-colour drawings; and the collection generally was a very pleasing one. On the tables were various portfolios of engravings, illustrated books on art, including Richardson's Illustrations of the Architecture of Elizabeth and James I.; Flaxman's designs; Robert's Spain and Morocco; Stansfield's sketches, &c., &c. Mr. J. E. Bowman placed on the table a number of the photogenic drawings of ferns, lace, &c. and a copy produced by this newly-discovered means, from a small copper-plate engraving. In conclusion, we are happy to state, that every one present at this very agreeable conversazione seemed to be highly gratified with the objects of interest provided for their inspection.—*Manchester Guardian.*

ROYAL SOCIETY.

Feb. 28.—Observations on the Parallel Roads of Glen Roy and of other parts of Lochabar, with an attempt to prove that they are of marine origin. By Charles Darwin, Esq., M.A.

The author premises a brief description of the parallel roads, shelves, or lines, as they have been indefinitely called, which are most conspicuous in Glen Roy and the neighbouring valleys, referring for more detailed accounts to those given by Sir Thomas Dick Lauder, in the Transactions of the Royal Society of Edinburgh, and by Dr. M'Culloch, in those of the Geological Society of London. Both these geologists endeavour to explain the formation of these shelves, on the hypothesis of their resulting from depositions of the margin of lakes, which had formerly existed at those levels. The author however shows that this hypothesis is inadmissible, from the insuperable difficulties opposed to any conceivable mode of the construction and removal, at successive periods, of several barriers of immense size, whether placed at the mouths of the separate glens or at more distant points. He does not, however, propose the alternative that the beaches, if not deposited by lakes, must of necessity have been formed by channels of the sea, because he deems it more satisfactory to prove, from independent phenomena, that a sheet of water, gradually subsiding from the height of the upper shelves to the present level of the sea, occupied for long periods, not only the Glens of Lochabar, but the greater number, if not all, the valleys of that part of Scotland, and that this water must have been that of the sea. It is argued by the author, that the fluctuating element must have been the land, from the ascertained fact of the land rising in one part, and at the same time sinking in another; and therefore, that this change of level in Scotland, attested as it is by marine remains being found at considerable heights both on the eastern and western coasts, implies the elevation of the land, and not the subsidence of the surrounding waters. The author next shows that in all prolonged upward movements of this kind, it might be predicted, both from the analogy of volcanic action and from the occurrence of lines of escarpment, rising one above the other in certain regions, that, in the action of the subterranean impulses, there would be intervals of rest. On the hypothesis that the land was subjected to these conditions, it appears that its surface would have been modelled in a manner exactly similar, even in its minute details, to the existing structure of the valleys in Lochabar. Considering that he has thus established his theory, the author proceeds to remove the objections which might be urged against its truth, derived from the non-extension of the shelves, and the absence of organic remains at great altitudes. He then shows how various details respecting the structure of the Glens of Lochabar, such as the extent of corrosion of the solid rock, the quantity of shingle, the numerous levels at which water must have remained, the forms of the heads of the valley, where the streams divide, and especially their relation with the shelves, and the succession of terraces near the mouth of Glen Spean, are all explicable on the supposition that the valleys had become occupied by arms of a sea which had been subject to tides, and which had gradually subsided during the rising of the land; two conditions which could not be fulfilled in any lake. From the attentive consideration bestowed by the author on these several and independent steps of the argument, he regards the truth of the theory of the marine origin of the parallel roads of Lochabar—a theory of which the foundation-stone may be said to have been laid by the important geological researches of Mr. Lyell, establishing the facts of continents having slowly emerged from beneath the sea—as being sufficiently demonstrated. The author states, in the concluding part of his paper, the following as being the chief points which receive illustration from the examination of the district of Lochabar by Sir Thomas Dick Lauder, Dr. M'Culloch, and himself. It appears that nearly the whole of the water-worn materials in the valleys of this part of Scotland were left, as they now exist, by the slowly retiring waters of the sea; and the principal action of the rivers since that period has been to remove such deposits; and, when this had been effected, to excavate a wall-sided gorge in the solid rock. Throughout this entire district, every main, and most of the lesser inequalities of surface are due, primarily, to the elevating forces, and, secondarily, to the modelling power of successive beach-lines. The ordinary alluvial action has been exceedingly insignificant, and even moderately sized streams have worn much less deeply into the solid rock than might have been anticipated, during the vast period which must have elapsed since the sea was on a level with the upper shelves: even the steep slopes of turf over large spaces, and the bare surface of certain rocks, having been perfectly preserved during the same lapse of time. The elevation of this part of Scotland, to the amount of at least 1,278 feet, was extremely gradual, and was interrupted by long intervals of rest. It took place either during the so-called "erratic block period," or afterwards; and it is probable that the erratic blocks were transported during the quiet formation of the shelves. One of these was found at an altitude of 2,200 feet above the present level of the sea. The most extraordinary fact is, that a large tract of country was elevated to a great height, so equably, that the ancient beach-lines retain the same curvature, or nearly so, which they had when forming the margin of the convex surface of the ancient waters. The inferences drawn by the author from these facts, and which he corroborates by other evidence, are, that a large area must have been uplifted, and that its rise was effected by a slight change in the convex form of the fluid matter on which the crust of the earth rests: and therefore that the fluidity of the former is sufficiently perfect to allow of the atoms moving in obedience to the law of gravitation, and consequently of the operation of that law modified by the centrifugal force: and lastly, that even the disturbing forces do not tend to give to the earth a figure widely different from that of a spheroid in equilibrium.

March 7.—The Marquis of NORTHAMPTON, PRESIDENT, in the chair.

George Gulliver, Esq., and George Godwin, junior, Esq., were elected Fellows.

The following papers were read:—

1. *Researches in Physical Geology, Third Series,* '*On the Phenomena of Precession and Nutation, assuming the interior of the earth to be a heterogeneous fluid,*' by W. HOPKINS, Esq. M.A.

Having, in his last memoir, completed the investigation of the amount of precession and nutation, on the hypothesis of the earth's consisting of a homogeneous fluid mass contained in a homogeneous solid shell, the author here extends the inquiry to the case in which both the interior fluid and external shell are considered as heterogeneous. After giving the details of his analytical investigation, he remarks that he commenced the inquiry in the expectation that the solution of this problem would lead to results different from those previously obtained, on the hypothesis of the earth's entire solidity. This expectation was founded on the great difference existing between the direct action of a force on a solid, and that on a fluid mass, in its tendency to produce a rotatory motion; for, in fact, the disturbing forces of the sun and moon do not tend to produce directly any motion in the interior fluid, in which the rotatory motion causing precession and nutation is produced indirectly by the effect of the same forces on the position of the solid shell. A modification is thus produced in the effects of the centrifugal force, which exactly compensates for the want of any direct effect from the action of the disturbing forces; a compensation which the author considers as scarcely less curious than many others already recognized in the solar system, and by which, amidst many conflicting causes, its harmony and permanence are so beautifully and wonderfully preserved. The solution of the problem obtained by the author destroys the force of an argument, which might have been urged against the hypothesis of central fluidity, founded on the presumed improbability of our being able to account for the phenomena of precession and nutation on this hypothesis, as satisfactorily as on that of internal solidity. The object, however, of physical researches of this kind, is not merely to determine the actual state of the globe, but also to trace its past history, through that succession of ages in which the matter composing it has probably passed gradually through all the stages between a simple elementary state to that in which it has become adapted to the habitation of man. In this point of view the author conceives the problem he proposes is not without value, as demonstrating an important fact in the history of the earth, presuming its solidification to have begun at the surface—namely, the permanence of the inclination of its axis of rotation, from the epoch of the first formation of an exterior crust. This permanence has frequently been insisted on, and is highly important as connected with the speculations of the author on the causes of that change of temperature which has probably taken place in the higher latitudes; all previous proofs of this fact having rested on the assumption of the earth's entire solidity, an assumption which, whatever may be the actual state of our planet, can never be admitted as applicable to it at all past epochs of time, at which it may have been the habitation of animate beings. The author concludes by expressing a hope that he may be enabled to prosecute the inquiry still further, and to bring before the Royal Society, at a future time, the matured results of his speculations.

2. '*On the Male Organs of some of the Cartilaginous Fishes,*' by JOHN DAVY, M.D.

In this paper, which is wholly occupied with anatomical details, the author refers to his paper on the torpedo, which was published in the Philosophical Transactions for 1834; and also to Muller's work, 'De Glandularum Secernentium Structura Penitiori,' whose descriptions and views are not in accordance with those given in that paper. In the present memoir he adduces evidence of the accuracy of his former statements, and offers some conjectures respecting the functions of several organs found in cartilaginous fishes, but does not pretend to attach undue importance to his speculations.

March 14.—J. W. LUBBOCK, Esq., V.P. and Treas., in the chair.

G. W. Featherstonhaugh, Esq. was re-elected; and Clement Tudway Swanston, Esq. was elected a Fellow.

The following papers were read:—

1. '*An Experimental Inquiry into the Formation of Alkaline and Earthy Bodies, with reference to their Presence in Plants, the influence of Carbonic Acid in their Generation, and the equilibrium of this Gas in the Atmosphere;*' by ROBERT RIGG, Esq. Communicated by the Rev. J. B. Reade.

The object of the author in the present memoir is to show, that the solid materials which compose the residual matter in the analysis of vegetable substances, and which consist of alkaline and earthy bodies, are actually formed during the process of fermentation: whether that process be excited artificially by the addition of a small quantity of yeast to fermentable mixtures, or take place naturally in the course of vegetation, or of spontaneous decomposition. His experiments also tend to show, that this formation of alkaline and earthy bodies is always preceded by the absorption of carbonic acid, whether that acid be naturally formed, or artificially supplied. He finds, also, that different kinds of garden mould, some being calcareous, others siliceous, and others aluminous, exposed in retorts to atmospheres consisting of a mixture of carbonic acid gas and common air, absorbed large quantities of the former, combining with it in such a manner as not to afford any traces of this carbonic acid being disengaged by the action of other acids. He considers the result of this combination to be the formation of an alkaline body, and also of a colouring matter. This combination takes place to a greater extent during the night than during the day; and in general, the absorption of carbonic acid by the soil is greatest in proportion as it is more abundantly produced by the processes of vegetation; and conversely, that it is least at the time when plants decompose this gas, appropriating its basis to the purposes of their own system. Hence, he conceives, that there is established in nature, a remarkable compensating provision, which regulates the quantity of carbonic acid in the atmosphere, and renders its proportion constant.

2. '*Note on the Art of Photography, or the Application of the Chemical Rays of Light to the Purposes of Pictorial Representation,*' by Sir JOHN F. W. HERSCHEL, Bart.

The author states, that his attention was first called to the subject of M. Daguerre's concealed photographic processes, by a note from Capt. Beaufort, dated the 22nd of January last, at which time he was ignorant that it had been considered by Mr. Talbot, or by any one in this country. As an enigma to be solved, a variety of processes at once presented themselves, of which the most promising are the following:—First, the so-called de-oxidising power of the chemical rays in their action on recently-precipitated chloride of silver; secondly, the instant and copious precipitation of a mixture of a solution of muriate of platina and lime-water, by solar light, forming an insoluble compound, which might afterwards be blackened by a variety of agents: thirdly, the reduction of gold in contact with de-oxidising agents: and fourthly, the decomposition of an argentine compound, soluble in water exposed to light, in an atmosphere of peroxide of chlorine, either pure or diluted. Confining his attention, in the present notice, to the employment of chloride of silver, the author inquires into the methods by which the blackened traces can be preserved; which may be effected, he observes, by the application of any liquid capable of dissolving and washing off the unchanged chloride, but of leaving the reduced, or oxide of silver, untouched. These conditions are best fulfilled by the liquid hyposulphites. Pure water will fix the photograph, by washing out the nitrate of silver, but the tint of the picture resulting is brick-red; but the black colour may be restored, by washing it over with a weak solution of hyposulphite of ammonia. The author found that paper impregnated with the chloride of silver was only slightly susceptible to the influence of light; but an accidental observation led him to the discovery of other salts of silver, in which the acid, being more volatile, adheres to the base by a weak affinity, and which impart much greater sensibility to the paper on which they are applied—such as the carbonate the nitrate, and the acetate. The nitrate requires to be perfectly neutral; for the least excess of acid lowers, in a remarkable degree, its susceptibility. In the application of photographic processes to the copying of engravings or drawings, many precautions, and minute attention to a number of apparently trivial, but really important circumstances, are required to insure success. In the first transfers, both light and shadow, as well as right and left, are the reverse of the original; and to operate a second transfer, or by a double inversion to reproduce the original effect, is a matter of infinitely greater difficulty, and in which the author has only recently ascertained the cause of former failures, and the remedy to be applied. It was during the prosecution that these experiments that the author was led to notice some remarkable facts relating to the action of the chemical rays. He ascertained the contrary to the prevailing opinion: the chemical action of light is by no means proportional to the quantity of violet rays transmitted, or even to the general tendency of the tint to the violet end of the spectrum; and his experiments lead to the conclusion, that, in the same manner as media have been ascertained to have relations *sui generis* to the calorific rays, not regulated by their relations to the rays of illumination and of colour, they have also specific relations to the chemical spectrum, different from those they bear to the other kinds of spectra. For the successful prosecution of this curious investigation, the first step must consist in the minute examination of the chemical actions of all the parts of a pure spectrum, not formed by material prisms, and he points out, for that purpose, one formed in Frauenhofer's method, by the interference of the rays of light themselves in passing through gratings, and fixed by the heliostat. He notices a curious phenomenon respecting the action of light on nitrated paper; namely, its great increase of intensity under a certain kind of glass strongly pressed in contact with it—an effect which cannot be explained either by the reflection of light or the presence of moisture, but which may possibly be dependent on the evolution of heat. Twenty-three specimens of photographs made by Sir John Herschel accompany this paper; one a sketch of his telescope at Slough, fixed from its image in a lens, and the rest copies of engravings and drawings, some reverse, or first transfers, and others second transfers, or re-reversed pictures.

GEOLOGICAL SOCIETY.

Feb. 27.—The Rev. Dr. Buckland, President, in the Chair.

The following communications were read:—

1. "*On Impressions of Drops of Rain on Slabs of New Red Sandstone, in the Storeton Quarries, Cheshire, and coeval with the formation of the Strata,*" *by Mr. John Cunningham, of Liverpool.*—In a paper read before the Society on the 3rd of December, an account was given of the impressions of footsteps of several species of animals in the new red sandstone of the Storeton Quarries, about three miles south-west of Liverpool. In examining some of the slabs of stone, extracted at the depth of above thirty feet, Mr. Cunningham observed, that their under surface was densely covered with minute hemispherical projections, or casts in relief of circular pits in the immediately subjacent layers of clay. The origin of these marks, he is of opinion, must be ascribed to showers of rain, which fell upon an argillaceous beach exposed by the retiring tide, and their preservation to the filling up of the indentations by sand. On the same slabs are impressions of feet of small reptiles, which appear to have passed over the clay previously to the shower, since the foot-marks are also indented with circular pits, but to a less degree, and the difference Mr. Cunningham explains, by the pressure of the animal having rendered those portions of the clay less easily acted upon. That rain fell during remote ages of the world, the author stated, no person acquainted with geology will dispute: as, to the destructive and transporting agency of rain-waters many of the sedimentary strata owe their origin. The vast forests also, which grew at a period anterior to the new red sandstone, and are now treasured up in our coal fields, could not have flourished without abundant supplies of atmospheric waters; and, that the effects of drops of rain may be preserved in a solid form, he proved by reference to an account given by Mr. Scrope of a shower which fell upon extremely fine volcanic ashes thrown out by Vesuvius during the eruption of 1822. The drops of rain formed small globules, which hardened into pellets, and accumulated in some places at the foot of a slope, in beds a foot or more in thickness, and were often so agglutinated that it required a sharp blow from a hammer to break the mass.

2. Extracts from two letters addressed to Dr. Buckland: one from Mr. John Taylor, jun., on the occurrence of a slab of sandstone containing impressions of Chirotherium Hercules at the house of Mr. Potts, of Chester; and the other by Sir Philip Egerton, on the peculiarities of the impressions. When the slab was first laid down there was no appearance of the remains which have been gradually developed by the action of the weather. Sir Philip Egerton is of opinion that the weight of the animal compressed the yielding sand near its foot, and that the print being afterwards filled with the same materials, the stone became nearly homogeneous in composition. The effects of the weather would necessarily remove the softer uncompressed portions, but the denser part acted upon by the animal's weight, would resist for a time the same operations, and present in relief the outline of the foot. The slab contains the marks of three hind and two fore-feet, the latter bearing the same proportion in size to the former, as in the other species.

3. "*On the Occurrence of Swallow-holes near Farnham, and on the Drainage of the Country at the Western Extremity of the Hog's-back,*" *by George Long, Esq., communicated by Mr. Lyell.*—Immediately to the north of Farnham, rises a chalk hill, capped by tertiary strata. No perennial main-springs occur on the face of the hill, but the gulleys are, for the greater part of the year, occupied by superficial land-springs, which occasionally become formidable torrents. These rivulets pour down the hill upon the surface of the tertiary clay, until they arrive at the chalk, where they are entirely absorbed in swallow-holes, except during great rains, when a portion of the water flows along channels in the chalk. Seven of these holes, between Clare Park and Farnham Park, were described in detail by Mr. Long. The water absorbed by two of them is supposed to well out in great force at the Bourne mill-stream; and, though soft where it sinks under ground, it is hard when it re-appears. The drainage, described in the second part of the paper, is effected by a stream, which passes through a gap at Runfold, the western extremity of the Hog's-back hill, and flowing northward through the chalk, carries off the surplus waters of a tract bounded on the north by the Hog's-back, and on the south by a semi-circular range of low hills, extending from Seal, on the east by Crooksbury, to Moor Park, on the west. This gap in the chalk has hitherto escaped the observation of geologists, but deserves to be recorded among the apertures through the North Downs.

4. "*A Letter from Capt. Charters to Mr. Lyell, dated Cape Town, Nov. 12, 1838.*"—During a very extensive tour through the colony, Captain Charters's attention was particularly drawn to the occurrence of greenstone resting upon the horizontally stratified sandstone, which constitute so large a portion of the country. The localities mentioned in the letter are in the neighbourhood of Fort Beaufort, on the Kaffir frontier, the small town of Cradock on the Great Fish River, the line of route from the Tarka district behind the Winterberg range to Shiloh, and to Colesberg, near the Orange River, and thence by the Schneeberg to Graf Reinet. In some places the trap presented thick deposits, more or less traversed by irregular cracks; and, in others, heaps of weathered or spheroidal masses, resembling transported boulders.

ASIATIC SOCIETY.

Feb. 16.—Sir George Thomas Staunton, Bart., M.P., in the Chair.

Mr. Wilkinson read a paper, "*On the Difference between the European and Indian Methods of making* Steel, *and on the reasons which induced him to ascribe many of the properties of iron, and much of the variety in its quality, to the action of electricity.*" After adverting to the extraordinary discoveries of Professor Ehrenberg, of Berlin, who has shown that the bog iron ore, from which the beautiful Berlin castings are made, is composed of minute animals, that Tripoli powder is of a similar nature, and that the ditches about Berlin abound in such animals, Mr. Wilkinson stated that these wonderful animals had recently been found in England also, and that in localities so near as Hampstead and Highgate. Mr. Wilkinson then entered into a description of the mode of manufacturing iron, and of the process by which it is converted into steel, both in England and India, which differ essentially; the English process being chiefly exposure of the iron to strong heat, in close contact with charcoal; while the natives of India put the iron into crucibles with dried branches of a certain shrub, and green leaves of others. Mr. Wilkinson then adduced arguments corroborative of the opinion, that the different properties of iron and steel depend on currents of electricity, which, however, he admitted were not conclusive; and he expressed his intention of instituting a set of experiments, with a view to ascertain its truth, and its applicability to practical purposes. He hoped shortly to obtain some specimens of Indian steel, and to receive replies to several queries on the subject, sent by him to India through the medium of the Society, which would enable him to proceed with more certainty.

Mr. Heath said, that a copy of Mr. Wilkinson's queries had been sent to him by the Madras government, to whom the Society had transmitted them in 1837; that his labours were at that time too great to admit of his giving close attention to the subject; but that on his voyage home he had written a paper, which he conceived embodied all that was required on the subject, and which he would now read. Mr. Heath's paper entered largely into the nature of the Indian ore, and the operations of the natives in manufacturing it into iron and steel. He said that the ore used was the magnetic oxide of iron combined with quartz, in the proportion of fifty-two of oxide to forty-eight of quartz; that it occurs in the district of Salem, the principal seat of the manufacture, in the form of low hills; and that the quantity exposed above the surface of the country is so great that it was not likely that underground operations would ever be required. It is prepared by stamping, and then separating the quartz by washing or winnowing. The furnace is built of clay alone, from three to five feet high, and pear shaped: the bellows is formed of two goat-skins, with a bamboo nozzle, ending in a clay pipe. The fuel is charcoal, upon which the ore is laid, without flux; the bellows are plied for four hours, when the ore will be found to be reduced: it is taken out, and when yet red hot, cut through with a hatchet, and sold to the blacksmiths, who forge it into bars, and convert it into steel. It is forged by repeated heating and hammering, until it forms an apparently unpromising bar of iron, from which an English manufacturer of steel would turn with contempt, but which the Hindu converts into cast steel of the very best quality. To effect this he cuts it into small pieces, of which he puts a pound, more or less, into a crucible, with dried wood of the *Cassia auriculata*, and a few green leaves of *Asclepias gigantea*. The air is then excluded by a cover of tempered clay rammed down close into the crucible. When dry, about twenty crucibles are built up in a small furnace, covered with charcoal, and heated for two hours and a half, when the process is complete. Mr. Heath observed, that the quality of the steel was excellent; but that the process of smelting was so imperfect, that of seventy-two per cent., of which the oxide is composed, only fifteen per cent. of iron was obtained by the natives. The discovery of steel by the Hindus appeared one of the most astonishing facts in the history of the arts; it seemed too recondite to be the effect of chance, and yet could only be explained by the lights of modern chemistry. In Europe the case was otherwise. In the early times, repeated hammering after refining, appears to have been the only process; and cementation by charcoal was not adopted until chemical investigation had shown that steel was a compound of iron and carbon. Two patents had been taken out within the present century; one for making steel by the application of "any substance containing the carbonaceous principle;" and another, by exposing the iron to the action of carburetted hydrogen gas at high temperatures; and it appears that the Indian process combined the principle of both these methods. The antiquity of the Indian mode was proved by the present of thirty pounds weight of steel, made by Porus, to Alexander the Great; and the ignorance of the Western world was shown as well by this as by the fact that the arms of the warriors of ancient Europe were composed of alloys of copper and tin. The tools by which the Egyptian obelisk and temples of porphyry and syenite were cut, were undoubtedly made of Indian steel. Mr. Heath concluded with observing, that he did not think the Hindu process influenced the quality of the steel; but it enabled the manufacturer to accomplish with very imperfect means that which it would be hopeless for him to attempt by European processes.

SIR CHARLES LEMON'S MINING SCHOOL IN CORNWALL.

It is hardly necessary to repeat the observation that the proposed course of instruction is not undertaken with the view of teaching Mining, for that can only be acquired in the mine itself, and the best opportunities are already afforded in various and extensive works throughout the county. But with respect to those arts and sciences, which, from their close connexion with mining, are most valuable to a Cornishman, equal facilities do not abound, nor are they generally within the reach of that large class of mining agents, engineers, and others, who would be chiefly benefited by them. It is proposed experimentally to supply this deficiency; and to afford facilities for attaining useful scientific and practical knowledge in the midst of the Cornish mining district, on the following plan:—

The principal course will commence early in July, and will comprise separate series of lectures and examinations in Mathematics, Mechanics, Metallurgic Chemistry, and Mineralogy—a detailed programme of this course will be submitted to the public in due time. At present it is only necessary to point out by what steps the student may prepare himself to enter on these studies with the best effect.

Probably two classes will be formed, according to the attainments of the pupils. But, as the professors conducting this course can remain in the county only a few months, it is of the greatest importance that, as far as possible, the students should be prepared at once, to take their places in the higher class.

The subjects taught will comprise *Algebra*; the elements of *Geometry*, which forms the only basis on which an accurate knowledge of planning and drawing sections of mines or machinery can be obtained, and which is indispensable in the execution of many most important works connected with mining.

The Elements of Land and Mine Surveying will be studied with reference to general principles; and the students will also be required to assist in actual surveys, and will be instructed in the construction of *Geological plans and sections.*

RAILWAY SOCIETY.

A private meeting, very numerously attended by the deputations from most of the leading Railway Companies, was held on Saturday last, at the chambers of Messrs. Burke and Venables, in Parliament-street, for the purpose of considering the propriety of forming a society for promoting and advancing the scientific improvement of railways throughout the kingdom, and for protecting generally the interests of railway proprietors.

Mr. George Carr Glyn, the chairman of the London and Brighton and North Midland Railway Companies, was called to the chair, and opened the proceedings by adverting to the great and manifest importance of the proposed society, as affording a means of bringing the united experience and influence of the principal persons connected with railways to bear upon all questions which may arise respecting them.

The honourable chairman further alluded to the very great ignorance which exists among many, even at this day, on the subject of railways, and the consequent prejudices, which prevail against them, and pointed out the great advisability of having some regularly organized association which would be looked up to as an authority on all subjects in which their interests were involved.

The meeting was subsequently addressed by several other gentlemen present, who all concurred in the importance of the proposed association, and dwelt on the advisability of forming, at its outset, a collection of maps, reports, models, and other scientific and statistical details relating to railways, which should be accessible to the several members of the society, and which would in time become a most valuable and interesting museum of reference on matters connected with railways.

Some discussion took place as to the amount of the subscriptions, and the name to be given to the proposed association, viz. whether it should be called the "Railway Society," or the "Railway Institute," but eventually this, with all other matters of detail, was left to a committee of management formed of some of the directors of the principal railway companies present, who were empowered to add to their number, if they should see fit.

Resolutions, embodying the substance of the foregoing remarks, were unanimously passed, and the several persons present, having enrolled their names as the first members of the society, the meeting separated.

MEETINGS OF SCIENTIFIC SOCIETIES FOR APRIL.

Royal Society, Thursday, half-past eight, P. M., 11th, 18th, and 25th.
Society of Antiquaries, Thursday, eight, P. M., 11th, 18th, and 23th.
Institution of Civil Engineers, 25, Great George-street, West, Tuesday, eight, P. M., 23th, and 30th.
Royal Institute of British Architects, 16, Grosvenor-street, Monday, eight, P. M., 8th, and 22th.
Architectural Society, Tuesday, eight, P. M., 9th.
Society of Arts, every Wednesday, half-past seven, P. M., 9th.
Ditto, Illustration, Tuesday, eight, P. M., 9th.
Geological, Wednesday, half-past eight, P. M., 4th and 25th.
Royal Geographical, Monday, nine, P. M. 8th, and 29th.
Graphic, Wednesday, eight, P. M., 25th.

New Locomotive Engine.—We have received a letter from a friend in America calling our attention to a new locomotive engine calculated to ascend an inclined plane, a model of which he has seen. The following is a brief account of it, so far as the inventor will at present allow it to be made public; for it appears he had not procured a patent for it. It is described as a locomotive engine of eight or ten tons weight, cylinder 12 by 18 inches, of the ordinary construction. In ascending or descending inclined planes, the driving wheels are raised from the ordinary track, and the locomotive is partly sustained on small wheels (well represented by the ordinary hubs of a carriage) on raised rails each side of the track two feet high. The invention consists in a mode of gaining adhesion, which can be increased to any extent with very little increase of friction The power being transferred from the large driving wheels to small ones, the velocity will of course (in ascending) depend upon the steepness of the ascent, which will regulate the size of the small wheels. We calculate, according to Pambour, to ascend a plane of 200 feet rise in the mile, at the rate of four miles the hour, with 100 tons burden. The apparatus to gain the adhesion cannot add 300 dollars to the cost of the locomotive; it is never in action except when overcoming inclined planes; will last longer than the locomotive, is simple, easily managed, and not at all liable to get out of order. The expense of the raised rails will depend upon the materials used in their construction, which may be of wood or iron. Two hundred feet in the mile is the maximum of ascent recommended, but by reducing the velocity and load, 400 or more may be overcome. The apparatus is within the locomotive, which, with the raised rails, constitute all that is necessary to overcome the ascent. There will be no time lost in commencing the ascent.—*Scotsman.*

Blasting by the aid of Galvanism.—An experiment was made with complete success with one of Daniel's galvanic batteries, under the superintendence of Colonel Pasley, of the Royal Engineers, at half-past two o'clock last Saturday, off the gun-wharf, Chatham. 35lbs. of powder were exploded in about 10 fathoms of water, the length of the wire conveying the electric fluid being 500 feet; it caused a most tremendous explosion. Three smaller ones were afterwards tried, but only one succeeded. There was a numerous assemblage of spectators. The Royal George, at Portsmouth, we understand, is to be blown up in a similar manner, and this experiment was preparatory to the attempt.—*Maidstone Journal.*

Iron Houses.—The efficiency of iron to the application of steam-vessels has been so successfully introduced, that we notice an elegant plan of a sea-coast cottage of that description hung up in the Tontine Coffee-room, which seems so admirably adapted that we have no doubt they will soon be in very general use. The plan referred to seems to have six rooms, kitchen, and laundry, and other conveniences, for the small sum of 250*l.*, or if a double house of fourteen rooms, 500*l.* This is not half the price of a common house with similar accommodation, and can be ready to possess in two months. The iron trade of this neighbourhood should each set down one by way of introducing them.—*Glasgow Chronicle.*

PARLIAMENTARY PROCEEDINGS.

House of Commons.—List of Petitions for Private Bills, and progress therein.

	Petition presented	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour	Feb. 6.	Feb. 27.	Mar. 12.	—	—
Aberdeen Harbour	Feb. 8.	Mar. 15.	—	—	—
Ballochney Railway	Feb. 12.	Mar. 14.	—	—	—
Barnsley Waterworks	Feb. 21.	—	—	—	—
Bath Cemetery	Feb. 22.	—	—	—	—
Belfast Waterworks	Feb. 22.	—	—	—	—
Birmingham Canal	Feb. 20.	Mar. 15.	—	—	—
Birmingham & Gloucester Railway	Feb. 21.	Mar. 15.	—	—	—
Bishop Auckland & Weardale Rlwy.	Feb. 22.	Mar. 18.	—	—	—
Blackheath Cemetery	Feb. 22.	Mar. 18.	—	—	—
Bradford (York) Waterworks	Feb. 21.	—	—	—	—
Brighton Gas	Feb. 21.	Mar. 18.	—	—	—
Brighton Cemetery	Feb. 21.	Mar. 18.	—	—	—
Bristol and Gloucestershire Railway	Feb. 21.	Mar. 7.	Mar. 19	—	—
British Museum Buildings	Feb. 22.	—	—	—	—
Brompton New Road	Feb. 22.	Mar. 18.	—	—	—
Cheltenham Waterworks	Feb. 22.	Mar. 12.	Mar. 22.	—	—
Commercial (London and Blackwall) Railway	Feb. 14.	Mar. 8.	Mar. 21.	—	—
Dean Forest Railway	Feb. 19.	—	—	—	—
Deptford Pier	Feb. 22.	Mar. 18.	—	—	—
Deptford Pier Junction Railway	Feb. 22.	Mar. 20.	—	—	—
Deptford Steam Ship Docks	Feb. 22.	—	—	—	—
Edinburgh, Leith, and Newhaven Railway	Feb. 19.	Mar. 11.	—	—	—
Eyemouth Harbour	Feb. 12.	—	—	—	—
Fraserburgh Harbour	Feb. 20.	—	—	—	—
General Cemetery	Feb. 20.	Mar. 11.	Mar. 21.	—	—
Gravesend Gas	Feb. 21.	Mar. 18.	—	—	—
Great North of England Railway	Feb. 18.	Mar. 13.	—	—	—
Great Western Railway	Feb. 14.	Mar. 4.	Mar. 13.	—	—
Great Central Irish Railway	Mar. 12.	—	—	—	—
Herefordshire and Gloucestershire Canal	Feb. 20.	Mar. 13.	—	—	—
Herne Gas	Feb. 22.	—	—	—	—
Holmfirth Gas	Feb. 11.	—	—	—	—
Liverpool Docks	Feb. 21.	—	—	—	—
Liverpool Buildings	Feb. 21.	—	—	—	—
Liverpool and Manchester Extension Railway	Feb. 14.	Feb. 28.	Mar. 12.	—	—
London and Birmingham Railway	Feb. 8.	Feb. 22.	Mar. 6.	—	—
London Bridge Approaches, &c.	Feb. 19.	—	—	—	—
London and Croydon Railway	Feb. 19.	Mar. 18.	—	—	—
London Cemetery	Feb. 19.	Mar. 18.	—	—	—
London and Greenwich Railway	Feb. 21.	Mar. 18.	—	—	—
London and Southampton (Guildford Branch) Railway	Feb. 22.	—	—	—	—
London and Southampton (Portsmouth Branch) Railway	Feb. 6.	Feb. 25.	Mar. 7.	—	—
Manchester & Birmingham Railway	Feb. 18.	Mar. 18.	—	—	—
Manchester and Birmingham Extension (Stone & Rugby) Railway	Feb. 11.	—	—	—	—
Manchester and Leeds Railway	Feb. 18.	Mar. 8.	Mar. 10.	—	—
Marylebone Gas & Coke Company	Feb. 22.	Mar. 18.	—	—	—
Monkland & Kirkintilloch Railway	Feb. 12.	Mar. 14.	—	—	—
Necropolis (St. Pancras) Cemetery	Feb. 21.	Mar. 15.	—	—	—
Newark Gas	Feb. 14	Feb. 28.	Mar. 11.	—	—
Newcastle-upon-Tyne and North Shields (Extension) Railway	Feb. 18.	Mar. 15	—	—	—
Northern & Eastern (No 1) Railway	Feb. 22.	Mar. 18.	—	—	—
Northern & Eastern (No. 2) Railway	Feb. 22.	—	—	—	—
North Midland Railway	Feb. 11.	Mar. 4.	Mar. 14.	—	—
North Union Railway	Feb. 22.	—	—	—	—
Nottingham Inclosure and Canal	Feb. 19.	Mar. 18.	—	—	—
Over Darwen Gas	Feb. 21.	-	—	—	—
Perth Harbour and Navigation	Feb. 14.	—	—	—	—
Portishead Pier	Feb. 22	—	—	—	—
Preston Gas	Feb. 6.	Feb. 20.	Mar. 6.	Mar. 19.	—
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	—
Preston and Wyre Railway, Harbour, and Dock	Feb. 21.	Mar. 18.	—	—	—
Redcar (No. 1) Harbour	Feb. 10.	—	—	—	—
Redcar (No. 2) Harbour	Feb. 22.	—	—	—	—
Rishworth Reservoirs	Feb. 21.	Mar. 6.	Mar. 22.	—	—
Rochdale Waterworks	Feb. 7.	Feb. 21.	Mar. 6.	—	—
Rochester Cemetery	Feb. 22.	Mar. 18.	—	—	—
[illegible] Ford Bridge and Road	Feb. 21.	Mar. 18.	—	—	—
[illegible] Railway	Feb. 12.	Mar. 18.	—	—	—
South Eastern Railway	Feb. 11.	—	—	—	—
South Eastern (Deviation) Railway	Feb. 22.	Feb. 27.	—	—	—
Teignmouth Bridge	Feb. 14.	—	—	—	—
Tyne Dock	Feb. 22.	Mar. 15.	—	—	—
Tyne Steam Ferry	Feb. 21.	—	—	—	—
[illegible] Junction Canal	Feb. 22.	—	—	—	—
West Durham Railway	Feb. 21.	Mar. 18.	—	—	—
[illegible] Improvement	Feb. 21.	—	—	—	—
[illegible] Railway	Feb. 12.	Mar. 14.	—	—	—
[illegible] and Birmingham [illegible]	Feb. 18.	—	—	—	

MARCH 7.—*Caledonia Canal.*—Select committee appointed "with a view to consider and report to the House, what steps it is advisable to take with respect to the present state of the Caledonian Canal."

MARCH 1.—*Irish Railways.*—Motion made, and question proposed, "That her Majesty be enabled to authorise Exchequer Bills to an amount not exceeding 2,500,000*l*., to be made out by direction of the Lords Commissioners of the Treasury, and to be by them advanced for the construction of a railway or railways in Ireland, the sum so advanced being secured, and the interest and sinking fund to be secured on the profits of the works, the deficiency, if any, being provided for by an assessment, on the several districts through which such railway or railways may be carried, or what may be benefitted thereby."—Question put, Ayes 144, Noes 100.

LAW PROCEEDINGS.

PAVING ACT.

MARLBOROUGH-STREET.—A matter of some importance to paving boards and proprietors of land was argued on Saturday, 2d ult., before Mr. Conant and Mr. Dyer, the sitting magistrates.

Lady Montfort, the lessee of a mansion in Park-lane, appeared by counsel (Mr. Clarkson) to answer an information laid under Mr. A. Taylor's act, by the trustees of the parish of St. George, Hanover-square, for an alleged violation of the act, in breaking up the pavement to the length of eight inches, whereby her ladyship had incurred a penalty not exceeding 10*l*.

Mr. Clarkson said the question between the parties was one of great public importance. Lady Montfort, in order to have a magisterial decision on the point at issue, had caused to be taken up a portion of the pavement before the house to which she laid claim as private property, and as belonging to the site of the house leased to her.

Mr. Bodkin, on the part of the trustees, said that in 1831, Lady Montfort rebuilt the house, and at that time she applied to the paving board to open a grating before it, but she was refused. Since the refusal, in order to raise the present question, she had broken the ground, and the trustees in consequence had adopted the present proceedings.

Mr. Clarkson said it was true that Lady Montfort had applied to the pavement board for permission to open a grating, and had been refused. But her application was for 18 inches, an extent of ground which he admitted Lady Montfort could not claim. Lady Montfort, in the present instance, had broken the pavement to the extent of eight inches, which she was prepared to prove by her lease was part of the ground belonging to the house.

The lease was then produced, by which it appeared that the extent of the ground in feet and inches was specified. The present mansion occupied the entire space, with the exception of eight inches, which the parish authorities some time back had paved over.

Mr. Bodkin said the parish proved their right by paving the ground in 1831.

Mr. Conant asked who was the freeholder of the ground?

Mr. Clarkson said the freehold was vested in the Dean and Chapter of Westminster. It was true the parish had paved over the eight inches now claimed since 1831, but that act did not vest the proprietorship of the soil in the parish. What answer would it be to the freeholders, because the leaseholder had not chosen to take in the eight inches when rebuilding the house, that the parish had paved the place and taken the soil? Though the parish had paved the ground, the freeholder, he contended, could resume it when he pleased.

Mr. Bodkin said, if it were competent for a person to go back to old documents to prove that at one time a portion of ground belonged to him, what, for instance, was to hinder Lord Grosvenor from resorting to the same course with respect to his property, and to say to the parish, "I had this ground, and I will break up the pavement and carry out a portico in assertion of my rights?"

Mr. Conant said, as lord Grosvenor had been referred to in the way of illustration, he would carry the argument further. Suppose the parish chose to pave before his lordship's house, they might then set up a claim to the ground. This appeared somewhat of the nature of Lady Montfort's case.

Mr. Bodkin said, the question was very important, and the parties were anxious to have the matter reviewed in a solemn way by an appeal to the superior courts.

Mr, Conant said, he thought the trustees were bound to show on what grounds they paved the portion of land in dispute.

Mr. Cunningham, the late surveyor, was called, but he could state nothing more than that he had paved flush up to Lady Montfort's house, in compliance with the orders of the paving board. He could not say whether the eight inches now claimed did not form part of the ground claimed by the freeholder.

Mr. Conant said, the matter for the court to decide was not whether the ground was public or private property; the question was as to the jurisdiction of the act of Parliament, and whether the present proceeding was such an encroachment as subjected the party adjoining it to a penalty. It would have been very material had the surveyor been able to show the ground on which the trustees had ordered him to pave the place, or that the eight inches in question did not form a portion of the private freehold; but the surveyor could do no more than prove that for about eight years he had paved the disputed piece of ground. Now, the time during which the parish had paved the place was too short to give the parish a right to the soil, or to permit them to levy a penalty on an attempt being made to resume an alleged right; for if the parish could claim under such circumstances, then any one might have his property paved over by the parish, and be called upon to pay a penalty if he attempted to take up what the parish had laid down. With this view of the case he must dismiss the information.

STEAM NAVIGATION.

ERICSSON'S STEAM-BOAT PROPELLER.

The experimental iron steam-boat, Robert F. Stockton, constructed for testing Captain Ericsson's propeller, which we noticed some time since, being on the eve of departure for the United States, at the request of a number of scientific gentlemen who were desirous of witnessing her performance, the proprietor consented to another trial being made, and on Saturday, the 9th ultimo, a large party was invited for this purpose. Among those present were Major-General Sir John Burgoyne, Major Robe, of the Royal Engineers, Mr. James Terry, of Dublin, Messrs. Vignolles, Delafield, Reid, Napier, and Thomas; several Swedish naval officers; Captain Stockton, of the United States navy; Mr. Ogden, Consul of the United States at Liverpool; Mr. Young, an American civil engineer, &c., and about thirty other gentlemen were present, and the result of the trial gave universal satisfaction.

One of our correspondents having before described the construction of the new propeller, we will now more particularly direct attention to the effect produced during the trial, which appeared quite conclusive as to the success of this important improvement in steam-navigation. The distance from the West India south-dock, to a point opposite Woolwich church and back, measuring 37,000 feet, was passed in forty-five minutes precisely (twenty-one minutes with, and twenty-four minutes against the tide), the boat towing at the time a heavy city barge on the one side, a large wherry on the other, and another wherry astern. The speed of the engine being repeatedly timed by Mr. Young, it was found to average sixty-six revolutions per minute, or 2,970 during the forty-five minutes. The inventor demonstrated by accurate working drawings, that the spiral planes of the propeller are set at such an angle, that had the resistance of the water been perfect, the progress of the boat could only have been 132 feet at each revolution, or 39,204 feet during the time, instead of 37,000 actually performed, thus showing a loss of less than 6 per cent. Respecting the engines for working the propeller, it was observed, that they may be made much stronger and more compact than ordinary marine engines, in consequence of the power being applied directly to the shaft which works very near the bottom: this for sea-going vessels will be very important, and their original cost must be considerably reduced, as all the paraphernalia of shafts, wheels, wheel-guards, &c., will be dispensed with. We were struck with the great regularity of the motion, not the slightest jar being perceptible. The engines consist of two cylinders sixteen inches in diameter, with eighteen inches stroke, and are worked by steam, of a pressure varying from 35lb. to 55lb., to the square inch; their construction is extremely simple, and evinces a knowledge of steam machinery in the inventor which is calculated to give additional confidence in the success of his propeller in all the varieties of its application for canal, river, or ocean navigation.—*Times.*

Great Western Steam Ship.—A half-yearly general meeting of the proprietors was held in Prince's-street, Bristol, last week. Mr. Maze took the chair. Mr. Claxton read the report, which stated that the company's first ship had disproved all unfavourable auguries, and promptly rewarded the enterprise of the projectors. It was impossible to speak too highly of the qualities of the Great Western steam ship; after having run 35,000 nautical miles, and encountered 36 days of heavy gales, her seams required no caulking, and when she was docked she did not show a wrinkle in her copper. The average of her passages out was 15½ days, and home 13 days; the shortest passage out was 14½ days, and the shortest home 12½. About 1,000 passengers had gone in the ship. After alluding to the great expense necessary to combine speed, security, and enjoyment, it expressed a hope that through the liberality of the American Congress the duty of 2d. per bushel on coals would be given up, and thus a saving of nearly 1,000*l*. a-year would be effected. The company have decided on constructing their next vessel of iron, for which the preparations are far advanced. It appeared from the statement of accounts, that after paying 2,000*l*. for additions to the ship, and insurance to October next, 1,500*l*. for goods damaged in the hurricanes in October last, and upwards of 2,000*l*. being set apart for a reserve fund, there remained from the profits sufficient for a dividend of 5 per cent., making, with the former one of 4 per cent., 9 per cent. for the year. The report was unanimously adopted.

Launch of the Steamer Nicholai.—The ceremony of launching a splendid steam-vessel, named the Nicholai, took place on Saturday, the 16th ult., at Deptford, and, notwithstanding the unsettled state of the weather, attracted a large concourse of spectators. Among those present were Count Lubinski, Count Woronzow, several attachés of the Russian embassy, and other foreigners of distinction, Sir J. Brand, Captain Hayman, Captain Rowland, and many influential individuals connected with steam navigation. The Nicholai, which is 800 tons burden, has been built for the Emperor of Russia, after whom it has been named, and whose bust, said to be an admirable likeness, adorns her figure head. She is the largest steamer belonging to Russia, and intended to ply as a packet between Lubeck and St. Petersburgh. The Nicholai was built in four months after laying her keel. The vessel has been removed to Messrs. Seawards' establishment at Limehouse, for the purpose of having her engines put on board, which are to be of 240 horses power.

The Star, a new iron steam boat, intended for the passage trade between Shields and Newcastle, is reported to be a fine vessel, and draws only 23 inches water. She is the first iron steamer that has been launched from the banks of coaly Tyne.

A splendid little iron steam boat, of about 120 tons burthen, was on Monday, the 18th ultimo, launched from the iron works of Messrs. Summers, Groves, and Day, of Willbrook, near Southampton. She is built for the Lisbon Steam Navigation Company.

Steam Conveyance to America.—Government have entered into a contract for conveying the mails by large and powerful steam-vessels from Liverpool to Halifax, and thence by branch steamers to Boston, and in the summer to Quebec. The mercantile interests, not only in the North American colonies, but also in the United States, will be gratified to learn that, instead of a monthly communication, as formerly, steamers will now be despatched on the 1st and 15th of each month. The enterprising contractor has engaged with those able and scientific builders, Messrs. Wood, at Port Glasgow, to build three ships of 1,000 tons each, in which Mr. Robert Napier is to place engines of 400 horse power. From the past success of Messrs. Wood and Napier we doubt not, when these vessels are on their station, in April, 1840, they will be quite unrivalled; and, moreover, that the acute observation of "Sam Slick," that "the route *via* Halifax is the shortest way to New York," will be verified to demonstration.—*Glasgow Paper.*

Royal Naval Steam Service.—A splendid building, under the name of the "Engine Factory," is nearly completed in Woolwich dock-yard, with a large adjacent mast and timber pond, and a short canal cut for its communication with the great basin, with a cassoon and bridge to allow the steam-boats to be brought up alongside the factory, instead of being sent to the private manufacturers'. The boiler department is not yet, however, organised.

Mediterranean Steam Navigation.—The Austrian government continue to pay assiduous attention to this important branch, and, by a recent regulation, they have obviated the necessity of quarantine, by placing a sworn government officer of health on board each of their steamers,—a regulation which, it is to be hoped, will be adopted by other powers.

Brazilian Steam Navigation.—Two boats of the Brazilian Steam Navigation Company have arrived at Bahia, where they have excited the greatest sensation.

PROGRESS OF RAILWAYS.

EASTERN COUNTIES RAILWAY.

Report of the Engineer to the Directors.

GENTLEMEN,—In compliance with your instructions, I beg leave to submit the following report as to the state of the works, and the line, commencing at London and terminating at Springfield, a distance of thirty-one miles.

The whole of the London Viaduct, commencing at Farthing-street, within 300 feet of the terminus, has been let to four respectable contractors.

That portion between Devonshire-street and Dog-row, for a length of 31 chains, the whole of the foundations are laid, and the abutments and piers, are nearly all carried springing high, and several of the arches are turned.

The iron-work for the three bridges, Dog-row, Ann-street, and Globe-lane, is in a very forward-state.

Nearly the whole of the portion from Dog-row to Winchester-street, a distance of 28 chains, is fenced off; several of the foundations are excavated, concrete forming, and brickwork for the piers and abutments commenced; large quantities of materials are on the ground. A further distance of 11 chains, extending to Bethnal Green Workhouse, is in possession of the contractor, and the house are being pulled down.

From Devonshire-street, eastward, to Angel-lane, at Stratford, the whole of the embankment is formed, with the exception of a small portion adjoining the Viaduct; also small portion at Tredegar-square, in the Fair Field at Old Ford, and east of the river Lea Bridge, in all amounting to less than 30,000 cubic yards on, which is being supplied from three different places, tendering the completion within a fortnight an easy-task.

The embankment from the River Lea Bridge to Angel-lane is ballasted, and the permanent way laid.

Westward of Lea Bridge, a considerable portion is ballasted, and the laying of the permanent rails is commenced.

By means of a temporary stage or tipping frame this embankment containing upwards of 270,000 cubic yards, has been formed in less than nine months, nothwithstanding the winter season, and the more than ordinary difficulties presented by the yielding nature of the marsh lands over which it crosses, and which has occasioned a serious subsidence for a distance of nearly half a mile, and which would have rendered the formation of this embankment an extremely difficult, tardy, and expensive operation without the introduction of this useful, and I am happy to add, successful expedient, which has not only enabled us to deposit the large quantity of 231,000 cubic yards out of the above quantity over one tip in so short a space of time, but has been the means of completing the work much under the estimate.

It may be here gratifying to remark, that although the present subsidence of the embankment is within but 15 feet of one of the great reservoirs belonging to the East London Water Works Company, I have succeeded in preventing any injury to it.

The cutting from Angel-lane to the Ilford Valley is opened the whole distance, and the ballasting and permanent way formed, all but twenty chains. The embankment over the Ilford valley has been completed for more than six months; the ballasting and permanent way laid. The cutting east of the valley, with the exception of a small portion in Curtis's field, and the crossing of the Essex turnpike road, at the eighth mile-stone, is open to the tenth mile stone, and the permanent rail laid through Ilford for a distance of half a mile from the valley. About 10 chains east of this cutting, the gullet leading to the Chadwell cutting is open. The cutting from Chadwell to Whalebone-lane is completed, the road ballasted, and the permanent way laid.

The embankment at Whalebone-lane, extending towards Romford, is completed and the permanent way laid for a distance of 60 chains.

In order to expedite the formation of this embankment, a side cutting contiguous to the Barrack field at Romford has been opened. I therefore anticipate that the whole embankment up to Romford will be completed in less than six weeks.

Up to this point, the masonry commencing at the east end of the London Viaduct is complete, consisting of the numerous bridges over the rivers, and over and under the turnpike and occupation roads, amounting in all to forty-three, many of them of considerable magnitude, involving great expense in the construction of their foundations.

Continuing east of Romford, several other important works are completed.

In addition to these works, the station of Angel-lane, Stratford, with the engine-houses, coke-sheds, and water-tanks, and Whalebone-lane and Ilford, are nearly complete.

The whole of the line east of Romford, extending as far as Springfield, two miles from Chelmsford, being 31 miles from the terminus at London, is let to respectable contractors, with the exception of the summit cutting at Brentwood and Mountnessing, and the Shenfield and Mountnessing embankments.

The contracts between Romford and Brentwood have been let nearly six months, and the various cuttings, embankments, and other works at Hare-street, Hare-lodge, Gubbings, Brook-street, and Brentwood, are now in active progress, having been materially retarded by the weather.

The contract drawings from Springfield to Colchester are nearly ready for advertising.

In order to ensure the early completion of the works, six locomotive engines are employed day and night.

Six passenger engines will be ready within one month from the present time when also a sufficient number of first and second class carriages will completed.

A large supply of rails and chairs have been delivered, sufficient for upwards of sixteen miles of double line.

Plans and drawings for a complete London station, constructed in accordance with the experience hitherto gained, have been prepared, ready to proceed with the works when directed, for the entire opening of the line to Shoreditch.

I am Gentlemen, your obedient servant,

JOHN BRAITHWAITE.

BLACKWALL RAILWAY.

The Report of the Engineers to the Directors.

GENTLEMEN,—The whole of the Works on your line of Railway being now contracted for, with the condition that the execution shall be completed by the end of the present year, it affords us great satisfaction to report, that looking to the progress which has been made by Messrs. Webb since the 1st of October when they commenced their contract, and to the character and resources of the gentlemen who have contracted for the remaining portion of the line, we see not the least reason to fear that your expectations will be disappointed in respect of these arrangements.

On taking into account the united amount of these contracts, and adding thereto the cost of the permanent way, not included in them, we feel ourselves justified in stating our conviction, that the anticipated saving to be effected by the alteration of the width and levels of this railway will be fully borne out by the result.

The respective parties who are under engagements to furnish the engines for the working of the line, are actively employed in their construction; at the same time they are also preparing the large drum and spur wheels for winding the rope. We deemed it desirable to delay to the latest period (consistently with the early completion of the works) the specification necessary for the construction of this portion of the machinery, in order that we might avail ourselves of every improvement, which a continued and careful consideration of the subject could suggest.

We have unqualified satisfaction in being able to state, after going into extensive detail on the subject of working by stationary engines, which we have had an opportunity of doing in the course of various enquiries and calculations, that the annual cost of working by the proposed system, will be less by some thousands per annum than the amount assumed in our first report to you. We have now sufficient ground to satisfy our minds that the annual cost of working your line will not exceed £8,000 per annum.

The foundations for nearly one half of the proposed viaduct are now actually completed, and the piers are most of them finished to the springing height, many of the arches are completed, and the centres removed, and we calculate that, from this time, seven arches will be turned weekly in Messrs. Webb's contract, and in the other contracts in the same proportion.

The work, it must be borne in mind, has hitherto been done during the least favourable time of the year, and under one contractor only, but when the energies of two other contractors, with ample resources, shall come into operation, the works will be so accelerated as to leave no doubt of their being successfully terminated by the time specified.

We are, Gentlemen, your very obedient Servants,

(Signed) G. STEPHENSON,

London, 25th February, 1839. GEO. P. BIDDER.

CROYDON RAILWAY.

Report of the Engineer, to the Directors, read at the Half-yearly Meeting, held on the 5th ult.

GENTLEMEN,—Having received your instructions, that I should report to you the state of the works of the London and Croydon Railway at the present time, I have to report as follows:—

The stations at Croydon and Norwood may be considered complete, and fit for passenger traffic.

All the stations along the line are nearly finished, except the erection of two lodges, which will be constructed in a temporary manner for the opening of the line.

With the exception of the cutting at Forest Hill and the dressing of some slopes, all the earthwork along the line is completed; and on the Forest Hill cutting the east side is cut through with the exception of the slip near Owen's-bridge, and the west side remains to be bottomed out, and the slopes dressed down, for a distance of about 10 chains; on the west side of this length the greater portion of the slips occurred in the winter, when we had to encounter great difficulties, but since the weather has become drier, and means have been resorted to to prevent any further extension of the slips, the works have proceeded more rapidly, and the slopes have remained in the finished part in a perfectly substantial state; no slipping worth notice has occurred on any other part of the line.

The station and workshops at New Cross are on the point of completion, and the carriages are about to be delivered there.

The London station will be in a sufficiently forward state by the time the permanent rails are laid on the rest of the line.

All the bridges along the line except one occupation bridge are completed, and of this the arches are turned, and a fortnight's fine weather will enable the contractor to finish it.

The permanent road is being pushed on with all possible vigour consistent with sound workmanship and good drainage. There are employed in this department upwards of 300 men, with an adequate quantity of horses, drivers, locomotive engines, &c.

Of the permanent way there are laid,

6 miles 1 chain of single road complete;
1 .. 23 .. partly complete:
4 .. 75 .. double road ballasted and laid;

so that all required to complete the permanent way throughout will be,

5 miles 07 chains, or 10,282 yards of single line to lay;
2 ... 1 .. or 3,502 to ballast.

The quantity of earthwork remaining to be excavated in the Forest Hill contract, including extra slopes, slips, removal of spoil, clearing up bottom, &c., amounts to about 30,000 yards; but the opening of the road need not be delayed until the whole of this is removed, as more than two-thirds belong to the slopes and slips, not affecting the bottom, and will be moved after the completion of the permanent way.

I am, Gentlemen, your obedient servant,

JOSEPH GIBBS.

THAMES HAVEN DOCK AND RAILWAY.

Extract of Report read at the last Half-yearly Meeting.

Your Directors, at the half-yearly meeting in August last, reported that they had enter d into a contract for the construction of the Dock at Thames Haven; the works have in consequence been proceeded with, to the extent of 400,000 feet o excavation; the contractors have built cottages to house 200 men, and the further progress is only delayed until more land shall be in possession of the Company by an arrangement with the tenant, and the present meeting shall place it in their power to continue. The Directors would advise the shareholders to continue the operations at the Dock, as a valuable basis, and as the surest method of attaining the grand object of the undertaking.

The Directors have made several efforts to come to some definitive terms of agreement with the Directors of the Eastern Counties' Company, for toll; but as the amount demanded for passengers would prevent any traffic on the Thames Haven line, or any profit if carried; and as the Directors of the Eastern Counties' line have declined to make any immediate terms whatever for goods or heavy weights, as coals, &c., which must form a large portion of the traffic of the Thames Haven line; and as it is absolutely essential that a fixed plan should be arranged by which such articles can be secured for the Company; and as it also appears upon the report of your engineer, that two lines of rails upon the Eastern Counties' line will not admit of the anticipated traffic of the Thames Haven line with its own; and would if it could be managed at all, utterly preclude the possibility of slow speed trains, by which means alone a profit can be made by heavy goods, but at which a larger amount will be derived than from passengers; and as they feel also that the inconvenience of one line of road for two companies, places the company in a dependent, uncertain, and unpleasant position, at the will of persons who may be indisposed to them, or anxious to give greater facilities to other parties, which would cause an endless source of litigation and annoyance to the public. Under all the circumstances of the case, your Directors have considered it better to be prepared with, and adopt any integral and direct line into London. To this end your engineer has surveyed and laid down a line of road from Thames Haven to the Minories, where one of the best termini in the metropolis can be made—the position for all purposes being much superior to that of the Eastern Counties, particularly for the traffic on your line. The road is thereby shortened to 25½ miles, and the gradients are so good as to be for all working purposes almost a level. The advantage this would give for the carriage of great weights is highly beneficial, and will enable the Company to carry out the principle they have established of low fares, which, wherever they have been supported by good management, have proved so entirely successful.

MANCHESTER AND BIRMINGHAM RAILWAY.

Report of the Engineer to the Directors.

Gentlemen.—In accordance with your instructions, I submit the following report on the progress and state of the works. Those parts of the line which are contracted for and in progress extend from Fairfield-street, in Manchester, to the south side of Daw Bank, on the Cheshire side of the river Mersey, at Stockport. This distance is divided into five contracts, which are separately noticed as follows, viz.:—

Contract No. 1, or Fairfield-street Contract.—Commenced August 14th, 1838. Time of completion, eighteen months. This contract is 1,155 feet in length, and comprises the first portion of the viaduct by which the railway leaves the depôt in Manchester. It consists chiefly of arches of brickwork, varying in span from 30 to 45 feet, and of one cast-iron arch of 128 feet 9 inches span. The progress hitherto made it consistent with the work being completed within the specified time.

Contract No. 2, or Chancery-lane Contract.—Commenced August 14th, 1838. The time for completion is eighteen months. This contract is 2,136 feet in length and consists of the second portion of the viaduct by which the railway leaves the town of Manchester. The contractor has not yet had possession of all the land, but is expected to have it in the course of a few days hence, and the whole will be completed with ease in the specified time.

Contract No. 3, or Hyde Road Contract, is 1,900 feet, and comprehends the third or last portion of the viaduct issuing from the town of Manchester. It is not yet commenced, by reason of the obstacles which have hitherto prevented the company from obtaining possession of the land; but, as it is expected that the contractor will have possession in the course of a few days, such arrangements will be made as will ensure no delay arising from this unavoidable postponement of operations in this part of your works.

Contract No. 4, or Heaton Norris Contract, extends from the Hyde Road at the south end of No. 3 contract, to near the right bank of the river Mersey at the town of Stockport; its length is four miles twenty-six chains. It also includes the ballasting and laying of the permanent way upon contracts one, two, and three. It dates from September 11th, 1838, and the time of completion is 20 months. The heaviest work on this contract is a cutting of 409,000 cubic yards, the whole of which is to be carried to embankment; and 350,000 yards of this quantity are to be carried in one direction. About 80,000 yards have been already excavated. The contractor is proceeding actively and judiciously; on the 18th of this month, he will commence night work, and he is making such arrangements as will enable him to calculate upon completing the embankment to the end of the third contract by November next, when he will be ready for laying three miles of the permanent way; and there appears to be little doubt of his performing his contract in the specified time, namely, by May, 1840.

Contract No. 5, or Stockport Viaduct Contract, dates from November 13th, 1838. The time for completion is two years. It consists of a viaduct of 22 arches, of 63 feet span each. The first stone of this structure has been laid to-day, and the contractors are making arrangements for proceeding vigorously with their work.

Contract No. 6, or Congleton Viaduct Contract.—This work has just been let, and is to be completed in two years and a half. It consists of forty-two arches, each of sixty feet span. Preparations have commenced by throwing up clay for making about 15,000,000 bricks, during the present year.

This work is that which may be expected to require a longer time for execution than any other on the line; and therefore its being now commenced will facilitate the making of such arrangements in the future lettings, as will tend to bring all the other parts of the railway towards completion nearly at the same period.

I am, Gentlemen, your obedient servant,

Manchester, March 6th, 1839. GEORGE W. BUCK.

BRISTOL AND EXETER RAILWAY COMPANY.

Extract from a Report read at the General Half-yearly Meeting of this Company, held on Tuesday, the 5th ult., at Bristol.

The Directors have the satisfaction of stating, that although the season of the year since the autumnal half-yearly meeting has been necessarily unfavourable to the rapid progress of the works, they are, nevertheless, so far advanced as to warrant a confident hope that the great bulk of what remains to be done, in the construction of the line between Bristol and Bridgewater, will be finished in the course of the present year, and several portions of the line so far completed as to allow of the formation of the permanent way to be commenced before the end of this year, and the remainder proceeded with early in the spring of 1840.

The principal works are comprised in the two first contracts, chiefly at the western extremity of the Ashton-valley. In these extensive progress has been made; and although more might undoubtedly have been done by the contractor, yet it is equally true that the state of the works is such, that as the season advances a considerable force may be advantageously employed, and a very large quantity of work executed during the summer months.

For some distance beyond this point the work is so light as to insure its early completion without difficulty.

At Puriton some interruption has been caused by impediments in the purchase of land; but these difficulties being removed, the facilities in the execution of the work are such, as to preclude any possibility of further delay.

The numerous and urgent representations that have been received, in favour of an immediate prosecution of the works below Bridgewater, afford a gratifying proof of the increased and increasing extent to which the value of the undertaking is appreciated by the inhabitants of the Western Counties. With the sincere desire, however, to accede to the wishes of the shareholders resident in that district, with an unabated conviction of the magnitude and certainty of the advantages to be derived from the extension sought for, and with a fixed determination to adopt as speedily as possible every step that can conduce to the early continuation of the line to Exeter, the Directors are, nevertheless, persuaded that they will most satisfactorily discharge their duty by faithfully adhering to the resolution expressed in former reports, to make expenditure and receipt go hand in hand, by an early opening to Bridgewater.

The construction of the bridge now in progress over the river Parret, may be justly appealed to as the best evidence of their anxiety to reach Taunton; a town of very great importance, less than ten miles beyond the bridge, approached through a fertile and populous district, by a route almost level, and itself the focus of such an extensive traffic in passengers and merchandise, as must at once place the question of revenue beyond the reach of doubt, and enable the Company to complete the entire line to Exeter, without inconvenience to the shareholders.

EDINBURGH AND GLASGOW RAILWAY.

Extract from the Report read at the last Half-yearly Meeting, held at Glasgow.

Your Directors, at a very early period, turned their attention to the letting of the Contracts for the more important works on the line.

The Almond Valley Contract, which comprehends the heaviest work to be executed and which had, at the date of the last general meeting, been just advertised, was shortly afterwards let to Messrs. John Gibb and Son, of Aberdeen, whose long standing and high character, as contractors, afford the best security for its completion within the time prescribed by the Company's Engineer. Your Directors are happy to say, that the expense of this portion of the line, although it embraces the great stone viaduct over the Almond, of 48 arches of 50 feet span each, will, notwithstanding the recent rise in the price of masonry, little, if at all, exceed the proportional amount of the Parliamentary estimate. In consequence of the arrangements previously made with Mr. Hogg, of Newliston, your Directors were able to give Messrs. Gibb and Son immediate access to the ground at the Almond; and these parties have ever since been pushing forward their works with their usual promptitude and vigour. Notwithstanding the unfavourable season of the year, the contractors have already removed a considerable quantity of earth, and sunk two shafts in the Winchburgh Tunnel, and have founded one abutment and several piers of the viaduct on the Almond; they have also laid down a great deal of building material, so as to avail themselves of the earliest improvement of the weather in spring.

Your Directors, after completing the contract for the Almond Valley, next turned their attention to the contracts for the tunnels, &c., in the neighbourhood of Falkirk and of Glasgow. These were advertised to be let in four different lots, and although your Directors experienced difficulty, in two instances, in procuring Contractors, possessing sufficient capital and experience, they have now the satisfaction of reporting, that they are all let on favourable terms, and to parties, of whose ability to complete them, your Directors entertain no doubt.

Other contracts of smaller extent, but embracing 18 miles of the line, have been advertised, and for these your Directors expect there will be a keen competition, as many most respectable contractors have already intimated their desire to offer for them. Before the season is much further advanced, your Directors anticipate that upwards of 26 miles of the line will be let, and in course of execution: and they will proceed with as little delay as possible to have the working plans prepared, and the contracts let for the rest of the line.

Leeds and Bradford Railway.—The report of Messrs. Stephenson and Gooch has been presented to the Provisional Committee. From a copy which has been lying at the Exchange News Room during the last week, we make the following abstract. The engineers propose to make the terminus at the Leeds end upon a piece of vacant ground lying on the south side of Wellington-road, and between that road and the Whitehall-road. From thence the line will cross the river Aire and the Leeds and Liverpool canal, upon an embankment, a little to the west of the Suspension Bridge, then curving round to the west, it passes to the south of Castleton Lodge, and again crossing the canal, passes a little to the west of armly mills. It then takes the low ground between the canal and the river, and passes under the Kirkstall-road, by Kirkstall Bridge, and continuing between the canal and the river leaves Kirkstall Forge to the right. At New Laiths it crosses the river, and leaves New Laiths Grange to the north. It then proceeds to near Rawdon Low Mills, thence on the north side of the river to near Woodhouse Grove, which it leaves on the south and will cross the river and canal, and pass under Birk Hill, by a tunnel of about three quarters of a mile in length. It will then run parallel to and on the south side of the canal to Shipley, where crossing the branch canal it will enter the Bradford valley, and proceedin nearly a direct line to the town. The terminus and depot at Bradford will be in a field on the low side of the quarry of Messrs. Coates and Thackray, and near to the works of Messrs. Haste and Sons. The length of the line will beabout thirteen miles, and no inclination on the main line will exceed twenty feet per mile. The estimated cost of laying down the railway is 400,000*l.*, exclusive of stations, depots, engines, which, together with all other necessary machinery, will require a further sum of 50,000*l.* Another important feature in the report is the formation of a junction line between the main line and the North Midland, which is intended to cross the turnpike-road near Wellington Bridge, and passing between Messrs. Marshall and Co.'s works and the village of Holbeck, and between Mr. Russell's pottery and the Toll-bar, and thence to the North Midland Railway, a little south of the Leeds pottery. This junction line, about one mile and three quarters in length, will enable passengers, &c. to pass on to the latter railway without the inconvenience and expense of changing conveyance.—*Bradford Observer.*

Preston and Longridge Railway.—We understand that Mr. Wilkie, the principal contractor upon this line of railway, has completed his works; and the Directors are now laying the permanent rails, so that, in all probability, the railway may be opened early in the summer. It is calculated that a saving of 2d. per cubic foot upon the carriage of ashler stone, and 1s. 6d. per ton upon walling stones from Longridge to Preston, will be effected by this means.—*Preston Chronicle.*

Newcastle and North Shields Railway.—The works on the line of the Newcastle and North Shields Railway are now rapidly drawing to a conclusion, and it is expected that the road will be opened to the public during the ensuing spring. Those stupendous erections, the great viaducts over the Ouseburn and Willington Deans, are on the point of completion, and are exciting, as might be expected, the attention and admiration of the neighbourhood and of all strangers. Two grander and more beautiful erections are certainly not to be found in this kingdom. The bridge over Willington Dean is now finished, and from its magnitude forms a most striking object in our local scenery. It is composed of seven arches each of 120 feet span, with two massy buttresses, and is in length 1060 feet. The height of the roadway of the main arch over the small stream which flows beneath is seventy-eight feet. The bridge over the Ouseburn Dean will be finished in a very few weeks. It is composed of five arches of 116 feet span, with two stone arches at each end, to throw the embankment from the breast of the hill. The height of the roadway of this bridge from the bed of the Ouseburn is 108 feet. It is a most magnificent structure, but its more confined situation causes it to be a less prominent object than that over Willington Dean. The public are daily taking more interest in this railroad, and are eagerly anticipating the increased accommodation and comfort it will afford them. The distance, it is confidently expected, will be accomplished within twenty minutes, and it is understood to be the intention of the Company to fix the rates for the conveyance of passengers at as low a point as circumstances will warrant.—*Newcastle Journal.*

York and North Midland Railway,—Since our last notice of the state of the works on this line, considerable advancement has been made. The men still continue to be employed day and night, and the excavation of the rampart is now completed. In addition to those employed in removing the earth, workmen had been busily employed in pulling down the wall that enclosed Messrs. Backhouse's garden. The foundations of the walls for the company's depots, near to the river, have been laid, and the bricklayers are busied in the building of those walls.—*Doncaster Chronicle.*

The London and Brighton Railway.—The works, both at Balcombe and at Clayton, have been stopped for several days, in consequence of the springs being out. There are from 50 to 60 feet of water in the Balcombe shaft, and from 20 to 30 feet in Clayton shaft. Indeed we have heard that a very grave doubt exists whether the line must not be altogether diverted, to avoid these dropsical hills. A gentleman was recently down from London to view and inspect these spots, who declared that the symptoms were more formidable than those which were the cause of so much expense and delay on the Great Western line—*Brighton Guardian.* There is no truth whatever in the report that the operations on this grand work are likely to be formidably impeded by the springs. It will be recollected that Mr Rastrick noticed, in his report, the water at Balcombe and Clayton, and the mode of getting rid of it. When the headings are run, the water at Balcombe will fall into a brook to the south of the tunnel; that at Clayton will fall into the Clayton brook. Nothing can proceed more satisfactorily than the whole of the works on the line; and it is only from parties who are willing to cry down Brighton and its prosperity that a single word is heard against them.—*Brighton Gazette.*

Doncaster, North Midland, and Goole Railway.—We understand that the project for connecting Goole, Thorne, and Doncaster with the North Midland and the Sheffield and Rotherham Railways, has been received with high prospects of success. It will branch from the North Midland at Kilnhurst, and proceed through or close to Doncaster, extending inwards to the port of Goole. The preliminary steps have already been taken, and the line is now being surveyed under the skilful direction of Mr. Swanwick.—*Derby Reporter.*

Railway Swamped.—By an inundation of the Senne, the Br[illegible] and Vilvorde Railway is covered with water six inches deep, and the travelli[illegible] of [illegible] is interrupted.

Chester and Crewe Railway.—We learn that Messrs. Jackson and Bean, who completed a portion of the Birmingham and Derby Railway, have undertaken the Bunbury and Wardle contract, in length about ten miles, on the Chester and Crewe line.—*Chester Gazette.*

London and Brighton Railway.—Great exertions have been making lately in order to the completion of about three and a half miles of road on the Shoreham branch of this line. The late heavy rains, however, partially retarded the progress of the works, and the opening was in consequence postponed till Tuesday, 19th ultimo. The contractors will then re-commence active operations at the Hove cutting. The tunnel there will, we understand, be completed in the early part of July.—*Brighton paper.*

Railway Sanctuary.—As the constable of Milford was employed in conveying a man employed on the railway to gaol, on a charge of felony, he managed to slip from the officer, and descended into the Claycroft tunnel, in which he could not be found. The fellow got into a cart, covered himself with earth and rubbish, and was drawn out of the tunnel without being perceived, and made his escape.—*Derby Mercury.*

Breaking in of the Hanwell-Bridge of the Great Western Railway, and Loss of Life.—(From a Correspondent.)—Considerable alarm prevailed on Monday, the 18th ultimo, about 9 o'clock, on the line of the Great Western Railway, to the passengers who were coming to town in the train drawn by the Vulcan engine. On the arrival of the train at the viaduct-bridge which passes over the high road at Hanwell, they were thrown into the utmost consternation by hearing a report resembling that of a heavy cannon, which was supposed to be occasioned by the bridge over which they were in the act of crossing having given way. On making an examination, it was found this supposition was in a great measure correct, as one of its principal supporters, consisting of an iron beam of great dimensions, extending from one pillar of the bridge to the other, had snapped in half, carrying with it in its descent a vast quantity of the material of which the bridge was composed, leaving an open space under a portion of the line. On the next train coming up great delay was occasioned, in consequence of the apprehension that if it passed over the rails would give way, but from the care of the engineers and others, such a result did not take place. Immediate steps were taken to repair the damage, and several of the workmen were employed to shore it up. Whilst so engaged, a massive piece of timber fell from the upper part of the bridge upon one of them, and almost immediately killed him.—*Times.*

ENGINEERING WORKS.

NEW HOUSES OF PARLIAMENT.

The works connected with the embankment for the new Houses are probably the most extensive hydraulic works now in progress, and the coffer-dam is certainly unequalled; drawings and descriptions both of the coffer-dam and river wall were given in our first volume, and we shall now briefly describe what has been done up to the present time.

The coffer dam and other works were contracted for by Messrs. Lee, to be executed under the direction of Messrs. Walker and Burges, Engineers, and Charles Barry, Esq., Architect. The coffer-dam was commenced in the month of October, 1837, and is constructed nearly similar to the drawings and specification before given by us in Vol. I., page 31, with the addition of horizontal struts of whole timber at the back of the brace piles, B, fig. 1 and 2, and abutting against other piles driven just within the inner edge of the foundation of the wall. Considering the great extent of the dam it stands remarkably firm, and is tolerably free from leakage; it was finished on the 24th day of December last, when it was closed, and operations commenced within. For the purpose of pumping out the water, a 10-horse power steam-engine was erected, which is kept at work night and day; at the present time, the water is easily kept under by the aid of two 18-inch pumps, each working 14 three-feet strokes per minute; since the closing of the dam the whole of the silt or mud lying at the bottom of the river within the enclosure has been removed, leaving a fine bed of gravel over the whole surface; the gravel has been excavated for the foundations of the river wall, and nearly the whole of the foundations laid, and the sheet piling protecting the footings completed, likewise a considerable portion of the brickwork to the backing is commenced. The granite intended for the curvilinear facing is in an advanced state, a very large portion of it being already prepared and ready for setting. Too much praise cannot be bestowed on all parties for the activity with which the works have been conducted within the last two months; before another four months elapse, we hope that we shall be able to announce the river wall is completed, and the new buildings ready to be commenced.

The first stone of the foundation was laid on the 5th ultimo, without any ceremony.

WESTMINSTER BRIDGE.

We before noticed a commencement of the works for the repair of Westminster Bridge, in a former number; a dam has since been completed round two of the piers on the Westminster side, and a beginning made with the piling round them.

The great extent of the coffre dam (being no less than 500 feet in circumference), as also the difficulty experienced in driving the piles through a hard crust of gravel which overlays the clay at this place, and the care that must have been taken in doing the work, by so effectually shutting out the water, makes it appear to us truly astonishing that so much has been done in the short period of eight months, especially as all works of this nature depend so very much upon the weather and tides.

Great credit is due to the parties in charge of the work; and, if we may judge from the earnest manner in which they are proceeding, the public will have no cause again to complain of the tardy progress which hitherto marked everything connected with this bridge.

Neither can we omit to state, that upon our late visit, the gratification we experienced in witnessing the very dry state of the work, and although the level at which they are now proceeding is several feet below the bed of the river, there was not the slightest leakage; and we understand that the same has been the case since the completion of the dam.

The plan of operation for protecting the foundation of the piers, from being undermined by the wash of the river, is, by surrounding the caisson upon which the pier is built with sheet-piling, driven as close as it is possible to bring wood and wood together. The piles are driven fourteen feet into the solid ground below the bottom of the stonework; they are twelve inches thick, and the space between the pier and the piles is afterwards filled in solid with concrete, upon which masonry of square stones of large dimensions is laid, the top of the piles being dressed off to a fair and uniform line, and further secured with a strong band or waling of timber, encircling the whole tie, which is held in its place by iron caisson bars, firmly fixed to the main timbers of the caisson.

By this plan very little obstruction will be offered to the current, should any further increase of depth in the river take place, and from what we saw of the care taken to make the joints close, there will not be, in our opinion, the slighest apprehension for the safety of the bridge, should the river deepen three times as much as it has since the removal of London Bridge—a circumstance very unlikely to happen.

In comparing this method of work with endeavouring to accomplish the same object by diving bells (which was the plan till lately followed at this bridge), there cannot be a question which is the best; in one all is done in the dark, or otherwise hid from view; while in the other it is seen as the work progresses; in truth, the last is the only proper course.

THAMES TUNNEL.

Extract from the Report of the Directors at the last General Meeting, held at the London Tavern, 5th March, 1838.

The plan upon which the works have been carried forward consisted of three principal features, viz.:—

1st.—To divert the Navigation from that part of the River immediately over the Mining operations.

2dly.—To gain the command of that part of the River, without interruption, and to be thus enabled to load and cover its bed, both over the Works in progress and in advance of them; and to compress this artificial bed, directly over the Shield, by grounding upon it, at every fall of the tide, a vessel, when ballasted, of about 900 tons burthen.—And,

3dly.—To make alterations in the auxiliary parts of the Shield, still further to add to its security and power.

The brickwork of the Tunnel has been advanced, since the last Meeting, 90 feet, and is now within 60* feet of low water mark; and if the same rate of progress continues, which there is every reason to expect, low water mark will be reached in the course of the autumn.

It will be clear to those who are best acquainted with the work, that when this is accomplished the most hazardous portion of the Tunnel will be completed; and that however novel, and even bold, the work which then remains to be dene, in order to realise the original design, yet its complation becomes comparatively safe and easy, and calculable within a reasonable time.

* Since this Report was read to the General Meeting, Ten feet have been excavated the distance to low water is therefore only 50 feet.

Suspension Bridges.—The largest suspension bridge in this country is that across the Menai Strait, with a span of 560 feet; the next in point of size, is that at Montrose, which is 432 feet in span; we have been much gratified by the inspection of a report and plan of a third which will rival these stupendous works of art, both in magnitude and importance; for while they have but one span each, of the above dimensions, that to which we are alluding projected by that able engineer Mr. J. M. Rendel, will have two of 450 feet each, and a whole length (with the side openings) between the abutments, of 1126 feet. The site of the proposed bridge, is at Newnham, on the Severn in Gloucestershire, where there is at present a ferry, which has the great inconvenience of being entirely navigable only half an hour before and after high water. The great advantages of such a work will be materially felt in the adjacent country, by the coal and other mines of Dean Forest, becoming easier of access, thereby producing a considerable reduction of price, besides the convenience it will secure of a direct route across the Severn to the southward of Gloucester. The various drawings by which the proposed bridge is illustrated are admirably executed, and convey both in point of topographical, geological, and perspective detail, as complete an idea of this magnificent proposed work and its locality as can be expressed by the artist on paper.—*Nautical Magazine.*

The Wreck of the Royal George.—The experiment of blowing up the wreck of the Royal George, at Spithead, by means of 13-inch shells, placed as far into her in different parts as the divers can manage it. To prevent accident to any boat, the explosion will be effected by the rising of the tide operating on a buoy attached to the shells by a log-line.

Steam Dock-yards.—In bringing in the navy estimates, Mr. C. Wood stated, that the government had laid in ample stores—had added one-third to the dock-yards—and had made preparations at Deptford, Woolwich, Portsmouth, and Plymouth.

Overland Indian Mails.—The contract for a carriage conveyance over the desert between Suez and Cairo has been taken by Messrs. Hill and Co., and by the 17th of January, there was to be a carriage for the conveyance of passengers from Cairo to Suez, between which the distance is 90 miles, and the time is about 24 hours.

NEW PATENTS.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 23rd FEBRUARY, AND THE 27th MARCH, 1839.

George Augustus Kollman, of the Friary, St. James's Palace, Professor of Music, for "Certain Improvements in the Mechanism, and general Construction of Piano-fortes, being an extension of former letters patent for the term of seven years."—23rd February.

Charles Louis Stanislas Baron Heurteloupp, of Queen Ann-street, for "Certain Improvements in Fire-arms, and in the Balls to be used therewith."—23rd February; 6 months to specify.

Thomas Pratt, of South Hylton, Durham, Mechanic, for "An Improved Capstan and Winch for Purchasing or Raising Ship's Anchors, without the application of a Messenger, in which there is no Fleeting or Surging, or for drawing or working of Coals or other articles, and things out of Coal or other Mines, and also for the drawing and working on Railroads, by drawing Pulleys with Flat or Round Ropes."—23rd February; 6 months.

James Russell, of Handsworth, in the county of Stafford, for "Certain Improvements in Manufacturing Tubes for Gas and other purposes, being an extension for the term of six years, granted to Cornelius Whitehouse."—26th February.

Moses Poole, of Lincoln's Inn, Gentleman, for "Improvements in constructing and applying Boxes to Wheels."—28th February; 6 months.

Moses Poole, of Lincoln's Inn, Gentleman, for "Certain Improvements in Tanning."—28th February; 6 months.

John Leigh, of Manchester, Surgeon, for "An improved Mode of obtaining Carbonate of Lead, commonly called White Lead."—28th February; 6 months.

Richard Whytock, of Edinburgh, Manufacturer, and George Chink, of the same place, Colour Maker, for "Further Improvements in the Process and Apparatus for the Production of Regular Figures or Patterns in Carpets and other Fabrics, in relation to which a patent was granted to the said Richard Whytock, on the 8th September, 1832, and generally in the mode of producing Party Colours on Yarns or Threads, of Worsted, Cotton, Silk, and other fibrous Substances."—1st March; 6 months.

Moritz Platow, of Poland-street, Oxford-street, Engineer, for "Improvements in Pumps or Engines for raising or forcing Liquids."—6th March; 6 months.

John Dickson, of Brook street, Holborn, Engineer, for "Certain Improvements in Rotatory Steam-Engines."—6th March; 6 months.

Auguste Victor Joseph Baron D'Asda, of Millman-street, Bedford Row, for "Improvements in producing or affording Light, which he denominates a Solar Light."—6th March; 6 months.

Walter Hancock, of Stratford, Essex, Engineer, for "Certain Improvements in Steam-boilers and Condensers."—6th March; 6 months.

George Robert D'Harcourt, of Howland-street, Fitzroy-square, gentleman, for "Certain improved artificial Granite, Stone, Marble, or Concrete, in which said invention neither Asphaltic nor Bituminous Substances are used."—6th March; 6 months.

Wm. Vickers, of Firshill, Sheffield, Merchant, for "A Mode of obtaining Tractive Power from Carriage-wheels under certain circumstances."—6th March; 6 months.

John Clark, of Upper Thames-street, London, Engineer, for "A New or Improved Form or Construction of a Leg and Foot for propelling Carriages on Rail or Common Roads, and a new Combination or Arrangement of Machinery for Locomotive Carriages, by means whereof the weight of the Load to be carried is rendered applicable as a part of the Power for moving or propelling the Carriage on which it is supported or rests."—6th March; 6 months.

Charles Schafhault, of Cornhill, London, Gentleman, for "An improved Method of Smelting Copper Ore."—6th March; 6 months.

Orlando Jones, of Rotherfield-street, Islington, Accountant, for "Improvements in the Manufacture of Starch, and the converting of the Refuse arising in or from such Manufacture to divers useful purposes."—6th March; 6 months.

George Holworthy Palmer, of Surrey-square, Old Kent-road, Civil Engineer, and George Bertie Paterson, of Hoxton, Engineer, for "Certain Improvements in Gas Meters."—6th March; 6 months.

Thomas Horton, of Prince's End, Stafford, Boiler-maker, and Thomas Smith, of Horseley Heath, in the same county, Mine Agent, for "Certain Improvements in the making or constructing of Chains for Pits, Shafts, Mines, or other purposes."—6th March; 6 months.

Edward Ford, of Liverpool, Builder, for "Certain Improvements in conducting the Manufacture of Salt Cake, or Sulphate of Soda or Hydrochloric, or other Acids and Alkalies, or other Chemical Processes, wherein Deleterious Vapours are given off, and in the Erection of Furnaces and Works connected therewith."—8th March; 6 months.

Josias Christopher Gamble, of St. Helen's, Lancaster, Manufacturing Chemist, for "Improvements in Apparatus for the Manufacture of Sulphate of Soda, Muriatic Acid, Chlorine and Chlorides."—14th March; 4 months.

Elisha Haydon Collier, late of Boston, in America, but now of Globe Dock Factory, Rotherhithe, Civil Engineer, for "Improved Machinery for Manufacturing Nails."—14th March; 6 months.

Christopher Nickels, of York-road, Lambeth, Manufacturer, for "Improvement in the Modes of Manufacturing of Fabrics from Linen, Woollen, Silk, and other Fibrous Materials."—15th March; 6 months.

Richard Lamb, of David-street, Southwark, Gentleman, for "Improvements in Apparatus for supplying Atmospheric Air in the production of Light and Heat."—15th March; 6 months.

Alexander Francis Campbell, of Great Plumstead, Norfolk, Esquire, and Charles White, of Norwich, Mechanic, for "Certain Improvements in Ploughs."—18th March; 6 months.

Thomas Henry Ryland, of Birmingham, Screw Manufacturer, for an "Improved Manufacture of Screws for Wood, in Iron, Brass, Copper, or any mixed Metals, commonly known as Wood Screws."—18th March; 6 months.

John Ruthven, and Morris West Ruthven, of Edinburgh, Civil Engineers, for "Improvements in Boilers for generating Steam, economizing Fuel, and propelling Vessels by Steam or other Power, and ventilating Vessels, and which may be applied to Mines and Buildings."—20th March; 6 months.

Edward Law, of Downham-road, Kingsland, Gentleman, for "Certain Improvements in evaporating Sea Water, and other Fluids, and in the Manufacture of Salt."—20th March; 6 months.

Joseph Amesbury, of Burton-crescent, Surgeon, for "Certain Apparatus for the support of the Human Body." 20th March; 6 months.

Andrew Smith, of Princes-street, Leicester-square, Engineer, for "Certain Improvements in the Manufacture of Ropes for Cables, and other purposes to which Ropes are applicable."—20th March; 6 months.

George Nelson, of Milverton, in the County of Warwick, Chemist, for a "New or improved Method, or new or improved Methods of preparing Gelatine, which has the Properties of, or resembles Glue."—23rd March; 6 months.

Fisher Salter, of Hallingsbury, Sussex, Farmer, for an "Improved Machine for winnowing and dressing Corn and other Grain."—23rd March; 6 months.

Edmund Butler Rowley, of Manchester, Surgeon, for "An improved Steam-engine, applicable to Locomotive, Marine, and Stationary Purposes."—26th March; 6 months.

Richard Roberts, of Manchester, Engineer, for "An Improvement or certain Improvements of, in, or applicable to the Mule Billy Jenny Stretching-frame, or any Machine or Machines, however designated or named, used in spinning Cotton, Wool, or other Fibrous Substances, and in which either the Spindles recede from, and approach the Rollers, or other Deliverers of the said fibrous Substances, or in which such Rollers or deliverers recede from, and approach the Spindles, being an extension of former letters patent for the term of seven years."—26th March.

Joseph Leese, Junior, of Manchester, Calico Printer, for "Certain Improvements in the Art of Printing Calicoes, Muslins, and other Woven Fabrics, and in certain Processes connected therewith."—26th March; 6 months.

Henry Montague Grover, of Boveney in the county of Buckingham, Clerk, for "Improvements in Brewing, by the Use of a Material not hitherto so used."—26th March; 6 months.

Elisha Hale, of the United States of America, now of Leadenhall-street, in the city of London, for "Improvements in Umbrellas and Parasols."—27th March; 6 months.

William Newton, of 66, Chancery-lane, in the county of Middlesex, Civil Engineer, for "Certain Improved Machinery for cutting and removing Earth, which Machinery is applicable to the digging of Canals, and the levelling of Ground for Railroads, or ordinary Roads, and similar Earth Works."—27th March; 6 months.

MISCELLANEA.

Fire at Rome.—A letter from Rome of the 8th of February, states that on that day the Palace occupied by Count de Lutzen, the Austrian Ambassador, was almost entirely destroyed by fire.

Bishop Heber's Statue.—The statue of Bishop Heber has arrived safely at Calcutta, and has been deposited in the Cathedral.—*India Gazette.*

St. Germain Railway.—This railway has declared a dividend for the year of seven and half per cent.—*Galignani's Messenger.*

Indian Silver Mines.—Capt. Drummond and an experienced miner have been deputed to the district in the Himmalaya (the immediate range between the D'Hauli and the Gori) where silver is said to exist, to ascertain the fact.—*Asiatic Journal.*

Louvre Exhibition.—The exhibition of the works of living artists opened on the 2nd March, with about 3000 works from 1500 artists.

Danube Canal.—An article dated Bucharest, Jan. 18, repeats that the project for uniting by a canal the Danube and the Black Sea, will be carried into execution in the course of next spring, in virtue of an agreement between England, Austria, and Turkey.—*Times.*

Kilcooley Abbey.—The fine old Gothic mansion of Kilcooley was consumed to ashes last month. It was insured for £13,000.—*Kilkenny Journal.*

Egyptian Antiquities.—The Egyptian government have appointed a board for the preservation of the national antiquities.

Horticultural Society.—The Horticultural Society are now erecting a grand conservatory at Chiswick on a very large scale.

London and Westminster Bank.—The cost of the buildings and fittings is about £60,000.

ERRATA.

In our last number, page 92, column 1, line 30 from the bottom, for "as the effective pressure, and inversely as the density," read "as the *square root of the* effective pressure, and inversely as the *square root of the* density."

Page 93, column 1, line 16 from the bottom, for "will be greater," &c., read "will increase with the elastic force of the steam admitted into the cylinder in a higher ratio than if the elastic force of steam were proportional to its density."

Page 98, column 2, line 3 after engravings, for $G = H\frac{AB}{2}$ read $CH = \frac{AB}{2}$

Page 104, column 2, line 2 after the table, for "sketched, read "stretched."

Page 106, column 2, line 2 of 3rd paragraph, for "hydraulic lime," read "concrete."

Page 116, column 2, line 1, Statue to Mr. Stephenson, for "Robert," read "George."

Page 116, column 2, line 9, Eastern Counties Railway, for "200 yards per day, read "2,000 yards per day."

TO CORRESPONDENTS.

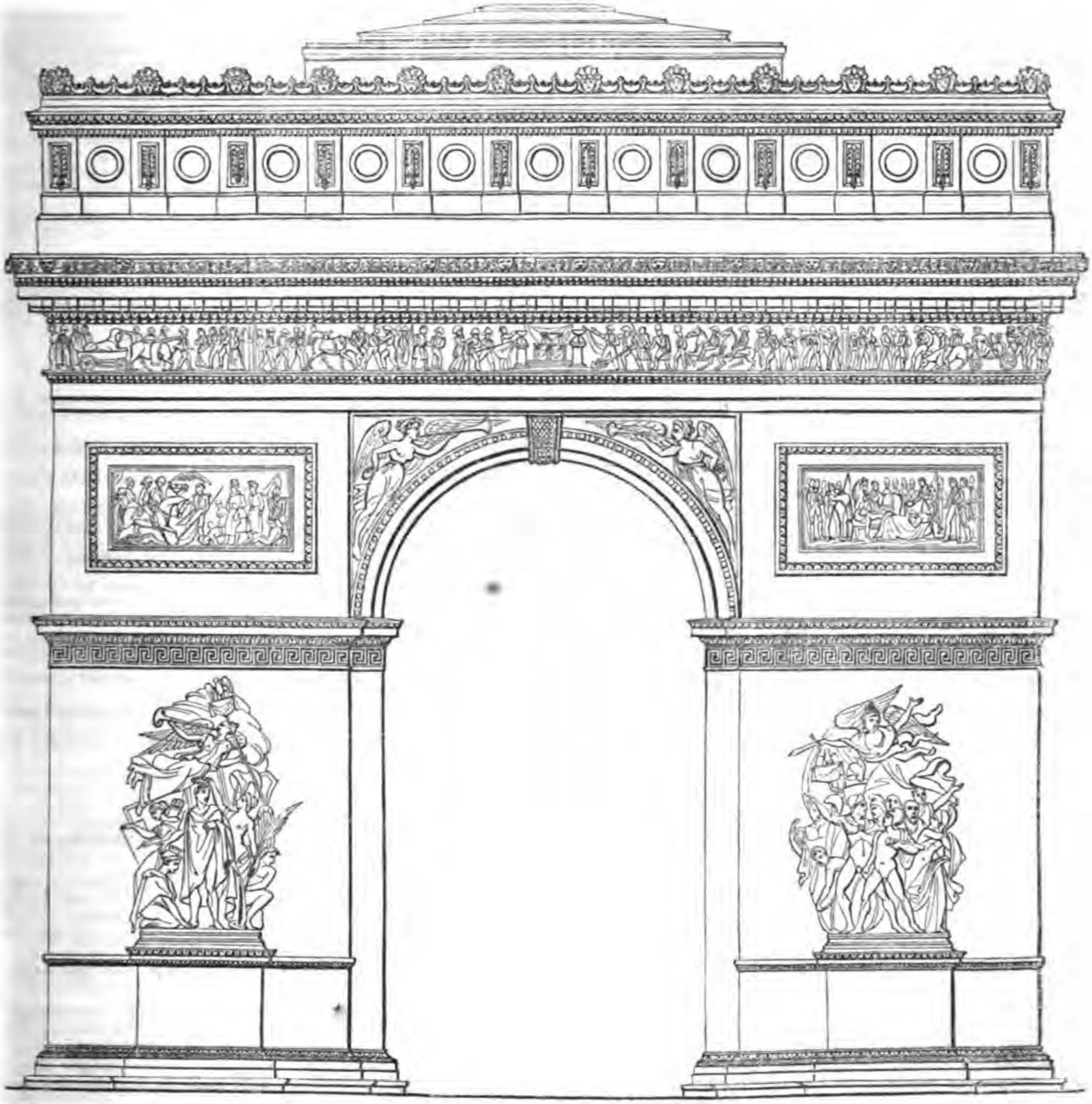
We have been obliged to postpone some of our communications and reviews until next month. We shall feel obliged to correspondents who may send drawings accompanying their communications, that they forward them early in the month.

We must apologise to our architectural friends for a deficiency of engravings connected with architecture. We intended to have given the drawings of the "Arc de l'Etoile," but in consequence of the considerable work in them, our wood engraver could not have them ready for the present number. They will be given in our next.

We shall feel obliged to our country correspondents if they will forward us any account of works in progress, or any newspaper containing articles connected with the objects of our Journal.

ARC DE L'ETOILE,

AT PARIS.

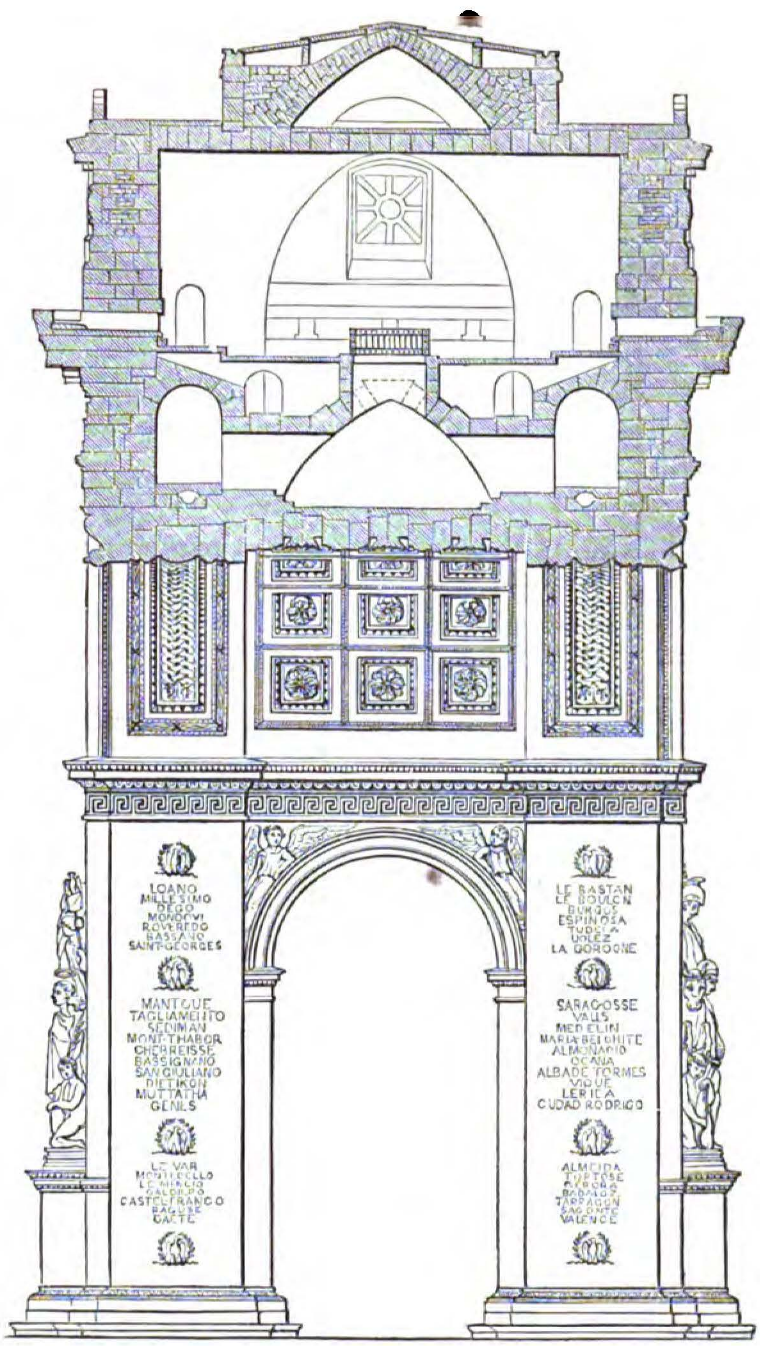


Scale of French Metres.

10 9 8 7 6 5 4 3 2 1 0 10 20

NOTE.—A French Metre is equal to 3·2809 Feet, or 3 Feet 3⅜ Inches.

Fig. 2.—SECTION THROUGH THE CENTRE OF THE ARCHWAY.



THE ARC DE L'ETOILE, AT PARIS.

Between the commencement and the completion of this stupendous monumental structure, just thirty years elapsed—in the course of which memorable period, the Napoleon dynasty crumbled away with a celerity equal to that of its rise. Of the many designs for it submitted to the then government, those of Raymond and of Chalgrin obtained the preference. That by the former of these architects, proposed twelve coupled Corinthian columns on each of the sides, supporting a magnificent entablature, on which would have been as many statues symbollical of the different cities that had been taken by the French, and between these, bas-reliefs of the chief victories. The interior would have been divided into four masses on its plan, by the principal archway or vaulting being intersected by the transverse one; and the design further proposed that there should be seven halls in the upper part of the structure; viz., three smaller ones on each side, and a larger one in the direction of the principal arch.

Chalgrin's plan was much more simple, though it resembled the other in its general disposition; namely, in having two intersecting vaults, and consequently an arch on each of its four faces.

Even before it was decided which of the two designs should be ultimately adopted, preparations were made for carrying one or other of them into execution, and the first stone was laid August 15th, 1806. The foundations, which are 8 metres in depth, and 28 in breadth (or a fraction more than 26 and 91 English feet, respectively) and are formed of blocks of Cyclopean masonry, were already far advanced when Raymond, whose leading ideas it had been determined to adopt, resolved rather to have nothing to do with the work, than consent to the alterations it was proposed to make in his designs. He accordingly gave up his appointment as architect, in 1809; nor did he long survive the chagrin he felt on the occasion.

Chalgrin, hitherto only adjnnct to the principal architect, now proceeded with the work according to his own ideas, and with such

Fig. 3.—The Ground Plan of one of the Piers.

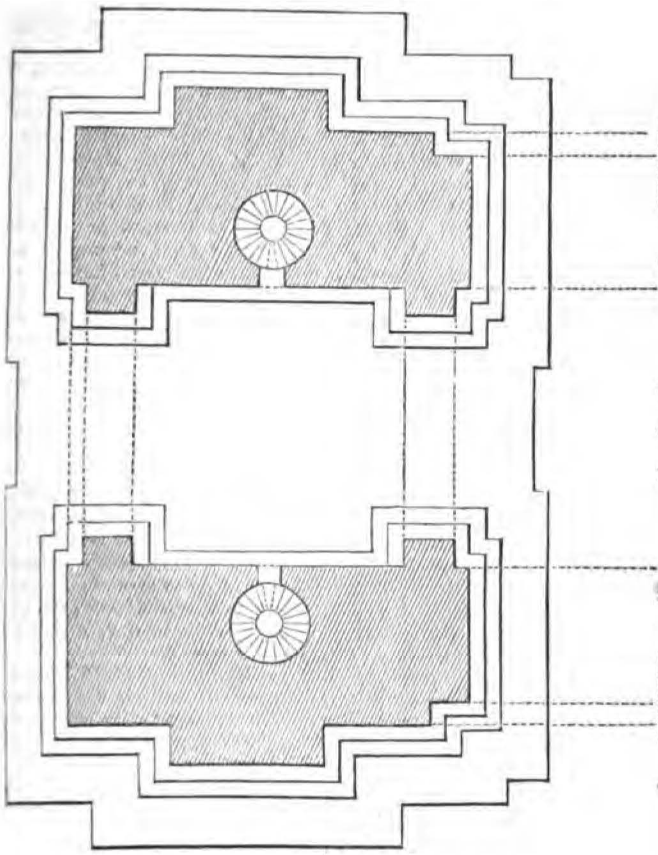
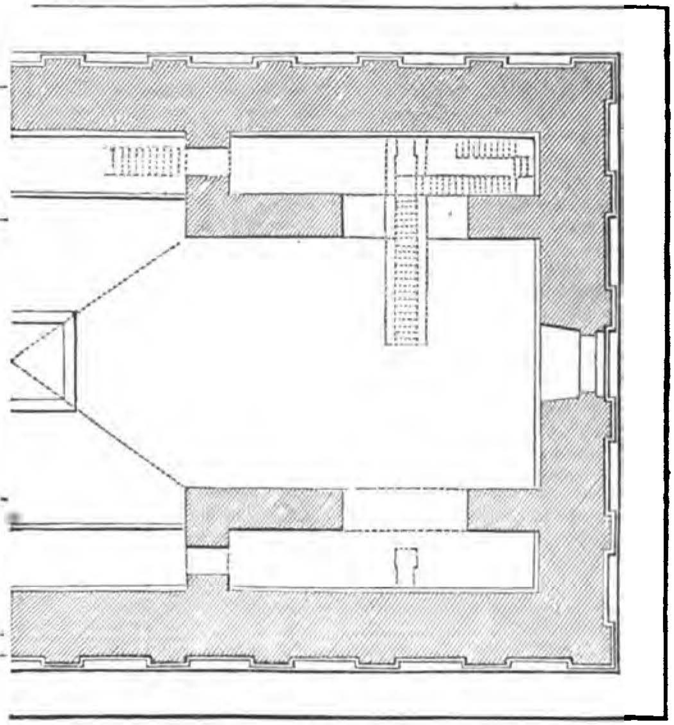


Fig. 4.—Half the Plan of Upper Story.



alacrity, that they had reached the height of more than twenty feet above the ground, when, in consequence of Napoleon's union with Maria Louisa, he was commanded to make some alterations in his designs with regard to the subjects of some of the reliefs, &c., but without interfering with the general idea for the monument. On Maria Louisa's entry into Paris, it was temporarily completed by a framework of timber raised upon it, covered with canvass, painted to resemble the decorations; and on this impromptu construction being removed, the works were prosecuted with all possible dispatch. Chalgrin, however, died in January, 1811, and was succeeded by Goust, who continued the edifice conformab y with the designs of his predecessor, till 1814, at which time it had been carried up as far as the imposts of the arch. Then came the reverse, whose history may be summed up in the four disastrous words—Moscow, Elba, Waterloo, St. Helena.

After a pause of nine years, it was resolved in 1823 to proceed afresh with the work, but to convert it into a monument of the Duc d'Angoulême's Spanish campaign; and among the alterations in consequence proposed, it was considered expedient to remove the pedestals on each side of the arch to the centre of the piers. Accordingly, both Goust and Huyot offered plans for that purpose; and Huyot's was the one accepted by the committee, consisting of Tournon, Hericourt de Thury, Quatremère de Quincy, and Percier. This was, however, afterwards set aside, and Goust was ordered to proceed according to Chalgrin's plan. But in 1825 he was superseded by Huyot, and he had carried up the building as far as the attic, which he intended to be decorated with thirty statues on lofty pedestals, connected by an open balustrade; when the political events of 1830 interfered, and Louis Philippe ordered that the monument should record all the exploits of the French armies, from 1792 to 1815. Huyot was dismissed, and Blouet, his successor, completed the monument as it now exists. But Chalgrin's idea, which he recommended should be carried into execution, and according to which the whole would have been surmounted by a figure of Victory, in a car drawn by six horses, has not been realised.

Although the reliefs and other sculptures are in themselves the most important features in the monument, which, independently of such decoration, and its colossal vastness, has nothing particularly striking in its design, we shall not enumerate their several subjects, which would after all be a mere catalogue of names. In regard to them, therefore, we will merely state that M. Thiery, a French architect, is engaged upon a large descriptive monograph, in which all the details and ornaments will be fully exhibited together with the constructive details, and the changes that were made from time to time in the works. We must not, however, omit to specify its principal dimensions; which, for the sake of greater convenience, we here give in a tabular form, both in metres and English feet:—

	METRES	FEET	INCHES
Entire Height	49.483	162	4
Breadth	44.820	147	
Depth or Lateral Breadth . .	22.280	73	
Height of Large Arch . .	29.420	96	6
Width of ditto	14.620	47	10
Height of Small or Lateral Arches	18.630	6	1
Width of ditto.	8.440	27	7

According to a return of the Minister of the Interior, made up to December, 1836, the total disbursements from 1806 to 1836 were 10,691,098 francs 91 cent. From this sum deductions must be made for alterations, caused by political changes 876,245 francs 83 cent. and for the temporary canvass erection on the marriage of the Emperor 511,345 francs 29 cent. or 1,387,591 francs 12 cent. Thus the arch property cost 9,303,507 francs 79 cent. (372,140*l.*); of which four millions were spent under the Emperor, three millions under the Restoration, and under Louis Phillippe, three millions. The gas-fittings cost 38,464 francs 50 cent. or 1538*l.*

The best way of estimating the effect of such extraordinary dimensions, is to refer to some well-known object that will furnish a direct comparison in regard to size, and we find such comparison ready made to our purpose, in the second volume of the "Illustrations of the Public Buildings of London," (p.216,) where, speaking of Temple-bar, the Editor remarks that the whole of it, "with another building of the same dimensions above it might be comprised within the opening of the large arch of the Barriére de l'Etoile!" Looking therefore at Temple-bar, we may, without difficulty, form an adequate conception of the vast scale of the French monument, particularly when we take into consideration its dimensions in regard to depth, which are such, that the void of the great arch would contain *eight* Temple-bars, that is, four placed one behind the other, and as many above them. How prodigious then must be the entire mass! Here again we may have recourse to comparison, and when we state that the height of this mass of architecture is only about twenty feet lower than that of the spire of St. Martin's church (measured from the street pavement), and that the clock of the latter would just be on a line with the architrave of the Arc de l'Etoile, something like a feeling of astonishment will be excited.

It would be interesting to delineate this monument, and some of our own edifices drawn to the same scale; and were we to do so with regard to the Strand front of Somerset-house, we should find that even in width, it is less than the edifice at Paris, and that, though composed of an order on a lofty basement, its cornice is not quite so high as the groups of sculpture placed on each side of the arch. Consequently, in this case, we should have to imagine more than another mass equal to the Strand building of Somerset-place, reared above the one we now behold. If we take the Banqueting-house, Whitehall, one of the loftiest of our buildings, exclusive of such structures as steeples and spires, we find that it is not higher than the impost of the arch, which being the case, it is easy to judge how diminutive even the Railway terminus in Euston-square would appear by the side of this colossal pile, the top of its pediment being about six feet lower than the Banqueting-house. It is true we have several façades (among others, that of the Post-office), which, in mere length, greatly surpasses the structure we are speaking of; but they are altogether different in character—display nothing of the same mass, or of the same scale of magnitude, being produced merely by *continuation*, without any amplification of the parts themselves. Here every thing is on the most gigantic scale, the very bas-reliefs in the panels being equal to one entire side of a large room; while each of the four piers formed by the two smaller arches intersecting the large one transversely in the plan, is equal to a very lofty house, with a frontage of 50 feet one way, and 25 the other.

RALPH REDIVIVUS.—No. XVI.

THE PIMLICO LITERARY INSTITUTION, EBURY STREET.

In making choice of this building, for my present article, it is not so much with the intention of confining myself to it for my subject, as with that of taking it as a theme upon which I may enlarge with respect to one peculiarity in it. Very probably some of my readers may have never heard of it before, and will therefore wonder not a little that I should condescend to waste any words upon a piece of such utter obscureness; and among them there may be those who will give me credit for being wicked enough to drag it forth into notice, for no other purpose than that of unsparingly ridiculing some poor abortive attempt at design which every body else would consider to be beneath criticism.

It must be confessed, the building itself has nothing at all in it to arrest the attention of persons in general, more than any thing else of the same kind and size; nor is it at all improbable that many have passed it without even so much as noticing the peculiarity for the sake of which it is that I am chiefly induced to speak of it. In the general elevation there is little remarkable, it being little more than a pleasing composition in the Grecian Doric style;—a distyle in antis, with a lower and narrower lateral portion or wing on each side of the loggia. Although, as far as decoration is concerned, these last-mentioned parts contribute little or nothing to the design, they have considerable value in it, both by giving character to it, and by producing an agreeable contrast of solid and void, and light and shade. It is to the back-ground behind the external elevation,—to the inner part of the loggia we must look for that which confers novelty on this small façade, and distinguishes it from every thing else of its kind; namely, the screen or low wall carried up little higher than the doorway placed in it; besides which the light is partially admitted at the sides or ends of the loggia between small square pillars, placed on he level of the top of the screen. Few and simple as they are, these circumstances impart to the whole a newness, a playfulness and picturesqueness of appearance that may be pronounced almost fascinating, when compared with the unvaried sameness that pervades all our imitations of Grecian architecture, and allows of no other diversity than what arises from the order employed, and its accompanying details. It is true, the façade porticos of the Greeks themselves exhibited so very little variety that they may be described as all of them conforming to one common established model, without other distinctions than those attending the columns and entablature, and the greater and lesser number of the former. Yet this constant repetition of one and the same idea merely a little differently modified, was not, I conceive, so much a merit as a defect in Grecian architecture; nor is it any satisfactory argument to the contrary to say, that, considered individually, each example was excellent. We may have too much, even of a good thing: *toujours perdrix* is a most unpalatable dish.

It is owing to this monotony that now its first novelty is worn away, the Grecian style has of late begun to be abandoned for others. Instead of endeavouring to infuse greater variety and freedom into it, our architects have practically abridged its tether still more, and reduced its orders to mere stereotype fac-similies of certain examples; whereas, although adhering almost without exception to one uniform plan, even the Greeks allowed themselves some little liberty in regard to matters of detail: nay, so far are we from aiming at any fresh combinations resulting from plan, that I cannot call to recollection any one portico, where inner columns have been placed behind those in front, for which at least there is sufficient precedent in Grecian buildings to satisfy the most timid and scrupulous. So far then we may be said rather sedulously to shun what is almost the only source of variety, or if not the only, the chief one in Grecian architecture; reducing every design for a portico to a mere line of columns before a wall, with no other difference than what is occasioned by there being windows or not, or by there being either a single door, or a principal and lesser ones. All that is done beyond this consists in occasionally making the portico recede within the building, as well as project from it; of which we have instances in those of the Post-office and the London University. At that point we stop.

One solitary example, however, of a single step further being taken, does now occur to me, and it is that furnished by the interior of the portico of the National Gallery, where there are two columns within the break or recess containing the central doorway; yet, although as far as it goes, this circumstance alone produces considerable richness, it hardly shows itself from without, until we begin to ascend the steps; because, owing to the portico being so elevated, it is almost concealed from the spectator when he is close to it, while seen at a distance all between the outer columns is veiled in obscurity.

With no more than these two instances before us, viz., the National Gallery and the Pimlico Institution, it is easy to perceive what various modifications and combinations might be obtained; the variety attending the former being that given to the horizontal lines or ground-plan, while in the other case, it lies in the section or vertical plan, both which species of variety might be resorted to, wherever a more piquant effect than would be attainable by employing only one of them was aimed at.

In order to render this more intelligible by something like direct exemplification of the principle recommended,—and unless I do so people will hardly be at the pains of giving it any serious consideration—I will here briefly point out one or two of the numerous combinations that may be obtained as soon as we break through the dull and wearisome fashion of placing one uniform plain wall behind columns, whose blankness is interrupted merely by the entrance or entrances. After admitting the screen in its simplest form—in which it presents itself at the Pimlico Institution; the next step would be to bestow some decoration on it, and to place either a statue or large bust in the centre over the doorway. It still remains, however, a simple screen, dividing the lower part of the portico into an inner and an outer one. We must not stop here, or if we do we shall lose not only that variety which serves to distinguish one design for another, but also those contrasts and complex effects which may be brought into a single design. It will be desirable therefore to admit square columns behind those in front, between the lower part of whose shafts the screen would be inserted; another mode would be to employ columns, placing them either immediately before or behind the screen, and occasionally to combine both modes, letting columns be seen beyond it, as well as in front of it; other variations present themselves in regard to the screen itself, since it does not follow that it must needs be of uniform height throughout—for whether it be divided into inter-columns or not, it may rise up in the centre where the entrance is placed, so that its fascia shall there coincide with the cornice of the doorway. Neither is there occasion that such screen should invariably be carried the width of the inner elevation of the portico: on the contrary, it might sometimes be confined to the centre, or vice versa; the doorway, in the latter case, being placed in a wall carried up to the soffit of the general architrave. Light, again, might occasionally be thrown upon the part seen beyond the screen, either from the side or from above; which would certainly greatly enhance the effect, and produce that kind of display of which we have as yet no instance whatever; and if I may be allowed the liberty of pointing out a portico where something of this kind could have been introduced without going at all out of the way in order to obtain it, I would refer to the portico of the Post-office, where had the compartment in which the great door is placed been separated from the hall merely by a screen carried up as high as the consoles against the jambs of that doorway,—which would have been even more economical than the present wall,—the upper part of the hall and its columns would have been seen over it in such manner as to produce a striking architectural scene. In fact, so much novelty, so many combinations, might be thus produced, that although not at all difficult, it would be tiresome to point them out more particularly.

That any one will be induced by what I have said to take these suggestions into deliberate consideration, is what I do not expect: well am I aware that I might all this while just as well have been "whistling jigs to the moon." Most people turn up their noses at "advice gratis,"—architects among the rest: therefore they must go on to the end of the chapter, with their single row of copied columns in front, which constitute their classical porticos. All I have to remark is, that the sooner they come to the end of that very dull chapter, the better.

CANDIDUS'S NOTE-BOOK. FASCICULUS IV.

> I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please.

I. Most persons seem to think that they have a right, when building, to commit whatever vagaries they please, and that it is excessively impertinent in any one to impugn their taste, be it ever so absurd. Certainly the legal right cannot be disputed: legislation, which touches every thing else in this country, where freedom consists in the liberty of making some new shackles for ourselves every day, has not as yet laid its hands upon taste. In building, a man has a most unquestionable right to please himself—if he can, whether he so pleases his neighbours or not; yet so has he a right to wear either his own nightcap or his wife's bonnet instead of a hat; and other persons have the right to laugh at him as much as they please in their turn.

II. For an experiment in polychromy on such a scale as should satisfactorily determine how far it is really valuable, how far consistent with good taste or the contrary, we have nothing so suitable as the York Column. In fact, it could not have been more so had the architect expressly intended it to be so finished up, for at present it strikes quite as much by its bareness, and the utter absence of all decoration as by any-thing else. There are several circumstances which recommend it—I might say, plainly point it out as a fitting architectural subject for such purpose: its being insulated in such manner, and its being of such form, that the effect which might be produced could not possibly violently interfere with any thing else: further, its being precisely the kind of structure to ornament which may be applied unsparingly, with the greatest propriety, or, rather, one which absolutely demands it. Yet, although I am of opinion that the experiment might be made with perfect safety as to the result, by no means would I advise that it should be a hap-hazard one: on the contrary, if it was intended that it should succeed, the utmost study should be given to it beforehand. A model, at least ten or twelve feet high, ought to be prepared,—one capable of showing the minutest details of every piece of ornament; and this should not only exhibit the precise colours, but the same pigments which are employed in polychromy. So, then, I actually propose that the poor York Column should not be whitewashed—as some have fancied Westminster Abbey ought to be—but daubed over of as many colours as a Harlequin's jacket displays, by way of introducing the outlandish architectural fashion termed polychromy? To be sure I do;—though, of course, the "daubing" and the "Harlequin's jacket," would be re-echoed from all sides against such a scheme. It is hardly worth while to discuss how far painting and daubing are one and the same operation; besides which, it might lead to some excessively *odorous* comparisons; but, as for the Harlequin's jacket, I enter my solemn protest against *that* comparison, which, were I to fling it any where I should fling at some of Turner's blue and brimstone pictures—daubings, I had almost said. No, I am of opinion that greys and warm neutral tints, with an inter mixture of light bronze-colour, sparingly relieved by touches here and there of different brilliant hues, would be most suitable; if properly managed would produce soberness without dullness, and sufficient energy and vivacity, without either crudeness or garrish glare. The positive colours ought perhaps to be applied to the grounds of the ornaments, rather than the ornaments themselves, in such manner as that these latter would appear a rich broidery of figures, foliage, and other embellishments, through whose interstices differently coloured surfaces would appear. As to the arrangement of the ornaments, they should be in horizontal zones, whether with plain spaces between them or not; but certainly not in a continuous spiral from top to bottom. My project is a very excellent and a very feasible one, and would certainly be realised to-morrow, were I but lucky enough to pick up Fortunatus' wishing-cap to-night.

III. If there be any truth at all in any of the representations I have seen of Abbotsford, it is but a sad sample of Sir Walter Scott's taste, being a most Brummagem piece of architecture and antiquarianism, hardly a whit superior to Strawberry Hill. In the print he gives of the house, Dibdin makes it a complete architectural scarecrow, such a motley and beggarly jumble of odds and ends, that its look is any thing but inspiring. It is wonderfully anti-poetical in the fancy it exhibits, so much so, that one would imagine it to have been built by some retired cheesemonger, or other vulgarian of that grade. Had such been the case, its ugliness would have been a by-word to all the world. Now, if the public insist upon deifying Sir Walter, well and good; but as for Abbotsford, we may surely be allowed to give the taste shown in it, if not the house itself, to the devil.

IV. The author of the "Original" has some very peculiar notions on the subject of dining-rooms; one or two to which I cordially assent, others from which I as cordially differ. I admire the perfect good sense with which he is satirical at the expense of those would-be-thought genteel people who make the giving a dinner an affair of fidget and fussiness, and thereby often entertain their good-natured friends very far more than they intend to do. From the very first you perceive the extraordinary state of things: all is masquerade, except the whole absurdity of the business—which stares you in the face without any disguise. But this is a subject I must turn over to Boz—who, I presume, is capable of doing it justice; and who, for aught I can tell, may have excercised his talent upon it already—for were I to allow myself to run on upon it, there would be no space for any thing else in this number of the Journal. But all this is merely a *scappata.*

Agreeing with Mr. Walker, that dining-rooms in London are in general very tasteless and uninspiring, I do not enter into his notions for rendering them otherwise; neither do I at all approve of attempting to establish rules, which however suitable they may be in some cases—or even the majority of them—may prove quite the reverse in others. The only rule that ought invariably to be adhered to is to provide a side-board alcove; for without this, instead of appearing to have been originally intended for its purpose, the room will appear to be merely made use of for dining in, for want of one better adapted to the purpose. Although preferable to none at all, a mere shallow recess for the side-board is little better than an apology for one. The recess ought to be deeper than the side-board itself, so as to have the appearance of being a space added to the room, capable of containing, besides the side-board itself, whatever it may be convenient to have at hand during the time of dinner. If this be attended to there will always be a certain degree of character and effect independently of any thing else; besides which, within a deep alcove there can be a door through which servants can go in and out with less interruption to those at table than otherwise; and if the recess be wider within than towards the room, so that such door be more or less concealed from view, all the better. But whatever others may think of it, I certainly do not at all approve of the worthy magistrate's whimsical idea of a 'quiet little kitchen' immediately adjoining the dining-room, and communicating with it by an entrance close to the side-board, closed during the process of dinner by a *curtain only!* I have no objection to his fixing the number of eight as the maximum for a comfortable dinner-party, if merely because that regulation would effectually prevent the misfortune of there being thirteen at table; neither do I quarrel with him for recommending the least possible number of attendants, it being anything but agreeable to have a regiment of flunkies crowding the room, and reconnoitring the company during the whole of their feeding-time. On the other hand, I certainly see no reason whatever for the arbitrary rule which would restrict the width of the room to what is just sufficient to allow the attendants to pass round the table without jostling against each other; in other words, the room ought, according to Mr. Walker, to be invariably a very narrow one.

This is absurd enough: and, in fact, all restrictions and positive rules in regard to colour, decoration, and other matters of a similar kind, are not only useless, but worse than useless; because were they attended to they would put every dining-room into a standard uniform, which is anything but desirable for there is at present far more monotony and sameness than one would wish to meet with. We rather want variety; and there is certainly ample scope for it. The only rule which ought to be received as applicable in all cases, without exception, is that EVERY THING OUGHT TO BE CONSISTENT THROUGHOUT, TO BE IN EXCELLENT TASTE, AND TO PRODUCE AS MUCH EFFECT AS THE ACTUAL DESIGN WILL ADMIT OF. Instead of fettering the artist, and putting his ideas on a Procrustean bed, this rule leaves him at perfect liberty. So far from being required to be invariably sober, modest, chaste, or whatever else of the kind we style it, a dining-room may be as splendid as any other apartment in a house; with this difference, that its splendour must differ in kind from that of the drawing-room and boudoirs. In fact, sumptuousness, rather than the contrary, ought, in many cases, to be the prevailing character, especially where there is a prodigal display of plate. Nor by sumptuousness do I mean gaudiness: *tout au contraire*, the former may be made to exclude the latter. Let there be, for instance, in order to give something like a positive and tangible example, a deep alcove—semicircular perhaps in plan—lined with draperies of purple velvet, to relieve the gold and silver plate on the side-board. Give this alcove a double screen of white marble or scagliola columns in front, between which would be placed lofty candelabra. The walls might be incrusted with scagliola of a darker tint than the shafts of the columns. The window draperies would of course match those of the alcove, at least in material, supposing a different colour to be selected for them;—ceiling of an architectural design, either simply white and gold, or relieved by colours in its lacunaria;—for ornamental furniture against the walls, we would have marble pedestals alternately supporting lesser candelabra, and gilt or alabaster vases filled with a profusion of flowers—but mind, artificial ones. Now I conceive that if properly arranged, so as to avoid all appearance of crowding together more than the space would allow, the kind of effect might be produced which would not at all be out of character for a dining-room, namely, the *Festal*. As for Mr. Walker's nice quiet little kitchen, I will take the liberty of shoving that under the dining-table.

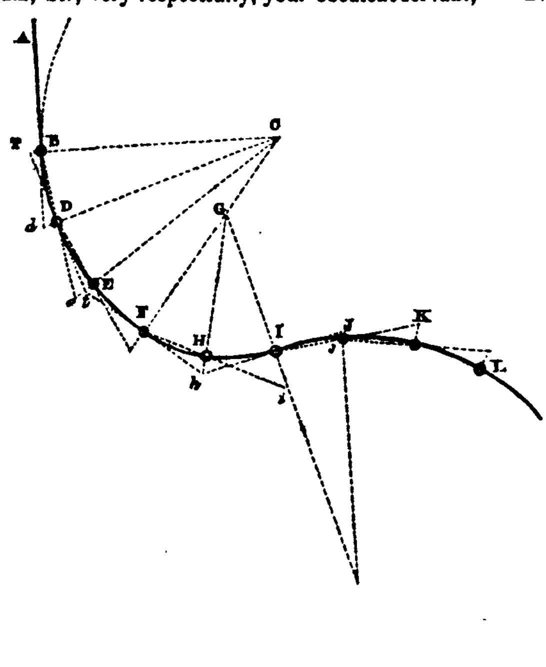
RAILWAY CURVES.

SIR,—Like your correspondents in the journals for January and March, I have been employed in making out Railway Curves; but in a country extremely unfavourable to the formation of railways, both as respects gradients and curves, and where, consequently, inclinations of one in 200 or 300, and curves of one quarter mile radii, are looked on as favourable. On sharp curves, you must be aware, it is necessary to elevate the outer or longer side, one, two, three, or even more inches, above the other, in order to assist the carriages in travelling round them. In short, without such a practice, curves of short radius would be impassable. But as the one rail must be raised above the level of the other gradually, and as gradually descend to the level of the same, the difference of level must be the greatest in the centre of the curve, and therefore the tendency of the carriages to fly off the rails, will, so far as it is affected by these means, be *least* towards the *centre of the curve*; or, in other words, *to make that tendency uniform throughout, the curve must be made sharpest at its centre*, and therefore leave the straight line at a larger radius than it afterwards assumes; as recommended by your first correspondent: but, as in curves of a mile or two radius, this reason does not obtain, I must agree with your subsequent correspondent on the subject, that, in general, the practice under discussion would be not only useless but injurious.

By the raising the outer rail of a curve above the inner, I know of a railway curve (of the ordinary 4 feet $8\frac{1}{2}$ inch gauge) of only 5 chains radius, which is readily passable by locomotive and train; and a curve of about $1\frac{3}{4}$ chains radius on the same railway round which (though certainly with considerable difficulty) heavy waggons are daily pulled by horses.

I know nothing of the modes *usually adopted* on laying out railway curves, therefore, for what I know, what follows may be unworthy of notice on account of novelty; but, for the sake of your junior readers, may possibly be worthy of insertion in your widely extending journal.

I am, Sir, very respectfully, your obedient servant, B. W. T.



1.—To mark out a curve of a certain given radius.

Let AB be the straight line of a railway, B the point where the curve is intended to commence. BC, DC, &c. radii of the curve to be described, Dd the deviation from the straight line at the end of any convenient length Bd, then Cd^2 or $(CD + Dd)^2 = CB^2 + Bd^2$ or $CD + Dd = \sqrt{CB^2 + Bd^2}$ *i.e.* $Dd = \sqrt{CB^2 + Bd^2} - CB$, produce BD to e, making De = Bd, and draw TDt a tangent to the curve at the point D, then the triangle TDB will be = and similar to the triangle DBd, and the angle TDB is = the angle eDt being vertical; also TD = tD and CB, CD, &c., being very great in comparison with BD, DE, &c., the triangles DtE, Det may be considered practically equal and similar, and therefore Et = te = Dd or Ee = 2Dd, which may be found by the above formula, where CB is the radius of the proposed curve, and Bd, any convenient length between the several points B, D, E, &c., is to be found.

The rule in words at length may be expressed as follows:—Add together the square of the radius and the square of the distance apart of the points to be found in the proposed curve; take the square root of their sum, and take from it their radius: the result will be the amount of deviation from the straight line in the given length—which will give the first point of the curve; after which the deviations must be doubled, to render the curve uniform.

2—To change from a greater to a smaller radius, or vice versa.

Suppose at the point F the curve changes its radius, having now the shorter radius FG, it is evident the curves BDEF and FHI, should have a common tangent at F, which tangent may be found (on the ground) by taking Et = $\frac{1}{2}$ Ee, and tF will be the common tangent, then the direction of the tangent tFh being found, the amount of deviation (hH) for the length Fh and radius GH may be found as before; then by producing FH to i, and making the deviation Ii double Hh, another point I of the curve is found. In practice Ii &c. may be measured at right angles to FHi, &c., the figures of course, being very much distorted; thereby rendering the angle HiI, which in practice might be taken as a right angle.

3.—To describe an S curve.

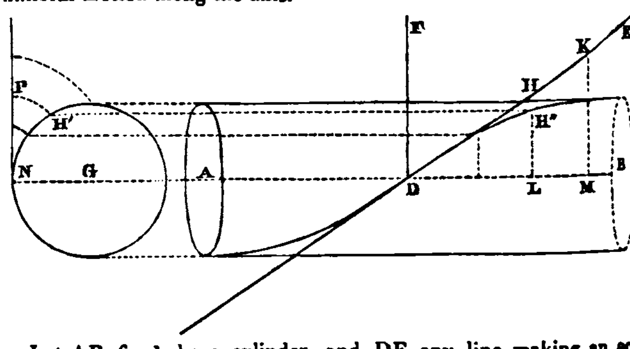
Suppose I to be the point at which the curve changes; then the curves FHI and IJK must have a common tangent at I, which can be found as before; also the deviation Jj, which being doubled, any number of points, as K, L, may be found.

SKEW ARCHES.

SIR—The usual method of obtaining the spiral courses, in drawings of skew arches, is productive of much labour.

I have been led to believe that the following plan is much simpler, more expeditious, and consequently easier of comprehension; and although the same idea may possibly have occurred to others, it may not be so generally known as to be entirely unacceptable.

A spiral is defined as being a line traced upon the surface of a cylinder, by the extremity of a revolving radius, which radius has also a uniform motion along the axis.



Let AB, fig 1, be a cylinder, and DE any line making an acute angle with the axis, it is evident that the line DE, is the locus of a point having a uniform motion, in each of the directions DB, DF, and if the line DE be wrapped round the cylinder, it will still possess the same property, only that the motion in the direction DF, will be transformed to a motion round the cylinder, and the line will thus become a spiral.

I have said this in order to show, as clearly as possible, that a straight line, when wrapped round a cylinder, produces a curve conforming to the definition of a true spiral, and will now proceed to explain the simplest method I have found of projecting this curve.

If a piece of paper, having a straight edge, represented by the line DE, be rolled round a cylinder, it will be found that all the points H, K, &c. will approach the cylinder, in vertical planes perpendicular to the axis, the edges of which planes are represented by the lines LH, MK.

Hence it will be seen, that to ascertain the position of any point H, when the line DE is wrapped round the cylinder, we have only to wrap round the line LH; this may easily be done by drawing an end view G, of the cylinder, and taking NP equal to LH, finding NH′ the length of the curve equal to NP,* and projecting the point H′ to H″, we obtain the position that H will occupy upon the cylinder. In the same manner all the points in the curve may be found.

We now come to the practical application.

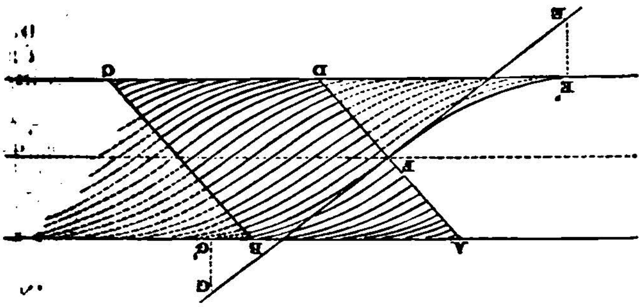


Fig. 2.—Let ABCD denote the outlines of the plan of the soffit of a skew arch, and let EFG be drawn making the proper angle† with the face.

Then by the plan I have just described, the line EG may be wrapped round the cylinder, and E′ FG′ the curve generated, will represent one of the spiral courses. Now each of the courses of a skew arch would, if produced, wrap itself round the cylinder, and present a curve similar to E′ FG′, hence every one of the courses of the arch will be a portion of this curve; if, then, a mould be cut to the curve E′ FG′, it is evident that by setting on the proper distances, along the lines AG′ E′C, and applying the mould to the corresponding points, all the courses may be drawn, as shown on the figure, with little trouble.

I believe the common practice is to project each of these joints on the soffit separately; where the arch is brick, and each course shown, this is a work of much labour.

The same principle, with a little modification, is applicable to the other views of the arch, more particularly to the outline of the develepement of the soffit, only that in this case the operation is unrolling instead of rolling the line.

In case any may not understand the preceding explanations, I would recommend those who feel interested in the matter to try the experiments with the paper and wooden roller, and they will quickly perceive the principle.

B. & G. Railway-office, Your's obediently,
Worcester. H. SPENCER.

PLYMOUTH BREAKWATER.

A communication from Sir JOHN RENNIE *to* T. L. DONALDSON, *Esq.*, Hon. Sec., *read before the Institute of British Architects*, April 11th, 1839.

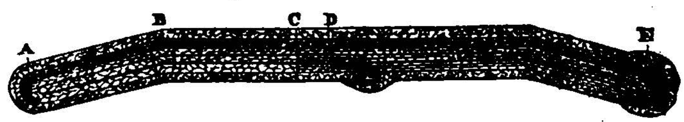
DEAR SIR,—I have the greatest pleasure in complying with your request, relative to the construction of the Breakwater in Plymouth Sound, and I shall always be extremely happy to forward the views of the the Royal Institute of British Architects in any way which may be considered most conducive to the welfare of that valuable society, in which you take such a laudable interest, and only regret that your application of yesterday had not been communicated to me earlier, in order that I might have been enabled to render the following account more complete, and more worthy of the society; and as I have written this chiefly from memory as far as the shortness of the time would allow, I trust that every allowance will be made for any omission, as I am about publishing a work upon Harbours, in which the subject will be more fully explained hereafter: and I entirely agree with you, that although strictly speaking, a work like the Breakwater may not generally come within the range of civil architecture as now practised; nevertheless it is to be hoped that the study of it may be found not altogether unprofitable; the more so, as Vitruvius, the earliest founder of the art, includes a knowledge of these kind of works among the necessary acquirements of the architects. I shall now, therefore, proceed to the description of the work in question.

* This may be done by calculation, but measurement by compasses is near enough for practical purposes.

† This line would be at right angles to the face, on the surface halfway between the soffit and crown. (See Mr. Fox's Pamphlet on Skew Arches.)

Plymouth Sound, from its extent, its depth of water, the numerous creeks and rivers which discharge themselves into its bosom, and its proximity to the Atlantic Ocean, had long pointed itself out as one of the principal stations for the British navy; and at an early period of our history, Devonport was selected as the chief port for fitting out vessels of war for the western portion of the kingdom; and although on account of the exposed nature of Plymouth Sound, a certain degree of inconvenience was more or less experienced during the infancy of the British navy, nevertheless, it never became so apparent until the tremendous conflict of the last war, when it became absolutely necessary for self defence to increase our fleet to that extent, that more than ordinary accommodation became necessary; it was then that the danger and inconvenience of the Sound became most apparent, and imperiously called for a remedy; various ideas had been suggested, and numerous plans proposed to obviate the existing evils, until at last the Admiralty applied to the late Mr. Rennie, my father, who proposed to erect a detached or isolated breakwater in the centre of the Sound, which, after a great deal of discussion and opposition, was finally approved of, adopted, and ordered to be carried into effect; and the first stone was accordingly deposited in the summer of 1812. The reasons for adopting the isolated or detached Breakwater were; first, because this part of the Sound was already obstructed, and to a considerable extent rendered unnavigable by the Panther, Shovel, and Tucker rocks: secondly, by placing it in the centre of the Sound, there would be an entrance at each end available for vessels to take advantage of either an easterly or westerly wind, which would considerably facilitate their entrance or departure to or from port: thirdly, by having two entrances there would be a greater facility for the reception, and discharge of the tidal and fresh waters, and thus maintain a more general and equal circulation of the current throughout the estuary and its various receptacles, and prevent the deposit and accumulation of sedimentary matter, with which the waters are more or less charged; and thus, whilst protection against storms would be gained, the depth would still be maintained, which constitutes one, if not the most difficult problem in the construction of harbours. The correctness of Mr. Rennie's decision has been fully corroborated by the result, for, contrary to general anticipation, the depth of the Sound has not been found to decrease, but rather to augment; as otherwise, although the embankment of several marshes over which the tide used formerly to flow, and thus to contribute and augment the scour or backwater, might reasonably have been supposed to have produced a different result, and should if possible have been avoided.

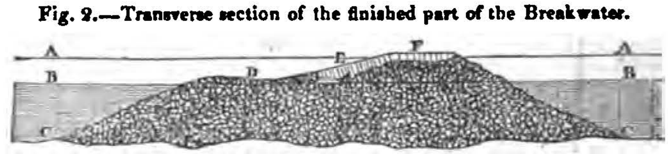
Fig. 1.—Plan of Breakwater.



Scale of yards, each divison 100 yards.

The span between A B, or eastern arm, is about 10 feet above low water spring-tide: B to C is finished with rubble;—C to D is to be finished with masonry;—D to E is finished with masonry.

Fig. 2.—Transverse section of the finished part of the Breakwater.



Scale of feet, each division 10 feet.

A A, High water spring-tides;—BB, Low water spring-tides;—CC, Original bottom, varying from 40 to 45 feet below low water mark;—D, The Foreshore;—E, Sea slope;—F, Top 45 feet wide.

The first stone was deposited August 12, 1812,

Quantity of stone deposited to April 3, 1830	.	2,603,979 Tons.
Ditto from do. to January 22, 1833	. .	611,423 „
Ditto from do. to March 31, 1838	.	68,311 „
Total	.	3,283,713

By referring to the plan, it will be seen that the Breakwater is composed of three arms, the centre being 1,000 yards, and the two outer arms 350 yards each, and inclines at an angle of 20 degrees to the main arm, and comprehending a total length of 1,700 yards at top, or 1,770 yards, or one mile, at the low water line. The exterior slope or inclination taken below the line of low water has been left for the sea to form, and is found to be at from three to four feet horizontal to one foot perpendicular, and in parts rather steeper, but from low water upwards, which has been set artifically, it is five horizontal to one perpendicular. The inner slope or that next to the land is nearly two feet horizontal to one foot perpendicular from the base to the top, which is two feet above high water of spring tides, and forty-five feet wide, rising one foot additional towards the centre. In addition to the sea slope above described, by referring to the drawings, it will be seen that there is an exterior berne or foreshore thirty feet wide, at the extremity of the east end, fifty feet wide in the centre, and seventy feet wide at the extreme west end. This foreshore, it will be seen, rises from the toe or base of the outer slope to about five feet above low water at its outer extremity, and serves to break the waves before arriving at the main body of the work, and thus diminish their force, and at the same time to prevent the recoil or back stroke of the wave from undermining the toe or base of the slope, and thus making a breach in the body of the work, which at times might otherwise occur to a certain extent. Towards the centre of the inner slope or face of the Breakwater (see fig. 1.), it will be seen, that there is a small jetty with a double returned head, for the purpose of enabling boats to land under protection. At the western extremity it will be seen that there is a circular head 570 feet diameter, upon which there is to be constructed hereafter a lighthouse, so designed as to throw a complete light over the entrance, at the same time to point out the anchorage, so that vessels entering at night may come to their moorings with the greatest facility, without fear of running foul of any ships which may already be there. The general depth where the Breakwater is placed varies from thirty-six to sixty feet at low water of spring tides, which generally rise about eighteen feet, and neaps twelve to fourteen feet. The eastern entrance is half-a-mile wide, and varies from six to seven fathoms at low water, and the western, which is the principal entrance, is about half-a-mile wide, and varies from seven to nine fathoms deep at low water spring tides, and the anchorage, where there is fine holding-ground, varies from eight to nine fathoms at low water spring tides.

The heaviest and most frequent gales come from the southward and westward, and the wind prevails chiefly from the latter quarter about nine months out of the twelve; and during gales from this quarter, which are very severe, exposed as it is to the uninterrupted reach of the Atlantic and Bay of Biscay, with such a range of sea and such a depth of water, it may readily be conceived that the sea must necessarily be very heavy, and require a corresponding degree of strength to counteract its disasterous effects.

The great mass or body of the work is composed of limestone brought from the quarries of Overton, lying at the mouth of the river Lary, called Catwater, about four miles distant. The stone is raised in various sized blocks, from one quarter to ten tons and upwards in weight, which are thrown promiscuously into the sea as they are raised from the quarry, in the line of the Breakwater, taking care that the greatest proportion of the large blocks are thrown upon the outer or sea slope, and that the whole, large and small, are so mixed together, that the mass may be rendered as solid as possible. In addition to the smallar class of rubble abovementioned, quarry rubbish and lime screenings are thrown down from time to time in order to fill up the smaller cavities. You must observe, that during the progress of a work of this nature, to a certain extent, storms are extremely beneficial, for they serve to wedge and consolidate the whole mass together, much more effectually and in much shorter time than human art could perform; and indeed it is desirable not to hurry until the work, as it proceeds, has been consolidated by the sea in the manner above described,—for until this has been effected and sufficient time allowed, it is in vain to attempt, successfully, the erection of any superstructure. As I have already observed, the work commenced in 1812, and continued with considerable activity until 1824, during which period scarcely any storms of consequence occurred, and the great mass of the work had been completed below low-water mark, and about half of the superstructure from the eastern end towards the centre had been carried to the full height above high water, and, judging from what had passed, the able and excellent superintendent, the late Mr. Wheatley, one of the most experienced officers in the navy, concluded, that it was necessary to incur the expense of an outer slope of 5 to 1 as originally proposed, and considered necessary by the late Mr. Rennie. The great storm, however, of Nov., 1824, completely established the accuracy of Mr. Rennie's calculations, for the sea increased the outer slope from 3 a 5 to 1, and transferred with the greatest nicety the superfluous rubble from the outer to the inner slope; the area of the one was nearly equal to the area of the other, making the requisite allowance that the former had become more consolidated by time than the latter. In proportion as the work advanced, it was found that the sea became much more heavy towards the western end, and consequently rendered a more solid description of work necessary; I therefore recommended that the surface should be cased with masonry and a foreshore on the sea-side, encreasing in substance and strength as it approached the west end, where the whole from low water to the top is composed of solid masonry, dowelled, joggled, dove-tailed and cramped together, and the foreshore to be regularly set as far as practicable, and using the diving-bell to found the lower courses below low water. I also recommended that air or vent-holes should be made on the surface of the casing where requisite, to enable the air compressed by the waves to escape and prevent it from blowing up the covering; although it was found by Mr. Stewart, the present intelligent and experienced resident superintendent, that where sufficient time had been given for the rubble below to become consolidated by the sea, and the masonry casing bad been carried up solid from low water, that the vent-holes were unnecessary. By referring to the drawings, you will observe that the stones coloured grey represent granite, which being obtained in larger blocks than the limestone, being more tough and not so brittle, has been found to resist the shake of the waves much more effectually. The lower, or footing granite courses, upon which the rest of the superficial casing abuts, are laid horizontally on their beds, the better to resist any lateral thrust which might otherwise result from sliding; the same may be observed of the middle, or bonding course, which is also of granite. The whole of the three granite courses are dove-tailed together, as well as being lewised and bolted to each other, so that they may resist effectually every shock to which they are peculiarly liable.

The mortar for the masonry is composed of one part Italian pozzolano, one part aberthaw, or Plymouth lime, mixed up with two parts of fine sharp clean fresh water sand, the whole being thoroughly mixed together, triturated under a mortar mill, and worked up with as little water as possible; this mortar very soon sets, and in a short time becomes as hard as stone. The exterior beds and joints for a few inches inwards are pointed with the best Roman cement, which has the property of setting directly, which is encreased by using warm water, but then it has the disadvantage of being easily broken and not uniting again, the other being decidedly preferable as soon as it has set. I also recommended that a mass of concrete, composed of similar materials as the mortar above described, only using five parts of sand, more or less, according to the position, should be used in the interior of the work to bed the blocks upon, near the level of low water; this kind of concrete I have been in the habit of using for many years past in various maritime works with great success, and even below low water, where, if protected and used in masses together so as to prevent the waves from acting upon it until some time after it has been deposited, soon becomes very solid and durable.

The loose rubble blocks are transported and deposited in their position in the following manner:—after having been worked in the quarries they are transported by railways to the quay side, they are put on board of vessels built expressly for the purpose. These vessels are about sixty tons burthen and upwards, and have two railways laid parallel to each, which traverse the hold of the vessel from stem to stern, which can be made to open entirely—as the railways approach the stern-port they form an inclined plane, the last part of which is made to revolve upon an axle, with a check to prevent the truck from going overboard with the stone; on the deck of the vessel there are fixed powerful crabs or windlasses. The blocks of stone, together with the trucks, are put on board the vessel, ranged in parallel rows on the railways before described. The vessel then takes her departure for her station at the Breakwater, the whole of which has been previously marked out with a sufficient number of buoys; and upon her arrival at the particular spot where stone is required, she is immediately moored to one of the buoys in question. The crew then commence their labours of discharge by heaving up the trucks containing the blocks of stone, by means of the windlasses on deck; and when the truck arrives at the termination of the inclined plane at the stern of the vessel, its own weight tilts it over, the block of stone is discharged into the sea in its proper place, and the truck remains; it is then placed upon the deck of the vessel, and there left; and in like manner each block is successively discharged, until the whole cargo has been disposed of: this operation, which is extremely simple, is very soon completed, seldom occupying above a quarter of an hour or twenty minutes; the vessel then returns to the quarry for another cargo, and, according to the state of the wind and weather, will make several voyages a day. At times steam-tugs are used to take them to their stations, which saves a good deal of time; but as the wind blows from the westward during a greater portion of the year, they generally sail back to the quarries. In order to ascertain the state of the work below low-water, frequent sections are taken on the line of the buoys before-mentioned at about every ten yards, and a regular register and journal is kept of the whole proceeding, so that the actual state of the work at any one period can be ascertained with accuracy.

The work has now been in operation nearly twenty-six years, but the great bulk or mass of the work, which renders the Sound a well protected roadstead, was completed ten or twelve years ago. The operations are now chiefly confined to the west end, where they are employed upon making the solid masonry foundation for the lighthouse, which is a work requiring a good deal of nicety and time to complete, particularly the foundation courses, which are to be laid by the diving-bell: but on account of the swell which so frequently prevails there, many days elapse when it cannot be used, so that the Breakwater, with the exception of this part, may be said to be almost completed. The original estimate of the late Mr. Rennie for the rubble alone, without the masonry, casing, or lighthouse, was, I think, 1,150,000*l.*, and these two latter works have been estimated at from 250 to 300,000*l.* more, so that the whole will not exceed 1,500,000*l.*; which I trust will be allowed as coming very near to the original calculations, considering the difficulty of works of this nature, exposed as they necessarily are to the vicissitudes of the elements, which render them peculiarly liable to casualties.

For the above short account, I trust that I have fully complied with your wishes as far as the short period of notice you have given would allow. I believe that I have not omitted any very material point, although you are fully aware that there is a great deal of detail which could not be included in such a necessarily confined account—it is of less importance now, as it will be included in my work previously referred to. The accompanying drawings, from which the work has been executed with some slight modifications according to circumstances combined with the above descriptions, will, I think, render the whole subject sufficiently intelligible.

Believe me very sincerely,

London, April 6, 1839. JOHN RENNIE.

A TREATISE ON RESERVOIR LOCKS.

BY J. A. ROEBLING, CIVIL ENGINEER.

(From the American Railroad Journal.)

By the term reservoir locks, is understood locks connected with reservoirs which receive and reserve a certain portion of the lockage water for the purpose of floating a vessel from one level to another, and which reserved portion of water is let into the lock-chamber again when another boat is passing the lock. As the reservoirs are alternately drawing and discharging a certain portion of the water, it is obvious that they may be so located as to use a far less quantity of water for passing vessels through the lock than is commonly wanted.

These preceding remarks will be sufficient to attract the attention of engineers, and lead to the suggestion that this kind of lock is of the greatest importance in a country where the summer season is generally dry, and where the want of a sufficient supply of water for lockage often interferes with navigation; further, that by means of these locks expense will be saved, and that a canal may be constructed, and kept navigable, where in the other case sufficient water could not be furnished for supplying common locks of ordinary lifts. An eminent engineer in England, where this subject is at present treated with much interest, lately claimed to be the inventor of these locks, but without any right. As far as the writer of this is informed, but one lock of the kind in question has ever been constructed until this day. This lock was built in France, under the reign of King Louis XIV., by an eminent engineer at that time. M. Belidor, in his "Architectura Hydraulica," gives a brief account, and a cross-section of that lock, which has about twenty feet lift, and stands at the point of junction of two canals. The level of one canal lies twenty feet above the level of the other, and the lower canal is supplied with the necessary water by the upper one. The ground at the junction, in the direction of the lower canal, drops down at once, and offered a favourable opportunity for the construction of a high lift-lock, with reservoirs. The head of that lock is constructed in two offsets, with two upper gates to divide the pressure of the water against the gates. This lock answers the purpose in every respect, and draws not quite seven feet water from the upper level, for passing a boat through the chamber. About three minutes of time more are required, when the two reservoirs are used, than when not, for the passing of a boat, and there is no more stamping of the boats during the passage than in a lock of seven feet lift, as the head of the water-pressure is never above seven feet.

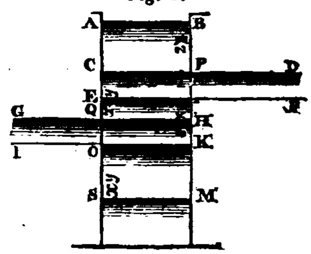
The first locks of this kind, in this country, are now being constructed on the Sandy and Beaver Canal, under the direction of Mr. E. H. Gill, Chief Engineer on that line, who by this improvement will considerably add to the already well established credit which that work greatly deserves, for the superior construction of its splendid locks and dams, and, in fact, for the solidity of all the works. Mr. E. H. Gill occasioned the writer to examine into the nature of this object to establish its theory, and demonstrate formulæ for computing the best dimensions of the reservoirs, the location of the communicating culverts and valves, and the water saved. He afterwards experimented with a model, to see how the theory agreed with the reality, and satisfied himself in every respect as to the practicability and the utility of reservoirs.

As the saving of water depends on the number of reservoirs attached to a lock, their areal extension, and on the placing of the culverts and valves, this matter must be rightly understood, and all dimensions must be fairly calculated, which calculations, however, are very easily performed. I offer here a general demonstration of the theory of this object, which for its plainness will easily be understood.

The number of reservoirs attached to one lock, may be one, two, three, four, and even more; a greater number than four seldom will be required, and found applicable: in most cases two reservoirs will answer the purpose. But there may be locations found where the ground offers sufficient room, and suits well for the construction of four reservoirs, two on each side of the lock, and where by these means a very great saving of water will be obtained.

The annexed drawing, fig. 4, shows the cross-section of a lock of fourteen feet lift, with a reservoir of 5,400 superficial square feet, on each side. The diagrams 1, 2, and 3, are likewise to represent cross-sections of the lock-chamber and reservoirs on each side. By the linear shadings are represented the different stages which the water will alternately occupy in the chamber, and in the reservoirs. The lines A B and S M represent the upper level, and the lower level, in all the diagrams; and by the lift of the lock, is to be understood the elevation of the upper level A B above the lower level S M. These two levels are supposed to be always permanent, and not to be altered.

Fig. 1.



To make the case more simple, it is supposed that each reservoir is to be as long as the lock-chamber is in the clear, and twice as wide, so that the area of each reservoir be equal to twice the area of the chamber. Let the required height which the water will occupy in the upper reservoir, be denoted by the letter x; the height of water in the lower reservoir, be denoted by y.

By examining the first diagram, any one will admit the following suppositions:—

1. When the valve of the upper reservoir is opened a quantity of water A B C P of the chamber will enter the reservoir and will flow in till the water surface in the chamber and reservoir, C P and P D, form one level. Now, suppose this reservoir shut, and the valve of the lower reservoir opened, the quantity of water marked by C P Q H will escape and enter the lower reservoir, till the water surface is sunk to an equal level G Q H. After the lower reservoir is shut, there remains a quantity of water in the chamber, marked by the letters Q H S M, which lies above the lower level, and of course must be drawn off into the lower canal, in order to clear out the boat.

2. Now, take the case reversed; when a boat is to pass from the lower level to the upper level. After the boat has entered the chamber and the lower gates are shut, open the paddle of the lower reservoir, and draw the reserved water into the chamber. All dimensions being right, this quantity of water should exactly fill out the space S M O K, so that the top water line, O K, and the bottom of the reservoir, I O, be in one level, and no water remains in the reservoir above that level. The boat will now be raised to the level of O K. After the lower reservoir has discharged itself, shut it, and open the paddle of the upper reservoir, and draw off its reserved content of water. This quantity of water should exactly occupy that space in the lock chamber marked by E N O K, so that no water remains in the reservoir above the level of N F, representing the bottom of the upper reservoir. To raise the boat to the level of the upper canal, a quantity of water A B E N is yet required, which must be drawn from the upper level into the chamber, after the valve of the upper reservoir is shut up.

In the first case, that quantity of water which has actually been drawn from the upper level, is marked by the lines S M O K, the quantity of water saved is marked by A B Q H.

N

In the second case, the quantity of water actually spent, is marked A B E N; and the quantity saved is marked S M E N. As the area of each reservoir is supposed to be equal to twice the area of the chamber, the space which a certain quantity of water occupies in the chamber will be twice as high, or deep, as the space required for the same quantity of water in one of the reservoirs. Hence it follows, that

$$BP = 2\,PN = NK = 2x$$

and $$CQ = 2\,QO = OS = 2y$$

The whole lift A S, or

$$L = AC + CQ + QO + OS$$

or $$L = 2x + 2y + y + 2y = 2x + 5y$$

and likewise is $$L = BP + PN + NK + KM$$

or $$L = 2x + x + 2x + 2y = 5x + 2y$$

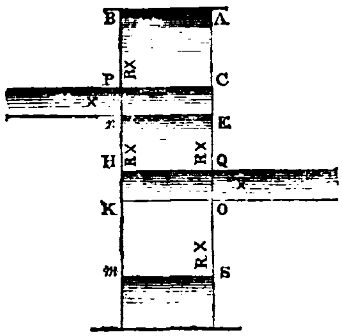
Hence $$2x + 5y = 5x + 2y$$

or $$3y = 3x$$

consequently $$y = x$$

The quantity and stage of water in each reservoir are therefore required to be equal.

Fig. 2.



Let the ratio which indicates how many times the area of the lock-chamber is contained in the area of each reservoir, be denoted by the letter R, so that when the area of the chamber is equal to 90 × 15 = 1350 square feet, let the area of each reservoir be expressed by R × 1350 square feet.

By examining the diagram fig. 2, it follows now, as a matter of course, that $OS = Rx = Km = Kn = QC = PB = AC$

By adding the different altitudes, which constitute the lift, we find

$$L = Rx + x + Rx + Rx = 3Rx + x = (3\,R + 1)x$$

an therefore, $$x = \frac{L}{3\,R + 1}$$

which expression gives the stage of water in the reservoirs, provided there are two. Without any further examination we can employ the following expressions as formulæ for the other required dimensions:—

1. The elevation of the bottom of the lower reservoir above the lower canal level, or $OS = Rx = \frac{R.\,L}{3\,R+1}$
1. The elevation of top-water line of the lower reservoir above the lower canal level, $QS\ (R+1)x = \frac{(R+1)\,L}{3\,R+1}$
3. The elevation of the bottom of the upper reservoir above the lower canal level, or $NM = 2\,Rx = \frac{2\,R.\,L}{3\,R+1}$
4. The water saved, marked by the space MSEN, or $BAHQ = AQ = MN = 2\,Rx = \frac{2\,R.\,L}{3\,R+1}$
5. The water used is marked by MSQH or $ABEN = SQ = BN = (R+1)x = \frac{R+1)\,L}{3\,R+1}$

By examining the formula No. 4 for the water saved

$$\frac{2\,R\,L}{3\,R+1}$$

we find that the saving increases with the ratio R, though not as fast. When we suppose $R = \infty$, that is, the area of each reservoir to be infinitely great, so that x, or the stage of water in each reservoir, will be almost reduced to nothing, the formula will then be

$$\frac{2\,RL}{3\,R+1} = \frac{2\,\infty\,L}{3\,\infty+1}$$

As the quantity 1 does not increase an infinitely great quantity,

it follows, $$\frac{2\,\infty\,L}{3\,\infty+1} = \frac{2\,\infty\,L}{3\,\infty} = \frac{2\,L}{3} = \frac{2}{3}\,L$$

The greatest saving of water by two reservoirs is therefore equal to two-thirds of the lift of the lock. However, this much can never be gained in reality, though we can come near to it, without extending the reservoir too much, which would imply other inconveniences, as increase of cost, loss of time, and loss of water by greater evaporation.

The foregoing result of the maximum of water-saving will become also visible by mere examination of the diagrams, fig. 2. We see that when the stage of water in the reservoirs, or $x = PN = QO$, becomes, by being spread over an infinitely great surface, reduced to an infinitely small height, the points P and N, and Q and O, will be brought so near together, that they may be regarded as being reduced to the single points N and O, and therefore is

$$SO = OE = EA = \tfrac{1}{3}L$$

and the water saved $= SE$ or $BH = \tfrac{2}{3}\,L$.

For a given lift L = 14 feet, and R = 4, or the area of each of the two reservoirs to be equal to 5400 square feet, where the lock-chamber is supposed to be 90 × 15 in the clear, we find

$x = \frac{L}{3\,R+1} = \frac{14}{3 \times 4 + 1} = \frac{14}{13}$	= 1·077 feet
The elevation $OS = Rx = 4 \times 1{\cdot}077$	= 4·308
The elevation $NM = 2Rx$	= 8·616
Water saved $= 2Rx$	= 8·616
Water used $= (R+1)\,x$	= 5·385

By means of two reservoirs of 5400 square feet area each, a boat may therefore pass a lock of 14 feet lift, and not use more than 5·385 feet water, drawn from the upper level, where formerly, without reservoirs, a body of water of 14 feet height had to be used.

The following table shows how the quantity of water saved increases with the area of the reservoirs, supposing two reservoirs attached to the lock:—

For $R = \frac{1}{4}$ the water saved, or $\frac{2\,R.\,L}{3\,R+1} = \frac{2.\,\frac{1}{4}.\,L}{3.\,\frac{1}{4}+1} = 0.285$ L

$R = \frac{1}{2}$	"	"	"	0.400 L
$R = \frac{3}{4}$	"	"	"	0.461 L
$R = 1$	"	"	"	0.500 L
$R = 1\frac{1}{2}$	"	"	"	0.545 L
$R = 2$	"	"	"	0.571 L
$R = 3$	"	"	"	0.600 L
$R = 4$	"	"	"	0.615 L
$R = 5$	"	"	"	0.625 L
$R = 10$	"	"	"	0.644 L
$R = 100$	"	"	"	0.664 L
$R = 1000$	"	"	"	0.6664 L
$R = \infty$	"	"	"	0.6666...L

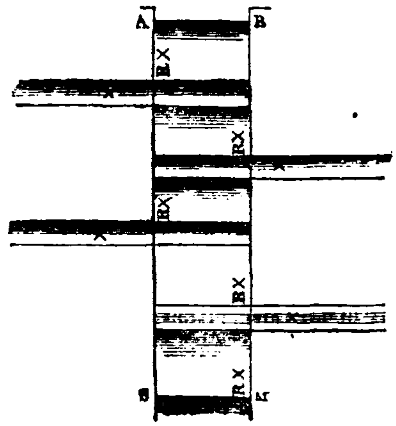
When only one reservoir is attached to the lock, the formulæ for all the required dimensions will be found:—

1. The water stage in the reservoir, or $x = \frac{L}{2\,R+1}$
2. The elevation of the bottom of the reservoir above the lower level, is expressed by $Rx = \frac{R\,L}{2\,R+1}$
3. The height of the water saved is $= Rx = \frac{R.L}{2\,R+1}$
4. The height of the water saved is $= (R+1)\,x = \frac{(R+1)\,L}{2\,R+1}$
5. The maximum of water saved by one reservoir is found

$$= \frac{\infty}{2\,\infty+1} \times L = \frac{\infty}{2\,\infty} \times L = \tfrac{1}{2}\,L$$

By means of one reservoir, therefore, nearly one-half of the lockage water may be saved in reality.

Fig. 3.



When four reservoirs are attached to the lock, as diagram fig. 3 shows, we find the lift

$$L = Rx + x + Rx + Rx + Rx + Rx = (5R + 1)x$$

and therefore $x = \frac{L}{5R+1}$

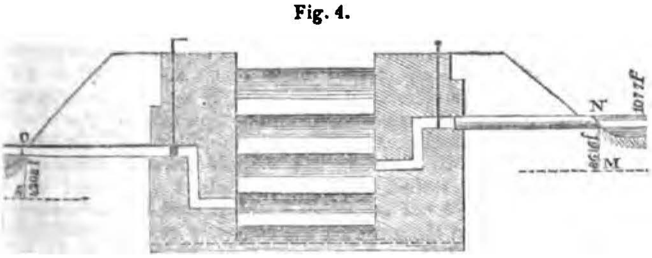
1. The elevation of the bottom of the lowest or the first reservoir above the lower level $= Rx = \frac{R.L}{5R+1}$
2. The elevation of the bottom of the second reservoir above the lower level $= 2Rx = \frac{2.R.L}{5R+1}$
3. The elevation of the bottom of the third reservoir above the lower level $= 3Rx = \frac{3.R.L}{5R+1}$
4. The elevation of the bottom of the fourth reservoir above the lower level $= 4Rx = \frac{4.R.L}{5R+1}$
5. The water saved is $= 4Rx = \frac{4RL}{5R+1}$
6. The water used is $= (R+1)x = \frac{(R+1)\cdot L}{5R+1}$
7. The maximum of water saved is represented by

$$\frac{4R.L}{5R+1} = \frac{4\infty}{5\infty+1}L = \frac{4\infty}{5\infty}L = \tfrac{4}{5}L$$

This demonstration shows that by means of four reservoirs attached to one lock, nearly four-fifths of the lockage-water that is wanted by a common lock, may be saved.

The annexed drawing, fig. 4, represents a cross-section of a lock of fourteen feet lift, connected with two reservoirs; each reservoir to have 5,400 supeficial square feet area. It is immaterial how the bottom of the reservoirs is formed, and it is necessary to have it below the level of the culverts, in order to prevent the dirt from being raised and carried into the lock-chamber. The bottom of each reservoir should be at least one foot below the mouth of the culvert, or lower, so that at least one foot of water remains in each reservoir, after the reserved water is discharged. The main object in constructing the culverts is, therefore, to have the points N and O, or the highest point in the bottom of the culverts so fixed above the lower canal level, that their elevation answers the expressions given by the foregoing formulæ.

Fig. 4.



The culverts in the lock-wall embankment are represented in the drawing to be of wood. The culverts in the wall itself must be constructed either in the form of rectangular syphons, or straight linear inclined, so that the mouth of the culvert of the lower reservoir opens into the lock-chamber, below the lower canal level; and the culvert of the upper reservoir enters the lock-chamber at an elevation equal to $2Rx$, above the former culvert. The reservoirs may be formed either by excavation or embankment, as the ground suits best. Where the natural ground is pretty level and square to the centre line, and the lock-walls are to be raised about one half their height above the natural ground at the middle of the lock, it requires but very little excavation and embankment to form the reservoirs. It often occurs that a depression in the ground, or a natural basin, near the lock, can be used to great advantage as a reservoir, requiring nothing but a little more culvert. Where there are two reservoirs, they must be located either, one on each side of the lock, or both on one side, as the ground suits best. In the latter case, the two reservoirs must be separated by a dam, either formed by excavation or embankment. The bottom of the reservoirs, and their side slopes should be covered with coarse gravel or slaty material, if such material can be had conveniently, in order to keep the water more fresh and clean.

The paddles are best placed in the upper parts of the culverts, as represented in the drawing, in order to prevent a great pressure of the water from the reservoirs towards the lock-chamber, and to keep the water safely shut up. The paddles should fit very close, and move in iron frames.

Whenever the supply of water is plentiful, the boats may pass the locks without using the reservoirs for saving a little more time. However, the excess of time which is required by using the reservoirs, is very trifling, and the passage can be effected with far less inconvenience and injury to the boats and locks, when the reservoirs are used, than when not. The objections which any engineer has against high lift locks, will be entirely removed by the construction of reservoirs. Reservoir-locks will be found very useful on slack-water navigation, where it is a great object to reduce the number of dams. If in such a case the river bank on the side of the lock offers no favourable opportunity, and not sufficient room, without removing great obstacles, as solid rock, &c. for the location of the reservoirs, the required width can always be obtained by shifting the lock a little more into the river, and by omitting the lock embankment. A bridge built along the lock-wall over the reservoir, will serve for a tow-path in this case. The attendance of a reservoir-lock requires no more skill than a common lock, as the state of water in the reservoirs and the chamber regulates itself, and the lock-keeper has nothing more to observe than to open the paddles, and to shut them as soon as the water-level gets settled. When the upper and lower levels are raised in time of a flood, the water will then occupy a different state in the reservoirs, and the contemplated saving of water will not be obtained exactly. In such a case, however, to save water is no great object, and the reservoirs will prove just as useful in all other respects.

THE NELSON MONUMENT.

Mr. Editor,—The unexpected decision of the Committee, to re-open the competition, unfettered by premiums, not only awakens the hope that now men who rank highest in the scale of art will deem it a prize worthy of their practised arms, and enter the lists with an earnest desire to distinguish themselves as artists and as Englishmen, but gives the public and the professions breathing-time, so that the soreness of the one, and the asperity of the other may be softened down.

I am quite old enough to recollect, that in the hey-day of exultation after the victory of Waterloo, the House of Commons came to something like, if not exactly, a vote that a large sum of money should be devoted to the erection of a public monument to commemorate it; and I am quite certain that desings for Nelson and Wellington monuments were advertised for in 1817. I know that designs were sent in, that they were kept some weeks, that artists were then desired to take them away, with an intimation that they might again be sent in, some three months afterward: and I apprehend you will find, upon inquiry, that the premiums were adjudged to Mr. Smirke and Mr. Wilkins. Why they were not executed your informant knoweth not, but mayhap those gentlemen will favour the public (if what I state be fact) with a view of them. If I mistake not, Mr. Flaxman proposed, as a fit monument, a colossal statue of Britannia, and published a pamphlet descriptive of the design, and of the mode in which he would construct it. These things are desirable to be known, and seen if it be practicable, that the public may ascertain whether art has receded or progressed since that day. Even did it no other service, it would caution critics to be more sparing of their censure, when such a man as Flaxman failed. But whether this can be done or not, in the absence of properly qualified persons, to undertake the task, will you allow one, who may rank as something intermediate between an amateur and an artist, and who has again and again, however feebly, considered the subject, quietly to state the difficulties which occur to him, that, if his opinions be well founded, the competing artists may not be spirit-broken by unfair and ignorant censure. I will first take the peculiarities which attend this competition. The Committee have never stated what kind of monument they think best fitted for the purpose. This alone is sufficient to paralyse the efforts of the most talented; for who can bring his mind efficiently to bear upon a subject which he is almost absolutely certain is but a will-o'-wisp? Sculptor and architect, each must fear that the sister art may be preferred, and consequently all labour bestowed upon the other will be thrown away. In emphatic, though common language, each feels that he is "working a dead horse." I do in my heart believe that few of the Committee can tell what they want, and am quite certain that not one of them can carry out his own ideas, so as even to satisfy himself: how then can it be expected that artists can remotely guess at what may perchance be something likely to suit their fancy?—Sooth to say, sir, I fear the selection is vastly like that of a lady in a cap-shop. Another difficulty is created by the situation which is pointed out for its erection. At first view it seems exceedingly easy to design a monument to be-set up in Trafalgar-square; but we first have to consider what is to be done with the ground, which falls from north to south some eleven feet at one end, and only about four feet at the other: and next, how a space about three hundred and ninety feet by two hundred and ten is to be laid out, so as, along with the monument itself, to grow into an appropriate picture; each feature bearing its part in the scene: and, supposing all this satisfactorily adjusted, we arrive at the questions, "What kind of monument is fitted for the site?"—"In what architectural style ought it to be?" or, if sculpture should be considered fitter, "Should it be broad and low, or should it be narrow and high?" The answers will be something like these—If narrow and high, the National Gallery will be cut in two—illustrating, it is true, one of Nelson's favourite manœuvres of breaking the enemy's line, but doing no great service to the building; and if broad and low, it so happens that even a height of fifteen or twenty feet would cut off about two-thirds of the portico of the Gallery; for if you stand upon the southern footpath, you will find that the trifling ridge of the ground shortens all persons walking on the footway at the Gallery, by the length of their legs. Then, as to architectural style: I have seen it suggested that it should assimilate with the surrounding buildings. Pray with which? There are but three buildings which can be said to have any style:—St. Martin's Church, the National Gallery, and Northumberland House;—the last is out of the picture, and consequently need not be cared for. The Gallery, whatever it may be in itself, is quite unfit to be worked up to in a naval monument; and St. Martin's Church need not be much heeded, for no style can injure that. Artists may erect whatever they please, that structure stands alone in its integrity, calmly scorning all the egotistical attempts around it. The questions, then, as to what style? and what kind of monument is fittest? can only be answered by going into a very difficult enquiry, involving a consideration of the distinct capabilities of architecture and sculpture, or of both combined; and how far they can be made to speak a widely understood language. There are certain simple forms prevalent among many nations, which, whether derived from the practice of one original stock, or inherent in the human mind, bring with them melancholy ideas. We, as it were, instinctively know a tomb; we feel that denotes a place of sculpture, and we reverence it as such:—but beyond that, it has no power of expression. To denote whether it be raised to commemorate a male or female, architecture has no resource but to call in the aid of sculpture.

There are certain other forms, which, although approximating to the sepulchral, yet appear to designate, not that human remains have there been interred, but that they have been set up in memorial of some event; but the architectural form conveys no idea to the mind of the event which is denoted, if sculpture have not, by her chisel, given to it a tongue. And there are other forms which, by their simplicity, solidity, and calmness, appear evidently intended as sacred places appropriated to the worship of the Deity. Architecture can erect temples, memorial stones, and tombs, with little risk of her meaning being misunderstood; the forbidding gloom of a prison, or the festive gaiety of a banquetting-room, can be characterized by her to some certain extent; but how, as some seem to expect, she is so forcibly to depict the qualities of the human soul, that all men are at once to understand the structure commemorates a hero, is far beyond my comprehension—it is in fact beyond her power. From the stone of Bethel set up by Jacob, from the obelisks raised by the Egyptian kings, down to the loveliest conceptions of Grecian art, and thence onward to the military columns of the Romans, and of the Place Vendome, all have required either the aid of inscription, or of sculpture, or of tradition, to point out what they mean; and where these have failed, as in the case of the Egyptian obelisks, there we stand gazing in utter ignorance. To come closer home.—Does the Monument on Fish-street-hill, divested of its sculpture and inscription, by aught in its aspect tell us that it memorializes the burning of London? What does the column in Waterloo-place tell us? What do all the columns and monumental structures over all England, set up in commemoration of Nelson, tell us of his character? The column of skulls piled up by the Tartar chief, unequivocally spake of an enormous slaughter; the projected Russian column of cannons and mortars might be supposed in some way to denote a victory, yet even these are not, strictly speaking, architecture; they partake more of the character of sculpture in its most barbarous form. But by what magic genius has architecture been made "trumpet-tongued," to tell of Nelson, the energetic, the fearless, the affectionate, the open-hearted, the generous, the devoted, the heroic? We may indeed be told of breadth, and height, and strength, and massiveness, as calculated to denote the warrior chief; but alas for the National Gallery if any one of these demons be conjured up, and woe to the paltry sum which is said to be available for the purpose. Sculpture has a more extended range, and greater power than her sister art, for she can call in the expression of the human form, and add explanatory embellishments in her own pictorial language; but even her power is limited, and needs written language to tell the whole tale. It is in her power to erect a statue, which, without being much beyond the human size, nay, it may even be very much below it, shall impress the beholder with the most sublime ideas of the being it represents. It is in her power to compose a group of statues, which shall, with the most impassioned eloquence, spell-bind the soul. It is in her power, by a well-conceived line of relievo, to carry out the whole of a continuous history; she, like Painting, can, to a vast extent, realize the poet's seraph-song, and bid the dumb stone start into life; but, notwithstanding all this her strength, there is a limit to her resources—she has one source of weakness, and that, I fear, will render all her art unavailing if she attempt to erect an isolated monument. All her works are necessarily and in themselves only embellishments, are only appurtenances: however firmly cramped to a building, they form no part of it; however deeply rooted in the earth, they are still nothing but moveables; but, independent of this, they are not calculated to be viewed from more than one, two, or three points advantageously. Owing indeed to the absolute perfection of all the Almighty's works, any correct imitation of the naked human figure, or of any animal, singly and in itself, must be beautiful, view it from any point; but when brought together in a group, so as to tell a story, the insufficiency of art is manifest. Sculpture, in fact, can only make pictures in stone, wood, or other material; those pictures, when so placed, as that the spectator can only see them in front or a few degrees sidewise, especially if within a building, and the quantity, colour, and direction of the light, be skilfully adjusted, may be made to produce the most wonderful effect; but, in an isolated monument, and that in the open air, it is altogether different. However well-composed the grouping, however grandly conceived the attitudes, and however admirably calculated to convey the artist's meaning, all its effect is likely to be marred, even if it be not made absolutely ridiculous, by the spectator taking it in flank, or viewing it from behind. It is in vain to say that the spectator ought not so to do. In its very nature an isolated monument should be calculated to look well from any and from every station; and therefore, if I be right in my showing, a group of sculpture only is not available for the Nelson monument.

If so, I apprehend the conclusion will be that the proposed erection must either be a statue (not a monument) more or less colossal, standing on a pedestal or block, more or less high, and more or less embellished, and those embellishments, made by the artist, to bear an important part in his picture; or an architectural monument, decorated with such sculpture as may be necessary, clearly and fully, and yet without confusion, to tell, as far as art can make it tell, the wherefore of its erection.

The mere statue would, in itself, be no insuperably difficult task. It must be colossal, or in a space of some five hundred feet in width, from house to house it will be lost; it ought to be calm and dignified, and especially no violent action ought to be attempted, or it will be ridiculous. An architectural monument is by no means so easily to be composed: it will require more ability than falls to the share of most men, so to unite architecture with sculpture, that neither shall unduly predominate, but both distinctly and forcibly assist in forming a fit basis for the hero's statue, for such, after all, I apprehend it must be. The object will not be attained unless that be the leading or ultimate feature, and the great art will consist in gradually leading the eye upwards until it rest upon that main object, without being distracted in its progress by intrusive ornament, and without finding the structure broken into steps as it were, and not forming one integral work, but so many separate pieces piled upon each other; or, should the artist deem a comparatively low erection more appropriate, it must not be so broad as to stretch beyond the field of distinct vision. If, however, breadth be deemed desirable, then can it be little more than a series of terrace steps, else will the National Gallery be destroyed. If height be deemed requisite, and it be made square, polygonal, or circular, it will either resemble a pedestal or a church-tower, or castle-turret, and no profusion of decoration can divest it of one or other of those characters, unless, indeed, it be made so high as to be columnar; and much I think that any desire to make it an architectural object must content itself with the columnar form. As to the kind of column, I apprehend that only the Ionic is inappropriate, for that is not calculated to stand alone, its fronts and flanks being dissimilar. Much has been said against Corinthian columns, but I think with very little justice or good taste. It is true that the substitution of the Jupiter Stator column for the Doric of Fish-street Hill, is no design at all, any cabinet-maker's apprentice could have done as well; but I think it may be possible even to make a Corinthian column form a very appropriate object, yet it must be ably treated, and made to seem what it really will be, nothing more than a standard to support a statue. Concluding then that the proposed memorial must either be a column surmounted by a statue, or a statue standing upon a block, or an architectural pedestal, the fit style of decoration is next to be considered.

A column of any order admits of but little ornament except upon its pedestal, and even there it is not peculiarly fitted to show advantageously. Mayhap the spiral reliefs on the Trajan column are the fittest for a military structure; but, independent of the cost, they could not be made very distinctly visible at more than a hundred feet in height, and in a London atmosphere not so high as that for any long period. But any attempt to surround the base of a column with either standing or sitting figures must end in its appearing at a distance, like an illumination candle stuck in clay. It is a ridiculous comparison I allow, but I cannot divest myself of it. The base of a statue will, if I think rightly, be capable of much and very appropriate decoration. I would certainly eschew all Neptunes, Britannias, and Victories; all very well in themselves, but much too common-place for such a work. Should groups of statues, or pannels, or other recipients of bassi-relievi be introduced, I strongly think that the great art will be, as much as possible, to make them, as it were, grow out of the masonry, in suchwise as to appear an integral portion of the pile; so that, although they might indeed be removed without injury to the stability, yet still that taking them away should detract from the completeness of the work. There should be no flutter, no pinnacling in the outline; all should be in calm and dignified repose; and the whole mass be such as that, while at a distance its harmonious proportion should delight, upon a nearer view its sculpture should be instructive and interesting, and upon the closest inspection found to be wrought in the highest style of art.

If I have rightly read the relics of ancient art, such was their principle. The same correct principle will, upon careful consideration, be found to prevail throughout styles, in many respects as wide asunder as the antipodes; but wherever it has prevailed there will grandeur and beauty be found combined.

I feel the subject has led me far beyond my original expectation, so far indeed that I fear few will care to follow it; but if they do, I think it will be felt that of all difficult tasks the composition of an isolated monument is incalculably the most difficult, and that it will be extremely unfair harshly to censure failure in such an attempt.

It is to be recollected that all competitions are in themselves tasks; that in such a competition as this the mind is, as it were, overwhelmed with the greatness of the character of Nelson, and overreaches itself in striving to grasp at an imaginary vigour of expression. It is also to be borne in mind, that if such men as Nelson and Wellington arise but with centuries between them, artists equal to the task of commemorating their deeds are of similarly rare growth. The enrapt spirits of Homer, or Æschylus, or Milton, might shadow forth their achievements; the mighty genius of Flaxman could almost soar a kindred flight, but even he failed in commemorating Nelson, marvellous as were his compositions on other subjects. Even if, in this second competition, not one of the designs should be fitted for the purpose, it will ill become critics to censure the failure so harshly and unfeelingly as has been done. They, as authors, must be aware that the happiest thought does not come for the seeking, that it is often the lightning glance from heaven, darting when least expected; and common charity should teach them forbearance from unmerited insult. I have already said that I do not believe any one of the committee can carry out his own ideas of what Nelson's monument ought to be, even if he be able to form any idea at all. I fearlessly say the same of others, and would advise them to think so, at least until they have fairly set to work and wrought out such a design as shall far excel those of the men they sneer at.

I know my own weakness, my own inability, and can therefore make large allowances for failure in a task so difficult; still do I not despair of the genius of English art, and shall most cordially delight in the success of any of my countrymen.

I have the honour, Sir, to be

Your constant subscriber,

OMEGA.

THE ROYAL EXCHANGE.

SIR,—The system pursued of late years in the management of architectural competitions, has been attended with manifold evils, and, beyond all doubt, fraught with gross and palpable injustice. Hastily and inconsiderately commenced—under the control of persons unfitted to sit in judgment on the various designs referred to their decision, they have in too many instances been attended by results, injurious to the best interests of Art,—unfair and unjust to its professors—and unfavorable to the public at large.

In making these remarks, I do not of course, intend to attack the principles upon which competitions are based,—properly conducted, their tendency is unquestionably, not only to call out the talent and genius of the experienced artist; but to rouse a spirit of emulation in the young professor, and encourage that rising merit, which without such a stimulus would remain undeveloped, and without such a means of exercise, unknown and unappreciated. But the thing which I wish most anxiously to press on the attention of the profession at large, through the medium of your columns, is mainly this,—The extreme defectiveness of the present system; the total want of security, which there is under its operation, that fairness and impartiality will be strictly observed towards all, and the urgent necessity which consequently exists for a searching and efficient remedy.

It would be needless to go into any lengthened proof of this assertion; the voice of public opinion has frequently been most unequivocally expressed in denunciation of the present mode of conducting architectural competitions; and, to mention no others, the whole proceedings connected with the new Houses of Parliament, speak with sufficient clearness to all, by way of warning. Upon that point, however, it is not my intention to enlarge; and I only make the allusion in order that architects may gather from the recollections and experience of the *past* a valuable lesson for their guidance and direction for the *future*.

Architects have been invited to send in plans for re-building the Royal Exchange, and as a preliminary, they are compelled to pay one pound to obtain the requisite instructions. I pass over the unreasonableness of this demand, which makes all the competing architects, except the successful three, actually pay one pound, in order to have the opportunity of embarking their time, talents, and labour, on what *must* prove to them *unrequited exertion*. I have more important considerations to urge, of paramount and leading interest, to all who intend to compete for the proposed edifice.

And I ask them plainly, what guarantee have they, that the present competition will be conducted on the principles of fair dealing, impartiality, and justice? On what grounds are they convinced (for the act of entering the competition shows that they have that conviction) that it is the intention of those upon whom devolves the duty of adjudication, to go into a strict and searching examination of their designs; making their decision according to *merit, and merit alone;* and selecting only those, which while they conform to the instructions, are distinguished alike by the beauty of the exterior *facade* and the convenience of the internal arrangement. I say, deliberately, that at present, there exists no such guarantee, either in the wording of the published advertisement, or the printed instructions of the Gresham Committee: and yet, unless architects can obtain from the authorised parties some pledge more explicit—some statement more distinct—some promise more definite, it is really madness in any one who values his time, station, or character, to embark in so uncertain a venture, when, perhaps after having spent months of concentrated effort, together with a vast amount of anxiety, fatigue, and money, in getting up his designs, he may be coolly superseded, by some favoured rival; who, without being able to lay claim to any extraordinary degree of talent, yet possesses a larger amount of personal interest and local influence.

What then is the duty of architects at this juncture as professors of a liberal art, and men of spirit and independence? Undoubtedly it is to bestir themselves, and act with unanimity and firmness.

Should they accept the present indefinite invitation, which contains no guarantee beyond that which the Parliament House Competition included, and which will probably—unless something be done,—be productive of dissatisfaction to all parties concerned, and disappointment to the public; they will have none but themselves to blame, in having, contrary to repeated advice, and with all the experience of former competitions before their eyes, tamely submitted and acquiesced in the terms proposed, when by the adoption of a more vigorous course of conduct, they might have effected an altogether different result.

In a report upon public competitions, lately published by the Royal Institute of British Architects,—every architect is recommended, individually, to address in writing to the Secretary, or other authorised party, the most searching inquiries upon every doubtful or indistinct point, and not to rest satisfied with any answer which fails to place everything necessary to be known, in the clearest point of view. This mode, however, seems open to many serious objections,—as it would not only give the Secretary of the Gresham Committee a great deal of trouble to answer the innumerable queries that would be put to him by individuals: but also, being in all cases strictly private, no information would thereby be afforded to the profession generally, of the intentions of the Committee,—which information, if it could be obtained, might be a *bonâ fide* pledge on their part, of their determination to act with strict fairness and impartiality.

Let then the architects—as the only alternative—convene a public meeting; let the leading members of the profession attend: let them delegate a certain number of their most influential men to request of the Gresham Committee, a fuller and more minute explanation of their intentions in reference to the Exchange Competition; let them inquire who are to be the judges?—Whether a strict adherence to the instructions is a necessary preliminary on the part of the architects, to secure his plan, *an inspection?*—Whether all designs, which cannot be executed for the sums estimated, shall be laid aside?—Whether a public exhibition shall *precede* as well as *follow* the decision of the judges?—And, whether the author of the chosen design shall be allowed to superintend the erection of the work, provided his standing in the profession, and experience as an architect, entitles his so doing? And, till these inquiries are *satisfactorily answered*, let it be the *unanimous* resolution of the Architects of England, that *they will not enter into the present competition—that they will not lend it their sanction—nor give it the benefit of their talents and support.* And if they thus act firmly and unitedly, a better system of things will be ultimately adopted, and the cause of truth and justice must eventually triumph.

In conclusion, I have only to add, that I feel quite assured, that some such proceeding as this, would not only tend to raise British artists in the estimation of the public—and secure, in a great measure, a fair and free competition—but would also induce many of the leading architects to contribute, who at present—being fearful of unfair dealing—have no such intention; and would moreover be the means of obtaining a design for the Royal Exchange, worthy of the metropolis it is to adorn, and an honour to the taste and genius of the age.

I remain, Sir, your obedient servant, and constant reader,

April, 1839. AN ARCHITECT.

FLOATING HARBOURS OF REFUGE.

SIR—I do not recollect that I have seen any observations in your interesting work relative to the principle of floating harbours or breakwaters, and I am led to notice the subject from having read with great pleasure the article by Hyde Clarke, Esq. C. E., upon Isolated Harbours of Refuge, in your last number.

No question can exist upon the advantages of natural harbours as described to be at the island of St. Michael, and I am induced to think that observations made upon Porto do Ilheo, led Admiral Sartorius to think of making a floating harbour at Terceira, upon which he corresponded with the patentee of the floating breakwaters, but which his expedition from the Azores most probably prevented his attempting to carry into execution. The principle of harbours of refuge is advantageous in proportion to the practicability of carrying the protections they afford into deep water. The construction of masonry, or the accumulation of stones, is expensive in a progressive proportion to the depth of water—hence the saving attending floating substances secured so as to form harbours in deep waters must be very great.

The successful experiments which were tried in 1824—though discountenanced by the Admiralty on account of the apprehension that they were favourable to smuggling—demonstrated that no objection ought to be raised against a floating harbour, if composed of rafts situated in a position where they could never ground. Julius Cæsar found out their advantage when he employed them, as described in his Commentaries, as follows:—

"Cæsar sat down, on the 9th of March, before Brundusium, with six legions, three of which were composed of veteran soldiers, and the rest of new levies drawn together on his march. He had sent Domitian's troops directly from Corfinium towards Sicily, not caring to bring them near Pompey's quarters. The Consuls had sailed on the 4th with thirty cohorts, and there were still twenty in the town with Pompey. Nor was it certainly known whether he continued there for want of shipping to transport his troops, or with the design to keep possession of Brundusium, that he might be master of the whole Adriatic Sea, the farthest parts of Italy, and the country of Greece, in order to make war on both sides the gulf. Cæsar having lost all hopes of an accommodation, and fearing that it was his intention to keep footing in Italy, resolved to push the war with vigour, and to deprive him of the advantages he might reap from the port of Brundusium. The following works were contrived by him for this purpose. He carried on a mole on each side of the haven where the entrance was narrowest, and the water shallow. But as this undertaking could not be carried quite across the port by reason of the great depth of the sea, he prepared double floats of timber, thirty feet square, which were each secured by four anchors, to enable them to resist the fury of the waves. These, which were to extend all the way between the two moles, were covered over with earth and fascines, that the soldiers might pass and repass with ease, and have firm footing to defend them. The front and sides were armed with a parapet of hurdles, and every fourth float had a tower of two stories, the better to keep the enemy's ships at a distance, and to guard the work from fire and the shocks of vessels."

I have not the advantage of having seen the Port of Brindisi, but the extract sufficiently explains the nature of the works. There are numerous positions on our coast which are well suited to such an operation, and if a harbour were constructed with stone jetties in the shallow water, and floating breakwaters moored seaward, there can be little doubt of the purpose being effected.

I have the honour to be, sir,

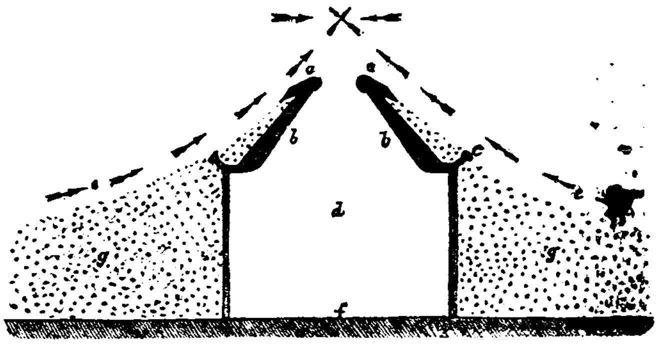
Your humble servant,

AN ARCHITECT.

[The employment of floating harbours is very important, and by means of Mitchell's screw moorings might be applied in many positions.—EDITOR.]

HARBOURS OF REFUGE.

The counter run. The true run of the tide.



The Line of Coast on Shore.

aa, The horn-work.—*bb*, Pier-heads.—*cc*, Jetties.—*d*, Harbour.—*ee*, Bays.—*f*, Quay.—*gg*, Beach or Shingle.

SIR,—Seeing by the public papers that the Lords of the Treasury have sanctioned the constructing of Harbours of Refuge for her Majesty's smaller vessels of the Royal Navy, against the easterly gales on the coast of Essex, Suffolk, and Norfolk, in these works of the government, it is not intended to prevent private companies from making inner basins or inland harbours.

I have sent you a Plan, which I shall feel obliged if you can find room for in your next Journal: it is entirely new, and adapted principally for a coast which is composed of beach or shingle, and their construction would be about half the cost of harbours as they are now built. By this plan you will perceive that it is in the formation of the Pier-heads which locks up a body of beach or shingle against their sides, and causes the tide to be embayed by whichever pier it sets against; this, with the run of the true tide, would propel all the surplus beach or shingle which was in motion several fathoms out seaward beyond the pier-heads, and prevent any bar forming at its entrance or around it; a large body of beach, &c., will be accumulated at the foot of both sides of the harbour, and form the best barrier in protecting it. These harbours of refuge would be very beneficial around our coast, for the protection of our seamen, ships, and commerce; and an encouragement to our fisheries, independent of the protection it would give, or afford, to her Majesty's steam-vessels.

I am, Sir, your humble servant,

W. KINGSFORD.

Buckland, near Dover,
April 10, 1839.

BRITTON'S DICTIONARY.

SIR,—There is a homely proverb, which says, "the proof of the pudding lies in the eating," and it applies exceedingly well to Britton's Dictionary of Architecture, for whatever commendation the book may have obtained as soon as it comes to be fairly tested it will be found most egregiously deficient and defective, nor least of all so where information is most wanted, and where there was, consequently, ample opportunity to supply what previous works of the same kind had neglected to do. Undoubtedly it was perfectly optional on the part of the compiler to limit its plan as he pleased, or as might best suit his own convenience, however he might, by so doing, lessen its usefulness; still, whatever he had once adopted, he ought to have considered himself bound to adhere to consistently throughout. Now this, most assuredly, he has not done with regard to terms connected with classical architecture; since, besides being very insufficient and unsatisfactory in themselves; what there are, amount to no more than a meagre sprinkling of them, and precisely of those of which a mere explanation will hardly be sought by any one. It avails not to say that this Dictionary is intended to elucidate chiefly the architecture of the middle ages, such excuse being altogether nugatory, and almost equivalent to saying that the other terms—at least such of them as occur, are brought in, not because at all called for by the professed object of the book, but merely to swell it out, and to induce persons, upon a hasty inspection of it to imagine that it is far more copious and complete than its title gives it credit for being.

What, however, I most strongly protest against is the disingenuous and even trumpery artifice, for I can give it no better name, of pretending to give the corresponding terms in other languages, but invariably omitting them in the case of strictly technical words, whose meanings are seldom to be ascertained from consulting French, Italian, or other dictionaries; whereas had they been uniformly introduced, and also indexed, so that their English meanings might be instantly ascertained, the Dictionary would have been really useful for reference; even in reading foreign architectural books. What is not the least surprising is that these omissions extend even to such terms as belong peculiarly to Gothic architecture, for instance, "corbel," "hood-moulding," "mullion," "pendant," "spandrel," "transom," "tracery," in fact to almost all the terms of that class, although more especially required, because for the foreign ones which answer to them, it is almost useless to look in dictionaries. I lately met with the German terms "Dobel," "Glaspfalz," and several others (of which I may at some other time, perhaps, send you a list, as some of your correspondents may possibly be able to explain them) they evidently refer to parts of Gothic windows, but what may be their precise meaning I cannot say, nor does Britton's Dictionary afford me the slightest clue, for in vain have I there referred to all the English terms, with which the ones above-mentioned are at all likely to correspond.

On the other hand, of what use is it, I ask, to give the French, Italian, &c., of such general terms as "architect," "house," and a hundred others, which the commonest dictionaries supply, and for which no man, who at all understands the language in which they occur, can have occasion to refer to a dictionary at all. The truth is all that Mr. Britton has done in this respect amounts to more than idle, and I may add, exceedingly silly parade, since nearly all the foreign words are more or less disfigured by blunders that convict Mr. Britton; of being utterly ignorant of the languages themselves, some of these blunders may be errors of the press, but then it is evident that he was unable to detect them, because an author's attention is always more particularly directed to such matters as foreign words or quotations, it being there that compositors are most likely to make mistakes. In addition to blunders of the above kind, which are so numerous, as to be on that account alone quite disgraceful, there are others which prove more completely that he compiled without the least understanding what he was copying. Should he ever have any German or French readers how will they stare at finding "raum," and "chambre," given as the words respectively answering to our English one of room. A Frenchman would, I conceive, more frequently than not employ the term "piece;" certainly in speaking of a building architecturally, while if a German were to make use of the term "raum," he would not be understood at all. The above is far from being a solitary instance of the kind, but it will serve to show what reliance is to be put upon a dictionary, the compiler of which speaks, in his preface, so '*d'haut en bas*,' of other works, of which he has, nevertheless, availed himself so largely, that to them he is indebted for almost all that is of any value in it.

ARGUS.

ROYAL EXCHANGE.

"The Joint Gresham Committee beg to inform Architects who are desirous of submitting Designs for the intended Royal Exchange, that they may obtain a Lithographic Plan of the intended Site, with other particulars, upon payment of *one pound*, at the office of the Surveyor to the Committee, Mercers' Hall, London."

A very great delay has certainly taken place asoto the progress of the Exchange itself, but the several committees, in their laudable anxiety to keep the public amused, have either by themselves or their friends, appropriated the site to a temporary shrine of Pasquin. Lately, some wag amused himself with a caricature representing the site to be let, until wanted, for a Royal Exchange; but now we are indebted to the joint Gresham Committee for a much better burlesque.

At the head of our article will be found the announcement on what terms architects can obtain the necessary information; and that for the modest disbursement of a sovereign, they can have *a lithographed plan of the site, and the printed particulars*. The modesty of these terms cannot be sufficiently lauded, for we doubt if even any printseller could have contemplated such profits of more than cent. per cent. At any rate, for 50*l*. a thousand copies of the plan might have been struck off, and as many of the proposals; and supposing all these to have been applied for, still it would have made but 30*l*. The Gresham Committee, however, "a poor but honest man, my Lord" could not afford the expenditure of such a sum, and still less could it resist the temptation of pocketing the difference from the two or three hundred competitors.

The paltry meanness of such a shabby imposition is as contemptible as it is dishonest, and it is equally a gross dereliction of public duty, and an offence against the conventional laws of common courtesy. Do not the members of the Gresham Committee know, that instead of conferring a favour that they are certainly cutailing a heavy expense upon ninety-nine out of a hundred competitors? or can they consider themselves as acting with common justice towards persons who are already exposed to a heavy outlay? Many individual architects will be put to a much greater expense than the Gresham Committee merely in preparing their drawings, independently of the loss of time consequent upon their attention to them. There are sacrifices made it is true for a personal object, but still as certainly conducive to public advantage, and almost as incontestibly productive of individual loss.

The commodities supplied for this nefarious bargain are admirably in keeping with its other details, and are as remarkable for their incompleteness as they are for their worthless character. There are no sections of the streets or sewers in the neighbourhood, so as to show the depth necessary to go for foundations, and no information as to the comparative heights of the neighbouring buildings, which must exercise an important influence on the design. To an architect in the country these must be serious impediments, and the very formation of the site is beset with sufficient obstacles not to require the intervention of more. The Globe Insurance-office, however new, ought to come down, so as to leave the site unrestricted to its present bag-like appearance. It may be very doubtful also, whether the site selected for the perspective view is positively the best, and whether it might not have been preferable to have made the elevation fronting the Bank the principal façade.

We regret to see that this print-shop is set up in a place where last of all we should have expected to see it. It is melancholy that one of the most respectable members of the profession, also a Vice-President of the Architectural Society, should have allowed himself to be made the medium in furthering such an insult and an imposition. It was his duty towards the profession, so far from fostering such a job, at once to have resisted it, and to have denounced to the Committee such a barefaced insult to his brethren.

We think that there is a laxity in the operations of the Royal Institute of British Architects, or, taking such an interest in competition as they assume to do, they should have been more active with regard to this edifice. Uniting among themselves many of the most eminent architects of the empire, they ought to take a decided part in the regulations of competitions, on which, by the bye, their last report is by no means satisfactory. To exercise a beneficial influence on public opinion they must be more decided; and one of the best steps they could take on the occasion of a competition, would be to send a deputation to the Managing Committee to effect a proper arrangement of the manner and terms of competition.

Below, we give a copy of the regulations of the Gresham Committee, and at our office may be seen a copy of the plan from which any member of the profession is at liberty to take a tracing. It will always be our endeavour to resist proceedings injurious to the profession, from whatever quarter they come; and we call upon our readers to show an equally strong opposition to an attempt at imposition so barefaced and so iniquitous.

Resolutions of the Gresham Committee, as Instructions to the Architects.

1. That architects be invited to offer designs for the re-building of the Royal Exchange in general competition, and that premiums be offered for three designs adjudged by the committee to be the best.

2. That the lithographic plan shows the site approved of by the Lords of her Majesty's Treasury, and that a copy of such plan, with the resolutions and instructions, be given, on the payment of *one pound*, to any architects wishing to furnish designs, on his applying at the office of the Gresham Trust, Mercers' Hall.

3. That the new building be of the Grecian, Roman, or Italian style of architecture, having each front of stone of a hard and durable quality,

4. That the designs offered by the several candidates must all be drawn to the same scale, viz., ten feet to one inch and a half, exhibiting the plans of each story, with an elevation of each front, and longitudinal and transverse sections, together with an interior elevation. That a copy of the lithographic plan be also sent by each candidate, drawn in Indian ink, to the same scale as the designs, and showing correctly the outline of the proposed building, the site thereof tinted red, and of all adjacent buildings, in Indian ink; that all the drawings sent by each candidate shall be tinted with brown Indian ink only, and that no perspective drawings of the design shall be received, except two, which shall be taken from the situations specified on the lithographic plan to be delivered to the parties.

5. That no model, sketch, perspective, or coloured drawing (save two such perspective drawings as are described in the previous resolution) shall be received.

6. That a specification be required to accompany each design, giving a general description of the building, and such other information as cannot be clearly shown on the drawings, stating also what stone or other materials are proposed for use in the different parts of the building, and specifying particularly the estimated expense of carrying the designs into execution in the most substantial and complete manner in every respect for occupation, the expense not to exceed 150,000*l.*

7. That no seal, motto, or other distinguishing mark be attached to any of the drawings or specifications, and that any drawing or other paper having such mark shall be rejected.

8. That the designs be delivered at the office of the Gresham Trust, at Mercers' Hall, on or before the 1st of August next; that each design have a number attached to it on delivery, and that a corresponding ticket and number be given to the person delivering the same.

9. That a sealed letter be delivered with each design, containing the name and address of the candidate, the same to be returned unopened to unsuccessful parties.

10. That for the design to which the Committee shall award the first premium the sum of 300*l.* shall be given; that for the second design the sum of 200*l.*; and for the third the sum of 100*l.* The successful competitor to whom the first premium is awarded shall not be considered as having necessarily a claim to be entrusted with the execution of the work; but if not so employed, and his designs are carried into execution, a further sum of 500*l.* shall be paid to him—the Committee retaining possession of all the drawings for which the premiums have been given.

11. That if reasonable doubts should arise in the minds of the committee as to the practicability of carrying into execution the successful design for the amount of the estimated expense of the building, the committee shall be at liberty to call upon the party to give sufficient and satisfactory proof of the accuracy of the calculations, and to withhold the premium and reject the designs unless such proof be furnished.

12. That the following further instructions be adhered to by the architects in preparing their design:—

First—That no part of the several fronts is to be advanced before the line shown in the lithographic plan, and coloured red, the same being considered as the extreme projection of the stone-work at the level of the pavement.

Second—That the basement of the building be appropriated to vaults, cellars, strong rooms, &c.

Third—That the ground-floor be appropriated to shops or offices, so far as the same can be adapted to the design.

Fourth—That each part of the building proposed to be held as a distinct tenement is to be completely separated by brickwork or other materials equally fireproof from every adjoining part, on either side, or above or beneath it.

Fifth—That the area or space for the meeting of the merchants and others be about 20,000 superficial feet, of which about 7,000 be open.

13. That the statement annexed hereto of the proposed dimensions of the rooms and offices, &c., required, be adhered to in the designs; but as the several measurements which have been given are stated with a view of affording a general guidance to the architects in preparing their plans, not restricting them to the precise dimensions given, the architects will be at liberty to suggest such forms for each room, office, &c., as may appear to them most convenient, observing that the superficial areas should not be less than the sizes specified. They are also to provide in the remaining portion of the building as many additional offices as possible, to be let as distinct tenements.

The following rooms and offices are required:—

	ft.		ft.		ft.		ft.
One room	125	by	40	Two rooms .... each	19	by	14
One do.	60	by	16	One room	60	by	30
One do.	94	by	60	One do.	40	by	20
One do.	38	by	32	Two rooms ..... each	19	by	15

In addition to the above, not necessarily on the same story, one room, a kitchen, and a bar, containing together about 2,300 superficial feet.

The above is exclusive of a staircase, or staircases, lobbies, landings, water-closets, urinals, washing-rooms, walls, and partitions; also strong rooms on the basement.

The following rooms and offices are further required:—

	ft.		ft.		ft.		ft.
*One room	50	by	24	One room	30	by	20
*One do.	10	by	10	One do.	16	by	20
*One do.	15	by	20	One do.	15	by	20
*One do.	21	by	20	Four rooms ...... each	13-6	by	13
*One do.	15	by	12	*One room	10	by	10
*One do.	40	by	25	One do.	16	by	20
One do.	15	by	20	*One do.	17-6	by	20
One do.	15	by	20	One kitchen	12	by	10
One do.	20	by	20	One room	15	by	12
One do.	28	by	20	*One do.	25	by	10

Those marked * not necessarily on the same story.

The above is exclusive of a staircase or staircases, lobbies, landings, water-closets, urinals, washing-rooms, walls, and partitions; also strong rooms on the basement.

The following rooms and offices are further required:—

	ft.		ft.		ft.		ft.
One room	50	by	30	One room	30	by	21
One ditto	21	by	20	One ditto	40	by	21
Two ditto .... each	30	by	21	One ditto	21	by	20
One ditto	35	by	21	One ditto	21	by	18

In addition, three waiting-rooms, water-closets, and washing-rooms.

The above is exclusive of a staircase, or staircases, lobbies, landings, urinals, walls, and partitions; also strong rooms on the basement.

14. All designs will be excluded from the competition which are not in strict conformity with the preceding instructions in every respect.

N. B.—The architect of the Gresham Trust and his partner do not intend sending in any design.

RAILWAY, CANAL, AND ROAD TRAVELLING IN FRANCE.

The current estimates of the French Board of Works, which amounted to 40,000,000f. (1,600,000*l.*) in 1831, were raised to 45,000,000f. (1,800,000*l.*) in 1837. This very considerable sum is devoted to the maintenance of the roads, bridges, and canals. An engineering overseer, who is attached to the administration of each department, directs and manages the works to which the money is applied. Besides these current estimates, a law, passed in 1833, gave rise to a vote of extraordinary supplies for public works, which provides for the more important repairs, the completion of undertakings still unfinished, and the construction of new lines of communication. This additional vote, which has been increased by similar laws, passed in the years 1835, 1836, 1837, and 1838, has now reached as large a sum as 350,000,000f. (14,000,000*l.* sterling.) Out of this fund the Chambers have granted 27,000,000f. for the improvement of harbours; 64,000,000f. for the amelioration of the river navigation; 63,000,000f. for the completion of canals began in 1832; to which has been added a vote of 85,000,000f. for a lateral canal to Garonne, between Toulouse and Bordeaux, and a junction canal between the Maine and the Rhine; lastly, the high roads have obtained a grant of 107,000,000f. The *conseils-generaux* in the various departments have voted for the extension of the departmental roads not less than 60,000,000f. When the works now undertaken, and in progress, are finished, there will be in France nearly 8,000 leagues of high roads of the first class *(routes royales)*, 8,500 leagues of high roads of the second class *(routes departmentales)*, and 850 leagues of canals. An unbroken line of internal navigation will be opened from Havre to Marseilles, and from Strasburgh to Havre. The principal deficiency in the means of communication in France is celerity. The steam-boats have great difficulty in ascending against the stream of the larger rivers. The only canal on which the system of fly-boats has been borrowed from the Scotch and English canals, or, at least, borrowed with success, is the Canal du Midi, from Toulouse to Cette. The mails, indeed, are transported at an average speed of three leagues an hour. The use of the telegraph is confined to the business of the Government. The railroads which have been executed, up to the present time, are inconsiderable, and the railroads at this moment in execution are for very short distances, their whole united length not exceeding forty four leagues.

CALEDONIAN CANAL.

Copy of Mr. Walker's *Report to the Board of Treasury.*

Instructions.—In compliance with the instructions contained in your letter of the 28th December 1837, after the accident to the lock at Fort Augustus, I proceeded without delay to the Caledonian Canal early in January; and, after passing through the Crinan Canal in company with Mr. John Gibb, who had met me by desire of the Commissioners, I surveyed the line of the Caledonian Canal with Mr. Gibb and Mr. May, the resident engineer and superintendent of the canal. While upon the survey I wrote two letters to Mr Spearman, to inform him my opinion that no immediate danger of magnitude was to be dreaded from the state of the works at the west end of Loch Lochy, or from the accident at the Fort Augustus Locks, to repair which, in a temporary way, orders were given. These repairs have since been executed, so that the recess wall that gave way is now as secure as the other parts of the lock for the purposes of the present limited traffic. I also requested Mr. May to take such measurements and surveys, as might enable an estimate to be made of the works that appeared to me necessary for the repair or for the completion and improvement of the canal, and to make certain inquiries as to the extent and nature of trade by which the canal, if completed or improved, might be used, to enable me to report more fully to the Lords Commissioners of the Treasury on all the points of your letter.

Since my return from the north, I have been in constant communication with Mr May, who has notwithstanding the extreme severity of the weather, been most diligent and persevering in his surveys. On these being completed, we met in Edinburgh, and went into details of measurements and estimates. It is now my duty to report my opinion on the various points, with estimates, dividing the consideration, as directed by you, into two heads; viz.

"1st. The repair of the lock injured by the late accident, and such further works as may be necessary to avert inundation.

"2d. The improvement of the canal, by rebuilding what may be appeheaded to be defective in its original construction, altering the depth, procuring tow-vessels, and other measures not urgent, however important."

I shall adhere to this division as closely as I can, premising that the two subjects are so connected and so blended with each other, that it will be very difficult to draw the line between them.

On the 8th February I also received from Mr. Spearman instructions to report such information as I had in my recent survey collected on the subject of the navigation of the Crinan Canal; and, in conversations with that gentleman, I have been requested not to confine my report strictly to the points above stated, but to embrace any information respecting the Caledonian or Crinan Canal which I might be in possession of, and which I might think likely to be useful, when the general question of the canal should come to be considered by their Lordships.

The general history of the Caledonian Canal, with its objects, difficulties and defects, are very ably stated in Mr. May's report of 1st November 1837, addressed to Mr. Smith, secretary to the Commissioners, and in Mr. Smith's letter to the Chancellor of the Exchequer, dated 22d December 1837. These are most important and useful documents, the facts of which I found fully confirmed by my survey. The principal defects there referred to are, however, chiefly in the original scheme and construction of the canal, which have therefore, with the danger attending them, existed from the time of the canal being opened. I name this as a reason against any very sudden alarm; although I fully agree in the necessity for prompt measures of security, in which the canal is certainly defective, probably from the great excess of cost above the estimates, the consequent loss of time, and the difficulty of obtaining funds for the purpose previous to its being opened, all of which are fully stated in Mr. May's report.

SURVEY FIRST DIVISION.

West End Culverts.—Beginning from the west end, the first danger arises from the culverts made between the Bannavie Locks and Gairlochy, a reach of six miles, to carry the mountain floods under the canal into the river Lochy. The masonry of these is certainly very rough, but they are altogether in a better state than I expected from Mr. May's report, the leakage through the work being very small and partial, when, however, the serious effects of a failure in one of these culverts, which would empty the reach of water, is considered, their perfect security, as the locks at present are, is most important.

Gairlochy Lock.—At the head of the reach is Gairlochy Lock, which has the important office of keeping up the waters of Loch Lochy. This lake contains an area of 6,000 acres, the water of which was raised 12 feet above its natural level for the purpose of the canal; in its ordinary state it is 6 to 7 feet, and in times of great floods 10 to 12 feet, above the present level of the canal in the reach below. If at this time any of the culverts were to give way, so as to empty the reach, an addition of 16 feet would be added to the pressure upon the gates of Gairlochy Lock, making a vertical head of 26 to 28 feet, which would, to say the least, place them in danger, and if they should then give way, the contents of the lake, for a depth of 27 feet, would be discharged upon the valley of the Lochy, the general surface of which is much below the level of the canal. The destruction of the canal works, and of property, and perhaps life, would be very great, and therefore the importance of securing the culverts, particularly as the works of the Gairlochy Lock are by no means in the best state. But my decided opinion, in which Mr. May agrees, is, that the renewal ofthe culverts would be but a partial remedy, and that complete security cannot be obtained here but by another lock at the entrance of the lock to the eastward of the present lock. By this means also the trade of the canal, which, with one lock is liable to be entirely stopped by any accident that would prevent the working of any one of the gates, would be secured. As things now are, a ship or steam-vessel coming up to the lock with any way upon her, and striking the gates, might produce this stoppage of the canal for a considerable time, and incur danger, as the dependence must then be upon one pair of gates. Considering all circumstances, I think it fortunate that this has not happened ere this time. I was delayed some time in my passage through the Crinan Canal by a steam-boat having, in the course of the preceding day, run against and seriously damaged one of the gates: a similar accident to one of the Gairlochy gates might have very serious consequences. When at Gairlochy, I advised Mr. May, as a temporary precaution, to stretch a strong chain across the lock at each end; this has to be lowered to enable vessels to pass, but, when drawn up, stops the vessel before she gets to the gates. The estimate of this lock, with the dams and other works, is 15,950*l*. If executed, the culverts in the reach below may, with a little repair, be left in, as the failure of one of them would then be confined to the discharge of the water in the reach of six miles.

Waste Weir for Loch Oich.—A better provision for letting off the flood waters of Loch Oich is the second work required for preventing danger from inundation. In the flood of November 1834, the water rose 7 feet 3 inches above the 20 feet water-mark of the canal, or 15 inches above the gates of Aberchalder Lock at the east end of the lake. An extension of the length of the waste weir, and widening the passage for the waters under it, is all that will be required; and then the present weir can be raised, so as to prevent the waste of water through it in droughts. The expense of this will be 1,287*l*.

Fort Augustus Locks are next in order. The masonry of the five locks is in general very bad, but only the lower lock comes strictly under the present consideration. To repair it, a dam will be requisite against Loch Ness, the sill of the lower lock being 15 to 20 feet under the water of the lake, and then the opportunity should be taken to repair the second lock also. I calculate on taking down to the bottom and rebuilding the recess walls, renewing the segments and other works, which will amount to 7,590*l*.

I think the above are all that come under the head of preventing damage or inundation, without reference to the mere stoppage of the canal, which would be the consequence of a failure at any of the Fort Augustus Locks, and from which, owing to the defective masonry having strained and injured the gates none of them are by any means secure.

The collected amount of the first division is 24,827*l*.

In the above, and in all that follows, I have calculated upon the available and standard depth of water being only 17 feet, which is less by 3 feet than the original design. To obtain 20 feet would be a work of enormous magnitude, difficulties and expense, and would much increase danger, without by any means a compensating advantage. A laden vessel of 38 feet beam (the available width of the locks) does not draw more than 18 feet, and 17 feet is sufficient depth for a ship of 400 to 500 tons,* and few, if any ships in the Baltic or American trade exceed this size.

SECOND DIVISION.

Finishing Canal and remedying Defects.—With the expenditure of 24,827*l*., for averting inundation, and for the repair of Fort Augustus Lock, the canal will still be left in a very unfinished state, liable to stoppages, inconvenient for business, portions very leaky, and many of its works much out of repair. All these, however, come more properly under the second head, of "finishing the canal, and remedying what is defective in the original construction," which come now to be considered. These, though not urgent as respects security to the country, are most of them essential if the canal is to be kept open, and to prevent still greater expense, which will be the effect if the repairs be delayed. With the present disadvantages, imperfections and want of convenience, it is rather to be wondered that there should have been even the trade there has been; and the fact of there having been even a small trade, certainly goes to prove what there would be if the canal were finished, and convenience given.

In explaining the particulars of the works required, it is so very difficult to separate repairing and finishing from improvements, that the better way may be to state the articles in detail, as I have taken them, with the estimate of each: this will also afford information as to what is the nature and extent of the repairs, and what appear to me to be required in the way of improvements, to render the Caledonian Canal complete and convenient for as great a trade as can be carried on upon it.

The repairs, improvements and machinery as detailed,† amount to 104,490*l*, and with this expenditure I consider that the canal will be complete and proper for work as originally proposed, and combining additional safety, but with the difference of 17 feet in lieu of 20 feet depth.

Steam Tugs.—As yet I have included nothing for steam-tugs, which, although no part of the original plan, appear to me quite indispensable for the proper working of the canal, as respects either the accommodation to trade, or the probable chance of a return for the great expense incurred in its construction.

PRESENT DIFFICULTIES.

Lakes.—One of the temptations to make a canal at all, and particularly of this great size, from Loch Eil to the Beauly Frith, was the apparent facility afforded by the three lakes, which lie in almost a continuous line, and are for the most part of ample width and depth; viz., Loch Lochy, 10 miles; Loch Oich, 4 miles; and Loch Ness, 23½ miles; together 37½ miles; thus leaving of the whole length of 60½ miles only 23 miles of canal to make. That the cost of making the canal has been much reduced, probably more than half, by the lakes, cannot be doubted; but it is equally apparent, as fully stated in Messrs. May and Smith's reports, that they are now great hindrances to the passage of vessels. From lying in the trough or hollow between two ranges of mountains, the wind blows always parallel to the line of the canal, so as necessarily to be a foul wind in one direction. From the rocky nature of the banks, and their crooked irregular shape, tracking through the lakes is impossible. The width of Loch Lochy and Loch Ness is sufficient for vessels of about 100 tons to work when once fairly in the lakes, but there is a great difficulty in warping against a strong head wind to reach this, and great danger also from the rocky shores in case of a vessel missing stays. Therefore, working or tacking through the lakes is seldom attempted, and the consequence is, that the passage of 60 miles, which, were tracking practicable for the whole length, might be accomplished generally in three to four days, often takes as many weeks; even a month is not unusual, and cases of five weeks have been known. The evil is increased by the westerly winds which prevail for eight or nine months of the year, and are opposed to the direction of what ought to be the greatest trade on the canal. To prevent passage of vessels proceeding from the east to the west end, which the is delay, sometimes three or four months, of going through the Pentland Frith and round Cape Wrath during the westerly winds, was one of the principal objects of the canal, which is thus in a great measure defeated. When I was upon my survey, several vessels were waiting for a change of wind at the east end of Loch Oich, and another number at the east end of Loch Ness, none of them above 135 tons burthen. A very few hours of a steam-tug would have set the whole at liberty. The approaches to the canal from the estuaries at each end are subject to the same inconvenience.

The want of Depth in the canal and portions of the locks is another great

* The late alteration in the measuring for register has tended to reduce the depth of British ships built since the passing of the Register Act.

† The report contains a detailed estimate, which we have here omitted, in consequence of the great length of the report, but we will endeavour to give it in the next Journal.—EDITOR.

drawback upon the use of the canal. This arises partly from the excavation of the canal never having been completed, partly from the weirs at the ends of the locks not being sufficient to support the depth of water, and partly from the great leakage in parts of the canal. Mr. May states that 11 feet in the navigable parts of Loch Oich, and 12 feet in portions of the canal connected with Loch Ness and Loch Lochy, is the depth after a continued drought. Last winter was an extreme case, and as the canal was shut up by the ice, there was no practical evil from the above cause. The water in Loch Oich on that occasion sunk to 5 feet, and Loch Ness to 11 feet, which evidently shows the want of a weir to support the water. I have already named that the reach above Muirtown Locks requires the discharge of 10 sluices, which is 24,000 cubic feet per minute, to supply the leakage of the banks: so great a leakage is perhaps unknown in any other canal navigation; it forms no mean river of itself as it flows by the side of the river Ness, claiming an equality even in ordinary times, and in short water time the leakage much exceeds the river. The sinking of Loch Ness lessens the supply for this leakage, and the canal sinks in consequence. This diminution of depth is objectionable, also by bringing the ships in contact with the rough banks, and injuring the sides, particularly of large vessels, if coppered.

Notwithstanding all these disadvantages, Mr. May states that the delay in going round the northern coast is sometimes such, that there have been cases of vessels having come south and gone through the canal after trying for weeks in vain to make the roundabout passage. This, however, and that there is any trade in the canal, is proof, not of the canal being good or convenient, which certainly it is not, but that the other passages, the shortest of which is 200 miles longer than the canal, are from their length, and the dangerous navigation, most desirable to be avoided; and the fair inference from this alone is, that if the canal were in a good working state, a much greater proportion of the trade between the two sides of the island and Ireland would use it.

Trade upon Canal.—The average of tonnage passing through the canal, exclusive of steam-boats and local traffic, has been about 25,000 tons per annum, without much increase or diminution, during the last ten years: its increase has been checked by various unseasonable interruptions during that period, caused by the imperfect and unfinished condition of the works, similar to what recently occurred at Fort Augustus.

From the accounts collected by Mr. May of the trade of several ports it would appear that the present traffic on the canal is not probably 2½ per cent. of the whole trade going through the Pentland Frith; and, from what has been seen, the canal is not capable, in its present state, of receiving vessels of any considerable tonnage, which, indeed, never attempt it. During the last seven years, only one vessel of 240 tons has made the passage.

Revenue.—The gross receipts of the canal have not exceeded £2,500 since the rates were reduced from a halfpenny to a farthing per ton per mile; the expense of repairs, working, and superintendence, have exceeded £3,000, an amount which is considerable for the trade done; but it is to be observed, that the expense is increased by the bad repair and unfinished state of the works, that the canal works are made for a trade of much larger vessels, and that the expense of them is almost the same as if such vessels, to ten times the present number, were to pass. If the works were finished and put into good repair the expense would undoubtedly be lessened.

If, therefore, the canal is to be kept open at all, I think there is no doubt as to the propriety and policy of doing the repairs and finishing, which it has been seen amount to £129,317, great as this sum is; and I have as little doubt that the effect would be very much to increase the trade, probably beyond what at present there is an idea of.

Steam Tugs.—After all the finishing and repairs are done, still the heavy disadvantage of the lakes will remain, and vessels must wait, as now, for a perfect calm or a fair wind. Indeed, the larger the vessel, the more this objection operates, and the only complete remedy for it, as respects either the accommodation to trade, or the probability of a return for the great expense incurred in the construction of the Canal, is the using of steam-tugs; so much so, that did we not know of the Canal having been projected, and even begun, before steam navigation was introduced, it would be difficult to suppose that steam tracking was not in contemplation, so defective and imperfect is the Canal without it, owing to the lakes, which are, on the contrary, great advantages with it. To make the establishment proper, I think three steam-vessels should be calculated on for the Canal, viz., one for Loch Lochy of 40 horses power, for Loch Oich of 40 horses power, and one for Loch Ness of 50 horses power. Two of these might be sufficient, but not so well as three; and in case of one of them being out of repair, the third would be useful to take its place. The expense of these, with coal-sheds upon the Canal, may be taken at 7,200*l.*; the expense of supporting and working them, supposing they are kept pretty fully at work, Mr. May estimates (from the experience of which he has furnished me with the details) at 1,000*l.* each per annum, which would be a very large addition to the ordinary current expenditure. To do full justice to the navigation, and add to the certainty of despatch, there ought also to be a steamer in the Murray Frith, to bring vessels from Fort George to the eastern entrance, and from Corran Ferry, or even the Sound of Mull, to the western entrance. This would require an additional capital of 6,000*l.*, and incur an addition of 2,000*l.* to the annual outlay, but the accommodation would be most complete.

Gross Amount.—The amount for steam tug-boats, with 10 per cent. for contingencies, added to the repairs and improvements before stated, make a gross amount of 143,837*l.*, or in round numbers 150,000*l.*, for putting the Canal in complete repair, making it proper for all vessels of 38 feet beam and 17 feet draught, providing machinery and utensils, and also a complete establishment of steam-tugs. Probably a less number of steam-tugs might do for a trial, and would be extremely useful; but I have thought better, in this as in the other items, to take what I consider a full amount. With these improvements and additions, the passage from Fort George to the Sound of Mull might generally be depended on to be made within four days, and certainly, even in foul weather, within a week.

Discontinuing Canal Passage.—And now the question presents itself, what, under present circumstances, is best to be done? Ought the navigation of the Canal to be discontinued? If so, this might be done either by keeping up the works, or destroying them. The former would require nearly the same establishment for preservation, and watching for the security of the country, as with the trade; part of the repair I have calculated on must be done, and an annual repair afterwards would be indispensable, all without any income. The other plan, viz., the permanently stopping up or destroying of the works, would require dams and outlets to be made, permanent bridges to be built, the locks filled up or fenced, other works done, and compensations to be made, which it is extremely difficult to calculate, and which, as Mr. May states, might equal in amount the expense of a proper repair, to say nothing of the public inconvenience and the breach of faith which such a proceeding might involve. Might, then, the works necessary to prevent inundation and the minor repairs be done, but the Canal left in its present unfinished and imperfect state, with its present inconveniences? This would, in fact, be continuing the system which has existed since the Canal was opened, but which could not be continued much longer; and, as the works are yearly becoming worse, some general repair must at once be done. The want of funds having probably obliged the Commissioners to expend as little as possible, the defects have been allowed to increase, and, in the course of a short time, it would be found that to have faced the repairs and done them properly would have been a cheaper plan. Certainly there would be no absolute necessity as respects security for adding to the present depth, or for other improvements; but on referring to the detail I have given, I find that only about half of the whole sum (exclusive of the steam-tugs) can be placed to the head of improvements; and I am opinion that, as respects the convenience of trade, or even strictly as a question of expenditure and revenue, the finishings are worth doing along with the repairs; and both, be it observed, can be done cheaper at one time, when the water is out of parts of the Canal than piecemeal. Here I take the opportunity to state that, to do the work effectually, or near the estimate, a season would be necessary for preparation, making plans, entering into contracts, and getting castings and materials to the ground through the Canal, so as to bring the necessary period of interruption to the navigation within the shortest practicable limits.

SUCCESS OF CANAL.

General Opinion.—The original objects for making the Canal are well known. Some of them, as giving employment to the Highlanders and preventing their emigration, it has effected partially. In improving the value of estates through which it passed, and that district of the country generally, it has, with the excellent roads and inns, proved highly beneficial, particularly since the introduction of steam-packets, which ply regularly twice a week to and from Inverness and Glasgow, through the Canal. As a facility for trade, in preventing the long passage through the Pentland Frith and round Cape Wrath, it has hitherto been a failure. This is not, however, if steam is included in the consideration, to be ascribed to the design, which has never yet had a fair chance, the works being incomplete and imperfect in the way I have stated. If the Canal were completed, even to 17 feet water, and steam-tugs stationed upon it, my decided opinion, from all I have seen and have been able to collect, is, that the Caledonian Canal will prove a most useful and important public work, for the general coasting trade of the Kingdom, and for the trade between the Baltic and the west coast, including the Clyde, Liverpool, Ireland, and for vessels bound to America from the eastern ports of the Kingdom. When it is considered that, in the one case, there may be almost a certainty of the vessel making her passage without danger, and with but little wear or tear, from the Murray Frith to the Sound of Mull, within a week in any state of the weather, unless when the Canal is frozen, in place of the dangerous passage of 300 miles by the Pentland Frith, which varies in time from a week to three or four months, with an insurance which, if the cargo be of much value, would alone do much more than pay the Canal rates, and with the expense of lights, there can, I think, be little doubt of the fact being as I have stated. Taking the present rate of one farthing per ton per mile the Canal charge upon a vessel of 200 tons is about 13*l.*, which is from two to three days of the wages, provisions, wear and tear, &c., of a vessel of that size; and if the average difference of time between going round the north coast and through the Canal be taken at ten days, as was stated in evidence, and is probably nearly correct, wages and wear would amount to three times the Canal rates, independently of the risk, the detention of the cargo, uncertainty, &c. In some cases, as in sowing-linseed from the Baltic for Ireland, &c., the detention is so great, that the sowing season is entirely lost. I am informed that the losses to the merchant, as well as to the Irish farmer, through want of good seed from this cause, are considerable.

On the subject of insurance I subjoin a letter from Mr. Alderman Pirie, of London; by this, it appears that the difference of insurance between the Canal and the Pentland Frith may be taken at 20s. per cent. on an average. This, upon a ship of 200 tons burthen, the value of which and cargo (which in Mr. Pirie's opinion may be taken at 6,500*l.*) makes the saving of insurance alone on such a ship and cargo 65*l.*

A letter from Messrs. James Miller and Son, Leith, to Mr. May, on the same subject, is also annexed; by this, the return of premium on going through the Canal is stated at about half the above only.

The lights form another item of difference, but less considerable. A ship passing through the Pentland Frith has to pay the following lights; viz., Pentland Skerries, Dunnet Head, Cape Wrath, Island Glass, Burra Head, and Skerryvore; each one halfpenny per ton, if British, or 1d. per ton if foreign. By passing through the Canal there will be only two lights to pay, viz. Tarbet Ness and Lismore; being a saving of 2d. per ton, if British, and 4d. Taton, if foreign.

In case of war, and the English Channel being infested by steam privateers, the canal will afford a passage of comparative safety for the trade between the West Indies or America, and the east coast of Great Britain.

I have not said that the Caledonian Canal is, as a money account, ever to be a profitable concern, but that it will be a useful public work; that being made, there appears to me no alternative but to finish it; and (this granted) but to finish it properly will be, even as a money account, the proper course to adopt. The time, however, may come, and may not be very distant, when, even as a money speculation, it will appear in a very different light from the present; this partly from the increase in the quantity of tonnage, and partly from the rate. The act allows 2d. per ton per mile, the present charge is a farthing; to raise it without affording increased facilities, would reduce the trade, but with better accommodation; the facts I have stated would justify an addition to the rate.

The Forth and Clyde Canal is a parallel canal, and in some degree a parallel case, although comparatively small, the locks being only 20 feet wide, with a depth of eight feet; it is therefore suited only for small craft under 100 tons. This canal was opened in 1777, and was at work for 30 years before it paid any interest. The tolls are charged not upon the tonnage of the vessels, but at various rates upon goods. On referring to the table of tolls, I find that by far the greatest number of articles is charged 2d. per ton per mile, which is the highest rate allowed by the Caledonian Canal Act, or eight times the present rate charged upon the latter. The trade and profits of the Forth and Clyde Canal are now such that the shares which were originally £100, exclusive of accumulated interest, are now £600 in the market. The accumulated interest upon the original share of £100, taken, I suppose, at compound interest, amounts to four times the original sum, but still shews the canal to be a profitable investment.

Mr. May has, at my request, prepared a table of the tonnage to and from the eastern ports, to show the extent of trade, a portion of which he considers would be likely to use the canal; it is so great, that a small portion of it would make the concern not only useful, but profitable. I dislike the appearing to calculate profits, which is not my department, and ought always to be received with caution, as a basis for any calculation. I would only remark, that, at a halfpenny per ton, the rates upon 100 tons would amount to £12 10s.; and that 400 tons passing daily would produce a gross income of £18,000 per annum, without any material increase of the present outgoings, but rather the contrary, if the works be put in repair.

The limit to the number of vessels passing is caused by the eight continuous locks at Bannavie, near the west end of the canal, through the whole of which, owing to their being no chamber or passing-place, a vessel must pass up or down before another can enter in the opposite direction. This is a great delay and evil; its effects might partly be remedied by dividing the trade, the ascending vessels one part of the day, the descending vessels the other part. A more effectual, but more expensive remedy, as respects money and water, would be making a siding or passing-place in the middle of the chain of locks. As, however, with its present imperfections, the locks can pass more than four times the trade I have named, 400 tons per day, I have not included in the estimate any thing for an alteration in these locks.

Mr. Gladstone, whose long and extensive mercantile concerns and general knowledge are well known, having applied to Mr. May to know if his vessel of 250 tons, bound for Liverpool, could be passed through the canal, was referred to me by Mr. May. After a conference at his desire, I requested Mr. Gladstone to favour me with his opinion, which be has kindly done. His letter has given me no reason to change the favourable opinion I certainly have of what this canal is likely to be at a future period. It has never yet had a chance, and I consider that all its bearings and prospects are completely altered by the introduction of steam; so that the evidence given previous to its formation, and much less its working, since it was opened, has but little to do with the present prospect.

[The report concludes with some remarks on the state of the Crinan Canal which we shall give in the next Journal.—EDITOR.]

BLASTING BY THE AID OF GALVANISM.

INTERESTING EXPERIMENTS ON BLASTING AT CRAIGLEITH QUARRY.

(From the Edinburgh Advertiser.)

On Tuesday, 26th of March last, a large party of gentlemen assembled in Craigleith Quarry, to witness some experiments on blasting by means of galvanism, which were made at the request of the Directors of the Highland and Agricultural Society of Scotland by Martyn Roberts, Esq.

It has long been known that the ignition of gunpowder can be very effectually produced by the application of the electric fluid; but Mr. Roberts has succeeded in producing an apparatus for this purpose, which is simple in its structure, very portable, and which, above all, is easily managed. He has also, in the application of this apparatus to blasting rocks, introduced various modifications of its arrangements, and effected great improvements in the mode of charging.

The apparatus consists of a small trough, about a foot in length, and four inches square on the end, and a battery containing ten pairs of plates. Along the battery runs a bar upon which a tin disc slides freely. This disc, when drawn to the end of the bar, touches another disc, and thus completes the connexion between the opposite poles of the battery. To prevent accidents, the sliding disc is kept in the middle of the bar by means of a spring of coiled wire; and it is impossible to put the battery in action although sunk in the trough without shifting the plate along the bar to the opposite end of the trough. The copper wires which convey the electric fluid to the gunpowder are kept separate during their whole course by a sheath of cotton thread, which is wrapped closely round them in the same manner as in the strings of a guitar, or as in the wire which stiffens the rim of a lady's bonnet. At their termination these wires are bent outwards, and their extremities are connected by means of a fine steel wire half an inch long, so as to form a small triangle, like the Greek capital *delta*. This triangular end is inserted into a small tin cartridge, and ignition of the powder contained in the cartridge is produced by the deflagration of the steel wire which connects the ends of the two copper wires. So rapid is the progress of the electric fluid, that it is impossible to measure the interval of time which elapses between the action at the trough and the explosion of the cartridge. The cost of this apparatus is only about fifteen shillings; and the price of the materials required for the solution is such, that a shilling will cover the expense of keeping the trough in a working state for months. The copper wire which, if properly shielded, may last for years, costs about one farthing for each yard. In applying this apparatus to blasting, Mr. Roberts makes the following arrangements:—In regard to the mode of charging, which is perhaps the most important peculiarity of his method, he leaves a space of about one foot, containing atmospheric air, above and below the gunpowder; and thus obtains, over and above the effect of the gunpowder, all the power which the sudden increase of its volume produces; and thus the same effect is obtained from a smaller charge. He also inserts the tin cartridge into the heart of the charge of powder, and as the cartridge explodes at both ends, the gunpowder is much more instantaneously ignited. Lastly, in tamping, no vent-hole is left, as in the common system, by the withdrawing of the needle; but the tamping is pressed closely round the wire which conveys the electric fluid from the trough to the cartridge. When the tamping is completed, the battery is plunged into the trough, which is at the distance of 40 feet from the bore-hole, and may of course be removed as far as may seem desirable, by giving a small increase to the power of the battery if required, which is easily effected by adding a pair of plates. The spring of coiled wire still keeping the tin disc in the middle of the bar, there is no risk of an unexpected explosion, a danger which occasionally happens by the too rapid ignition of a train or fuze in the common method of blasting. Every one having retired, a person stationed at any safe distance, pulls a string, which makes the tin disc pass along the bar, and the instant the connection of the opposite poles of the battery is established, the explosion takes place. We shall briefly detail the chief advantage of this new system of blasting, which we conceive to be as follows:—

1. Freedom from the dangers which always attend blasting is obtained from various causes. In the common system, the fuse or train must be fixed at or very near the bore-hole, long trains being expensive and uncertain in their action; and accidents, from the too rapid burning of the fuze, are unfortunately very common. But in Mr. Roberts' system, the person who pulls the string which puts the battery in action, may be stationed at any convenient distance. In the present system, perhaps the most common source of accident is the withdrawing of the needle; and this is completely avoided in Mr. Roberts' plan. Lastly, there is less chance of failure, and when failure does occur, the bore-hole may be at once, approached without risk of accident, as the moment the string is slackened, the action of the battery ceases.

2. The next advantage is, the great facility which this mode gives for blasting under water. This is one of the most inconvenient, expensive, and uncertain of all engineering operations. It involves much trouble and expense in laying hoses for the train or fuse, which are destroyed every time; and after all, there are, perhaps, three failures out of ten trials. All this is avoided by Mr. Roberts' system, which is as efficient under water as above it, and involves not one farthing of loss under water more than on land.

3. The great advantage of a much more rapid ignition of the gunpowder, which incloses the cartridge on all sides, and receives the action of the flame over the greater part of its surface at the same instant, gives the new system a great superiority. This is a most important element in the effect of the charge, as its full force is thus secured. In the present method, on the other hand, the powder is fired from the top, and when hard rammed frequently burns away in a series of smaller explosions, producing successive shocks, separated, it is true, by imperceptible intervals of time, but yet producing an effect greatly less powerful than they could have done if concentrated in one shock, so as to act simultaneously.

4. There is absolutely no vent-hole in the mode of tamping pursued by Mr. Roberts, which mode cannot be applied to the present system of blasting. This is an important gain, the vent-hole being a decided loss of power, which is well known to gunners, and to counteract which, the Turks are in the habit of covering the touch-hole of their guns with a bag of sand the moment the priming is fired.

5. The advantage of enclosing a column of atmospheric air, as practised by Mr. Roberts, is obvious, for the force exerted during its expansion is added to that of the gunpowder itself. What that expansion may be it is difficult to tell, as we have no good means of ascertaining the increase of temperature which accompanies the explosion of gunpowder: but as the volume of atmospheric air is doubled for every increase of temperature of 480 deg. of Fahrenheit, the force produced by the expansion of the inclosed column of atmospheric air must form an important addition to the effect of the gunpowder.

6. It follows necessarily from what has been said above, that the combined effects of the instantaneous ignition of the gunpowder, the absence of all vent-holes, and the expansion of the enclosed column of atmospheric air must cause a much greater effect than the explosion of the powder alone in the common system can produce, and consequently that a great economy in the article of gunpowder must result. This is a far more important item in the expense of quarrying and rock excavation than is generally imagined by those who are unacquainted with such works. In the excavation for the Philadelphia Water Works, for example, nearly 3000*l*. were expended in gunpowder, and at the rock-cutting for the new approach to Edinburgh, by the Calton Hill, 1000*l*. was spent in this item alone. In granite quarries the powder for a single shot often costs 3*l*. If the method of Mr. Roberts produces a saving of about two-thirds of the quantity of gunpowder required for blasting, as would appear from the experiments which were made on Tuesday, some idea may be formed of the great economy which would follow on the adoption of the new system.

7. The system of Mr. Roberts makes the simultaneous firing of several blasts easily practised: and in many situations where the removal of the men to a place of safety is difficult, this is an important advantage.

The following details of the experiments made on Tuesday, by Mr. Roberts, are chiefly taken from the notes made by Mr. Inverarity, of the Madras Engineers.

No. 1. Bore of the hole, 2½ inches; depth, 3 feet; powder used, 2 lbs.; column of air left in the bore, only 3 inches in height; line of least resistance, 18 inches; the effect was good; the rock was much splintered, and some fragments were thrown into the air.

No. 2. Bore of hole, 2¾ inches; depth of hole, 8 feet; half the usual charge of powder used; column of air left, 2 feet in height; effect enormous; immense mass moved; few fragments thrown into the air; deep rents all round, and large masses loosened.

No. 3. Bore of hole, 2¾ inches; depth 6 feet; two-thirds of the usual charge of powder: column of air left 18 inches in height; few fragments thrown into the air; but large masses loosened.

No. 4. Dimensions of hole, same as the last; charge of powder less than one-half the usual quantity; column of air left, 2 feet in height; effect very good indeed; much rock loosened; no fragments thrown into the air.

No. 5. Bore of hole, 2¾ inches; charge of powder, two-thirds of the common charge; column of air left, two feet in height; effect excellent; about 300 tons of rock supposed to be torn away; much rock loosened, and deep rents observable; no fragments thrown up.

Nos. 6 and 7. No account of bore-hole taken; powder, one quarter of the usual charge; effect of both was good.

No. 8. Experiment under water. In this experiment, 5 lbs. of powder were put into a bladder and sunk to the depth of ten feet under the surface of the water, in a deserted quarry, west of Craigleith. The string was drawn, and the effect was instantaneous; a dull red globe of light, caused by the explosion of the powder under water, was observed, and immediately there followed a considerable shock which was sensibly felt on the margin of the pool, at the distance of about 100 yards from the explosion; a mass of water, about 10 feet in diameter and 2 feet in height, shaped like a flat dome, rose above the surface of the pool, and immediately after it disappeared, the mud and burned powder boiled up from below like a cauldron.

The Directors of the Highland Society in attendance, and all present were highly pleased with the complete success of the experiments.

EXPERIMENTAL SUBTERRANEOUS AND SUBAQUEOUS EXPLOSIONS AT CHATHAM BY THE VOLTAIC BATTERY,

From the Times of April 9, 1839.

For several months past the Royal Engineers at Chatham, under Colonel Pasley, have been trying experiments in firing gunpowder by the voltaic battery, chiefly under water; and, after many vicissitudes of partial success and of failure, they have at last succeeded in bringing this process to as much perfection as it seems capable of—that is, to as much certainty as the former methods of firing mines in dry soil. They have repeatedly fired gunpowder at the distance of 500 feet, with their conducting wires either buried under ground or led entirely under the water, excepting a few feet connected with the battery, which in their subaqueous explosions was in a boat on the Medway, the powder being lodged at the bottom of that river. In their subterraneous explosion they blew up a field-work, and in one of their subaqueous experiments they blew to pieces a vessel representing a wreck, the fragments of which being of fir timber came up to the surface of the Medway immediately after the column of water thrown up by the explosion. On Saturday last they applied their voltaic battery to the blasting of rock under water. Two very large and heavy pieces of hard sandstone were each prepared with a hole three inches in diameter by a borer, after which a charge of three-quarters of a pound of powder was put into each, and the upper part of the hole was tamped by pouring in small fragments of broken stone round a cone fixed over each charge, in a new and ingenious manner, first suggested by Mr. Howe, clerk of the works of the Royal Engineer Establishment, more than five years ago, which does not seem inferior in resistance to the common mode of tamping, but is much safer and far more expeditious. The conducting wires were led from each charge to the battery, which was placed on the gun-wharf, whilst the stones thus prepared and loaded were lowered down from a crane to the bottom of the river opposite, where the water was fourteen feet deep at the time. The first stone, being of a compact form, was blown to pieces, and the rope sling by which it had been lowered, and which had not been removed, was broken. The second stone, being of a more irregular shape, and much thinner, so that there was not sufficient resistance above and below the charge, was brought up by the crane after the explosion, which had only blown out the solid part of the stone below the bottom of the hole, apparently without injuring any other part of it. Another charge was therefore placed in the same hole, which was tamped both above and below in the mode before described, and the stone was then again let down to the bottom of the river, and after firing this second charge, on being hauled up by the crane it was found to have been broken into three parts, one of which did not reach the surface, whilst the other two, being still held together by the slings, after being raised nearly to the level of the wharf, separated from each other, and fell to the bottom. One of these charges was contained in a tin cylinder fitted to the size of the hole, the two others in canvass bags of the same form covered with waterproof composition. These last experiments, which like several of the former, were witnessed by a great number of spectators, chiefly military, have proved that the voltaic battery may succeed for blasting rock under water, as well as for blowing wrecks to pieces, and in the former supposition the holes in the rock would be formed and the charges placed by means of the diving-bell.

The results of this course of experiments may be of great importance, especially for defensive military mines, because the voltaic battery affords the only possible means of firing several such mines, not only instantaneously but simultaneously, and at the very moment when an enemy's column advancing to the assault is over the spot where these mines have been prepared; whereas by the common mode of firing military mines, by a piece of portfire or slow match connected to a powder hose, there can be no certainty of their taking effect at the precise moment required, so that the enemy's troops might either have passed over, or not yet reached the spot, at the period of explosion: and the simultaneous explosions of conjunct mines by this method is out of the question, for no two pieces of portfire or powder hoses, though cut to the same length, were ever known to burn exactly alike. For subaqueous explosions the superiority of the voltaic battery is still more striking—so much so, that Colonel Pasley has repeatedly declared, that if he had been possessed of the same voltaic apparatus, and had known how to use it last year in his operations in the Thames, it would have saved a great deal of trouble and expense.

Nothing can appear easier than to fire gunpowder under water by the voltaic battery, as exhibited in a lecture-room or scientific institution, but the mode usually adopted on such occasions, of passing the conducting wires into the charge through a cork coated with sealing-wax, and of insulating the remaining length of each wire by enclosing it in small India-rubber tubes, is inadequate and inexpedient, for practical purposes in a rapid tideway and in deep water. In Colonel Pasley's experiments at Chatham, corks and sealing-wax were rejected, the former as being too weak, the latter from being liable to crack, and India-rubber or caoutchouc was also rejected, as being far too expensive; instead of which a composition of pitch, softened by beeswax or tallow, was adopted, the remarkable efficiency of which was proved by keeping one of those experimental charges ten days under water before it was fired, when the powder was still perfectly dry. Each pair of conducting wires used in these experiments was always attached to a rope or line, previously saturated with boiling tar, to prevent it from tearing asunder the soldered joints of the wires, by its alternate contraction and expansion when wet and dry, an effect which on one occasion actually took place before the rope was so saturated. The two wires and rope were bound together by tape and served round with hemp yarn, and in this state they had the appearance of a single rope capable of being coiled and veered out conveniently. One of the most important points necessary was to prevent all strain acting upon the conducting wires from without, and thereby breaking the very small delicate platinum wire within the charge, which, by interrupting the circuit, would render explosion impossible. To guard against this cause of failure in the shocks to which the conducting wires may be exposed in a rapid tideway appeared at first a very difficult task.

The voltaic battery used was of Professor Daniell's improved construction, which, from retaining its energy much longer than any former voltaic battery, he has named the constant voltaic battery, and which Colonel Pasley found to be much superior to the best of the former constructions, at least for the peculiar purpose of firing gunpowder, either under ground or under water. Sergeant-Major Jones, and the non-commissioned officers and privates who have been employed in these experiments, are now as expert in the use of this battery as can be desired, and, being artificers, they are able to make as well as to use such batteries.

Having described these recent interesting experiments of the engineers at Chatham, we may add a brief historical notice of what has been done before. No doubt small charges of gunpowder must have been fired by the voltaic battery, as a matter of experiment and of curiosity, almost as soon as the first rude battery of that description was invented, but the merit of having first applied it to practical purposes is due to Dr. Hare, of Philadelphia, whose proceedings were published some years ago in Silliman's *American Journal of Science* (vol. XXI. page 139), and more recently in a paper communicated to the British Association in 1836, and published in vol. v., in the transactions for the sections of that year, page 45. Dr. Hare states that he used it in blasting rock for the purposes of building, and that he has even fired twelve blasts simultaneously at the distance of 150 feet, by a powerful voltaic battery of a very ingenious and peculiar construction, which he calls a *calorimotor*. He says that the same process might be applied for blasting under water, but he does not mention that he had ever done so himself. Colonel Pasley, after comparing Dr. Hare's mode of firing charges simultaneously, with other modes which he also tried, considers the Doctor's method of soldering the wires together in two parcels, one to be led to one pole, and the other to the other pole, of the voltaic battery, to be the best, and not likely to be improved upon; but he has not adopted any of the Doctor's other arrangements, as they are not applicable to subaqueous explosions under difficult circumstances, and he neither uses the large nor the small iron wires, nor the fulminating powder recommended by Dr. Hare. His own experiments for firing several charges simultaneously have as yet only succeeded at very short distances, because he had not a sufficient quantity of thick copper wire in his possession; and therefore was obliged to employ common bell-wires, only 1-16th of an inch in diameter, which are comparatively useless, the best conducting wires being those of 1-5th of an inch in diameter, which should always be used for great explosions, and none less than 1-8th of an inch even for small explosions or for blasting. The officers who witnessed the various experiments at Chatham are therefore of opinion that it would be absolutely impracticable to fire gunpowder under water at the distance of 300 or 400 yards by six of Professor Daniell's cells, with conducting wires only about as thick as a common bell wire, as was asserted in a paper on the subject of blasting rocks by galvanism, published in a scientific journal for the month of May, 1838; instead of which, they think that to produce ignition by such wires at the last-named distance would require the operator to go to the enormous expense of providing himself with a most unwieldy battery of far greater power than has ever yet been used within the memory of man; for in their own experiments they never succeeded in firing a subaqueous charge, even at the distance of 100 feet, by fewer than eight cells, with common bell-wires: whereas, in using the large wires, the same number of cells was found capable of producing ignition at five times that distance.

We shall conclude by mentioning with due applause the extraordinary success of Mr. William Snow Harris, of Devonport, who did wonders in firing gunpowder by wires led through water at a great distance by the common electrical machine in 1823. But for a detailed account of the interesting experiments of this justly celebrated electrician, which astonished a number of distinguished naval officers and other spectators at Devonport, at the period alluded to, we must refer to the *British Press* newspaper of the 17th of March of that year. Notwithstanding this brilliant success, the voltaic battery must be considered preferable to the electrical machine, because the latter requires a much longer apprenticeship to use it properly; and one cannot expect such skilful manipulation as Mr. Harris has displayed either from military or from civil miners; besides which, that gentleman worked from a warm dry cabin, which is indispensable to the success of the electrical machine; whereas in the experiments of the engineers at Chatham the charges were always fired from Daniell's voltaic battery in the open air, often when exposed to heavy rains, and on one occasion during a very violent snow storm.

EARLY GREEK SCULPTURE.

AT THE BRITISH MUSEUM.

(*From the Times.*)

The casts from the Ægina marbles, of which some time since we gave a full description, have within these few days been placed on the pediment which has been erected for them; it is in that part of the gallery of antiquities called the Phigalian room, and is an exact representation of that portion of the temple of Jupiter Panhellenius, in the island of Ægina, in the ruins of which the statues were discovered. The composition is of brick stuccoed. Although a great improvement on the former shelf, as being deeper and bolder in the relief, and also as having the ornamented figures placed on the apex, yet it is much to be regretted that the situation has not been more happily chosen—first, because it is not erected at a sufficient height from the pavement to give the full effect to the statues, and also, as the width of the apartment does not afford sufficient space for the angles to be carried out, they are necessarily cut off, which gives the whole an unfinished and uncouth appearance. Neither, from the locality, can the spectator take that distant view which is required to bring out the beauty of the whole. Both in the Vatican and in the gallery of Florence a great effect is given to the master-pieces of antiquity by assimilating the edifices in which they are contained with the works exhibited, and avoiding as much as possible the warehouse look which a number of statues of all sorts, sizes, conditions, qualities, placed in juxtaposition must always, in a certain degree, give to the building, which reduces the effect on the beholder, as it prevents the merits and beauties of the sculptures being observed, creates confusion in his mind, who, if he afterwards sees a cast of any single one, is surprised that he has overlooked or forgotten it. The statue of the Apollo in the Vatican, and the Venus de Medicis in the Ducal gallery at Florence, would lose half their grandeur were they republicanised amidst the heterogenous denizens of the spacious halls of the British Museum. The truth of this may easily be proved: let any one observe the superb statue of the Venus found in the baths of Claudius at Ostia through the entrance of the terra-cotta room, and he cannot fail to be struck with its beauty; but he will find on entering that other sculptures placed around, of different character and dimensions, materially reduce the effect. We are well aware that it would not be possible so to arrange that every sculpture of consequence should possess its distinct apartment; but here the contrary practice has been carried to excess. It is strange that as one of the principal defects of the National Gallery consists in the diminutive proportions of its rooms, so that paintings which require both light and space to be viewed with advantage are deprived of both, that in the statue galleries of the British Museum nothing but spacious halls are to be found, and that there is not one chamber so constructed as to bear resemblance in its proportions and its "dim religious light," its "solitude of silence," to those sanctuaries in which many of the statues exhibited were originally placed. We mention this, because there are situations in the Museum where, at least with regard to those Ægina figures, this object might have been effected. In the great centre saloon it would have been easy to have made the partition columns harmonise with the pediment, by which it would have been placed at a sufficient elevation from the pavement; or in the new building which is to occupy the ground the twelfth room now covers and about to be rebuilt. Of the whole collection within the walls these statues are alone as a group *per se* perfect, and had they been placed to advantage would have given to the general visitor a far better idea of the grandeur and beauty of ancient art than the headless, armless, and legless remains contained in the Elgin saloon. We protest, also, against the unseemly impalement of the horses, which creates a feeling of horror in the mind, and which might easily have been obviated by attaching them to the walls with iron rods invisible to the spectators; also the wall within the pediment forming the back ground should have been made to resemble stone, and not have had the glaring colour it now possesses. On the opposite side of the apartment a similar building is preparing, in which are to be placed the nine figures that ornamented the eastern front of the same Temple of Jupiter whence these were taken.

Within a temporary building opening from the fifth room are the casts from the marble metopes of the great temple of Jupiter Olympius, at Selinus, in Sicily. Valuable as they are, as belonging to a school of art prior to that of Ægina, and probably of a date coeval with the earliest Egyptian, a short notice of them may not be unacceptable, as no account of them is to be found in the synopsis, and to the public in general, although subjects of great curiosity and inquiry, the legend which they tell, and their appearance are altogether as unaccountable as mysterious. At Selinus, in Sicily, there are the remains of six temples of the earliest Doric, within a short distance of each other, and it was during the researches into the ruins of the largest, called the western, and the one furthest from it, named the eastern, by Messrs. Harris and Angell, in 1832, that these ancient sculptures were found: among them there were no single and perfect statues as in the temple at Ægina, which probably arose from the neighbourhood being well peopled, and they had no doubt been repeatedly ransacked. These temples may be reckoned among the largest of antiquity, being equal in their dimensions to those at Agrigentum, in the fluting of whose columns there is sufficient space for a man to stand. Immediately after the discovery, application was made to the Neapolitan Government to allow them to be shipped for England, but permission was refused, and they are now in the Royal Gallery at Palermo; casts were allowed to be taken, and they are these we now describe. They are probably of as early a date as any that have reached our times, and are of different styles of art; those which belonged to the Temple called eastern, whence the sculpture of the head of the dying warrior, and the chariot drawn by horses, were taken, possess much of the Æginitan character; those of the western are of a ruder age, in most of the figures the anatomy resembles that of the earliest coins, but different in many respects from the Greek sculptures; and there is a short and full character in the faces approaching the Egyptian. From the short proportions, the fleshy part of the thigh overcharged, and the peculiar manner in which the hair is arranged, they might be taken for specimens of Æginitan art; but on a close inspection it will be found, that they are the work of artists educated on different principles. At a much later period it is known that the artists of Ægina were employed by the kings of Sicily, and these therefore are not unlikely to have been the work of Carthaginian sculptors brought to decorate a city in alliance and newly founded, which will account for the Egyptian character given to the whole. The cast, which consists of the body and head of a dying soldier, a part of a female figure behind, formed the third metope of the eastern temple, and is a most valuable and curious fragment, and determines the style and character of the sculpture of the temple. It bears a marked resemblance to some of the heads in the Ægina marbles, but it has much more expression; the artist has evidently intended to mark the agonies of death, by the closed eyes, the mouth slightly opened, and the tongue appearing between the teeth; the hair and beard are most carefully and symmetrically arranged and most elaborately finished, the helmet is thrown back, and is of the kind called "γεῖσον," part of the crest "λοφος" is visible under the left shoulder of the figure. The fragment of the female is very spirited, and evidently in strong action. These metopes, like those of the Parthenon, are in high relief, and in some parts detached. Thorwalsden has pronounced them equal in execution to the Ægina.

The next, which consists of three figures, one of which has a horse under the arm, is particularly interesting, from the illustration it presents of the death of the Gorgon Medusa. Perseus, emboldened by the presence of Minerva, is represented in the act of slaying Medusa; his eyes are averted from the object of his honour, while his right arm, guided by the goddess, thrusts his sword into the throat of the monster. Pegasus, a winged foal, springs from her blood, and Medusa presses him to her side with apparent solicitude. The monstrous face of the Gorgon is finely represented; the large round head and hideous face rise from the shoulders without the intervention of a neck; all the features are frightfully distorted, the nose is flat and spreading, and the mouth is nearly the whole width of the face, and is armed on each side with two immense tusks; the hair over the forehead is curiously shown, and almost appears to have represented the serpent's, to which it was changed. The figure of Minerva on the right is draped with the "πεπλον" and has the Mæander ornament on the edge. The figure of Perseus is in the centre;

he is armed with the harp of Mercury and the helmet of Pluto, which latter has a pendant falling on each side; the "ωτηνα πεδιλα," or *talaria*, are represented as covering the feet entirely, and bear some resemblance to the ancient greaves; the front part is attached to the ancle by thongs. The form of the young Pegasus is exceedingly beautiful; he seems bounding from the earth. The metope containing the figure bearing two others on its shoulders represents the adventure of Hercules, surnamed Melampyges, from the black and hairy appearance of his loins; the story is as follows:—Passalus and Achemon, two brothers, reviled their mother, who warned them to beware of a man whose loins were covered with black hair; they attempted to rob Hercules while asleep, and from that had the name of Cercopes; in the attempt they failed and awoke him, and he bound them hand and foot to his bow, with their heads downwards, and carried them in that manner; they began laughing on the accomplishment of their mother's prophecy; Hercules asked them why they laughed, and on their telling him the reason, he also laughed and liberated them. The figure of the god is represented as strong and muscular, and the two prisoners have a very ludicrous appearance; in the reversed position, the hair falls in a curious manner; the whole group has been painted in various colours, and in the countenances much of Egyptian expression is to be observed. The horses which draw the chariot formed part of the centre metope of the Eastern Temple; it is very imperfect, and is supposed to represent the celebration of the race of Pelop s and Ænomaus; they are drawn full of fire and courage, and are finely fore-shortened; they have the cropped ears and manes which are observable in those of the Parthenon.

These sculptures are valuable as specimens of the third period of the art, the earliest of which is probably the Hindoo; the great resemblance both these and the Egyptian bear to that style is remarkable, and gives warrant to suppose that it was the original school. Of Hebrew sculpture there are no remains; the command to form no graven image prevented the art attaining the perfection which it reached in the neighbouring country of Syria, and would seem to account, that within the land of Judea no statue bearing marks of great antiquity has been discovered. The Egyptian, the Etruscan, the Selinuntine, and the Ægina schools, furnished the models for the Grecian; and the careful observer has it in his power within the walls of the Museum, to trace, step by step, the progress of the art, till it attained its meridian splendour in the production of those sculptures, whose dilapidated remains are there preserved, and which the accumulated knowledge, genius, labour, and talent of 2,500 years has never yet been able to surpass.

On the walls of the building containing the sculptures we have described are a splendid collection of architectural models and casts from the antique, which were collected by Sir T. Lawrence, and purchased at his death. In the centre is a model of the shield of Achilles, by Flaxman, taken from the *Iliad*, and justice has been done to the conception of the bard. Under glass cases are some very curious models of Druid quoits; the limits of this notice will not allow us to describe them.

ECONOMY OF FUEL.

BY FREDERICK S. PEPPERCORNE, ESQ.

Perhaps there is no subject of more general importance, both in a scientific and a national point of view, than that which forms the title of this paper, more especially at the present time, when owing to the vast and rapid augmentation of steam-power, whether as applied to mines, manufactures, locomotive or maritime purposes, the consumption of fuel has increased to an almost incredible extent. When to these are added the enormous quantity consumed in the iron-works, besides that which is annually exported to India, the Colonies, and foreign parts, we cannot but contemplate the probability of the exhaustion of our coal-beds (there being no reproduction of coal in this country, since there are no known natural causes in operation to form other beds of it) otherwise than as a national calamity, involving the destruction of a great portion of our manufacturing and commercial prosperity. Nor is the period so very remote when the coal districts, which at present supply the metropolis with fuel, will cease to yield any more. The number and extent of all the principal coal-beds in the north of England have been ascertained, and calculations made, by which it would appear that the supply will be probably exhausted in a period of from 350 to 400 years.

Professor Buckland, in his evidence on this subject, estimates the duration of the coal in these districts, at the present rate of consumption, to be 400 years.

Professor Sedgwick, who is well acquainted with the coal strata of Northumberland and Durham, gave his opinion respecting the duration of the coal of these counties, as follows :—

I am myself convinced, that, with the present increased and increasing demand for coal, 400 years will leave little more than the name of our best coal seams.

And he further adds :—

Our northern coal-field will probably be in the wane before 300 years have elapsed.

Already this event has occurred in the coal-fields of Staffordshire, Warwickshire, and Leicestershire, once amongst the most important in the kingdom, and now nearly exhausted; owing to which cause the manufacture of iron, for which these districts were for a long time celebrated, has been nearly discontinued in those counties, and the chief seat of the iron-trade is now removed to Monmouthshire and Glamorganshire; in which two counties alone there are upwards of 100 blast-furnaces for the smelting of iron at present at work, which may be equal to the production of about 400,000 tons of iron a year. Now it is a known fact, that from five to six tons of coal are required for the production of one ton of iron, consequently 2,400,000 tons of coal would be consumed in South Wales in the iron-works alone.

The quantity of iron made in Great Britain in the year 1836 is stated in the "Mining Journal," of October 7, 1837, to be about one million of tons, in the manufacture of which six millions of tons of coal would be consumed.

The total consumption of coal in Great Britain in the year 1837 was stated to be 22 millions of tons, and the quantity exported to India, the Colonies and foreign parts about two millions of tons. It is probable, however, that even this amount was considerably under the actual quantity consumed; and if we take into consideration the immense increase that has taken place since that period for the purposes of steam-navigation and locomotive engines, we shall probably be considerably under the mark in stating the whole quantity of coal consumed in Great Britain, exclusive of that which is exported at 30,000,000 of tons, to which must be added *one-third* of the whole amount, or 10,000,000 of tons, *for coal left and wasted in the mines.* (See "Holme's Treatise on the Coal Mines," who states the waste of small coal at the pits' mouth to be one-fourth of the whole, and that in the mines one-third.) This enormous proportion of coal left and wasted in the mines seems so incredible as to require some further explanation, and this cannot be better given than in the words of an eminent geologist, Dr. Buckland, in his "Bridgwater Treatise," who says :—

We have for many years witnessed the disgraceful and almost incredible fact that more than a million of chaldrons (1,350,000 tons) per annum, being nearly one-third part of the best coals produced by the mines near Newcastle have been condemned to wanton waste, on a fiery heap, perpetually blazing near the mouth of almost every coal-pit in that district. This destruction originated mainly in certain legislative enactments, providing that coal in London should be sold, and the duty upon it rated, *by measure* and *not by weight.* The smaller coal is broken the greater the space it fills; it became, therefore, the interest of every dealer in coal *to buy it of as large a size* and *to sell it of as small a size as he was able.* This compelled the proprietors of the coal-mines to send the large coal only to market, and to consign the small coal to destruction.

In the year 1830 the attention of Parliament was called to these evils, and pursuant to the report of a Committee, the duty on coal was repealed, and coal directed to be sold by *weight instead of by measure.* The effect of this change has been that a considerable quantity of coal is now shipped for the London market in the state in which it comes from the pit, that after landing the cargo the small coal is separated by skreening from the rest, and answers as fuel for various ordinary purposes, as well as much of the coal which was sold in London before the alteration of the law.

The destruction of coal on the fiery heaps near Newcastle, although diminished, still goes on however to a frightful extent; that ought not to be permitted, since the inevitable consequence of this practice, if allowed to continue, must be, in no long space of time, to consume all the beds nearest the surface, and readiest of access to the coast, and thus enhance the price of coal in those parts of England which depend on the coal-field of Newcastle for their supply; and, finally, to exhaust this coal-field at a period nearer by at least *one-third,* than that to which it would last, if wisely economised.

The concluding observations of Dr. Buckland, on this important subject, are so much to the purpose, that it will be a sufficient apology for introducing them here. He proceeds thus :—

We are fully aware of the impolicy of needless legislative interference, but a broad line has been drawn by nature between commodities annually or periodically reproduced by the soil on its surface, and that subterranean treasure and sustaining foundation of industry which is laid by nature in strata of mineral coal, whose amount is limited, and which when once exhausted, is gone for ever. As the law most justly interferes to prevent the wanton destruction of life and property it should seem also to be its duty to prevent all needless waste of mineral fuel, since the exhaustion of this fuel would irrecoverably paralyse the industry of millions.

The tenant of the soil may neglect or cultivate his lands, and dispose of his produce as caprice or interest may dictate; the surface of his fields is not consumed, but remains susceptible of tillage by his successor: had he the physical power to annihilate the land, and thereby inflict an irremediable injury upon posterity, the legislature would justly interfere to prevent such destruction of the future resources of the nation.

This highly favoured country has been enriched with mineral treasures in her strata of coal, incomparably more precious than mines of silver or of gold. From these sustaining sources of industry and wealth, let us help ourselves abundantly, and liberally enjoy these precious gifts of the Creator; but let us not abuse them, or by wilful neglect and wanton waste, destroy the foundation of the industry of future generations.

Might not an easy remedy for this evil be found in legislative enactment, that all coals from the ports of Northumberland and Durham, should be shipped in the state in which they come from the pits, and forbid ding, by high penalties, the skreening of any sea-borne coals, before they leave the port at which they are embarked. A law of this kind would at once terminate that ruinous competition among the coal-owners, which has urged them to vie with each other in the wasteful destruction of small coal, in order to increase the profits of the coal merchant, and gratify the preference for large coals on the part of rich consumers; and would also afford the public a supply of coals of every price and quality, which the skreen would enable him to accommodate to the demands of the various classes of the community.

A farther consideration of national policy should prompt us to consider how far the duty of supporting our commercial interests, and of husbanding the resources of posterity, should permit us to allow any extensive exportation of coal, from a densely peopled manufacturing country like our own; a large proportion of whose present wealth is founded on machinery, which can be kept in action only by the produce of our native coal-mines, and whose prosperity can never survive the period of their exhaustion.

At the last meeting of the British Association at Newcastle, Dr. Buckland read a paper on the application of small coal to economical purposes, in which he referred to the well-known enormous annual waste of coal at the mouths of the various pits near Newcastle, and stated that, owing to what he had said on the subject in his Bridgewater Treatise, the attention of a benevolent individual had been called strongly to the subject. That individual had succeeded in agglutinating the small particles of coal into a firm compact mass, by a process at once simple and cheap; and he believed he had taken out a patent for the method. There would be even an economy in using this coal for many purposes, as it occupied *one-third* or *one-fourth* less space, when packed in boxes, than coal in its ordinary state. Specimens were exhibited, which had a firm compact appearance, and Dr. Buckland stated that by the direction of government, trials had been made under the inspection of competent persons, and that success had been complete, the combustion being at least as productive as that of coal in its common state.

The experiments alluded to by Dr. Buckland, took place at Woolwich Dockyard in August last, under the superintendence of Messrs. Kingston and Dinneu, two experienced engineers. The "prepared fuel," as it was termed, is a composition of skreened coal, river-mud and tar, cast into blocks of nearly the size and shape of common bricks. One great advantage attending this form is that a much larger quantity, weight for weight, may be stowed in the hold of a sea-going steam-vessel, than of common-coal, and it is besides not liable to shift its position, like the latter. An Engine was worked with this prepared fuel, and the consumption for 6 hours 45 minutes, was 750 lbs. The same engine required 1165 lbs of north country coals to keep it going for the same time, showing a saving of 415 lbs in favour of the prepared fuel.

At another experiment, Welsh coal was used, and 1046 lbs. were consumed, while 680 lbs. of the prepared fuel easily performed the same work in the same time. It was also remarked that it required about 50 lbs. less of the prepared fuel to get the steam up, than of common coal, and that the steam was maintained by it at a more even temperature, with very little feeding.

It would seem, therefore, that there can no longer be any excuse for a continuance of the wasteful practice of consuming the small coal at the pit's mouth, to say nothing of that which is thrown aside as useless in the pits themselves, and which never sees the light, since by this invention, that which was before considered as mere refuse, has acquired a certain fixed value, and it is to be hoped that this disgraceful practice is now completely put a stop to.

Of the various substances which have been used as a substitute for coal, where that article is scarce, peat stands foremost in the list. Our peat or turf beds are of great extent, especially in Ireland, and contain a valuable reserve of fuel, applicable, when properly prepared, to all the purposes of mining or manufactures. An important feature in this fuel is, that, unlike coal, of which we know of no instance of reproduction, turf or peat is continually being reproduced; in fact, in many parts of England the growth exceeds the consumption, and consequently the turf beds in those places are on the increase.

Before being used, however, this fuel requires to be thoroughly dried by exposure to the sun and air, during which process it contracts considerably in its dimensions, and increases in density, so much so as frequently to approach in hardness and appearance to common coal. This, however, is only the case with bog peat, or that which is saturated with water, but turf may be made so by placing it at first in running water, and then suffering it to dry. Artificial means have been used for compressing peat; and a machine for this purpose, invented by a patriotic nobleman, Lord Willoughby de Eresby, has been attended with complete success. The chief advantage of this invention is the great saving of time effected in the conversion of the wet peat into a solid dry fuel.

In France peat is extensively employed, both for domestic purposes and in the different metallurgic processes, after having been converted into a charcoal by placing the peat to be carbonised in a furnace, where it is ignited, and smothered up in the usual manner. The iron made with this peat charcoal is described to be of a superior quality to Swedish iron, being more malleable, and more easily welded, owing, as it is supposed, to its comparative freedom from sulphur, which is known to exist in large quantities in coal, and which is not completely driven off by its conversion into coke.

Very lately this peat-coke has been introduced into some of the transatlantic steamboats, in combination with a certain proportion of resin. This resin fuel is not used alone, but when about 2½ cwt. of it are mixed with 20 cwt. of coal, a much better combustion of the coal takes place; and the effect is described as being equal to that which would be produced by 27 cwt. of coal. The mode of using it is by throwing it in front of the fire with each charge of fresh coal.

For many years the attention of scientific and practical men has been directed to a method of using a valuable description of coal, the use of which, owing to its peculiar properties, has been, until lately, confined within a very narrow compass.

This fuel is the "anthracite," or stone-coal of South Wales. Its chief properties consist in its freedom from sulphur or bitumen (being composed wholly of carbon, mixed with a slight proportion of oxide of iron, silex, and alumina), its great durability and steady heat, burning clearly without smoke or flame. These valuable qualities have long secured to anthracite a very extensive use in the drying of malt in many districts of England, where it is preferred even to coke or charcoal; but it is only within the last few years that it has acquired the high rank of importance, in a national as well as a domestic point of view, which it now possesses.

Dr. Arnott, for whose stoves it is exclusively recommended by him, has declared that it is a blot in the police regulations of London, that all great manufacturers are not confined to the exclusive use of this description of coal, its non-emission of smoke and noxious vapours, tending so much to preserve the purity of the atmosphere in the metropolis. Since, so long back as the reign of Elizabeth, the burning of coal was prohibited in London during the sitting of Parliament, lest the health of the knights of the shire should suffer during their abode in London (so careful was this queen of the health of her subjects); it is surely incumbent on us in the present day, when from the immense increase of the number of manufactories of every description, the atmosphere of London is never clear from smoke, to pass some legislative enactments to remedy the growing evil. Experiments have satisfactorily proved that anthracite gives out in combustion 30 per cent. more caloric than coke or bituminous coal.

In America, this valuable mineral has been long and extensively employed, not only for manufacturing processes, but also in steam-navigation, and for locomotive engines; also for the warming of apartments, and for every other domestic purpose: indeed, its cheapness, the intensity and durability of the heat which it produces, together with its perfect safety and freedom from smoke or smell, give it a decided preference over every other species of fuel.

Mines of this coal have for some years been extensively worked in Rhode Island, Massachusetts, and other states; but it is in Pensylvania that it is found in the greatest abundance: there the anthracite coal formation covers a tract of country many miles in length and breadth, extending across the two entire counties of Luzerne and Schuylkill. Throughout this region it is obtained with very little labour, being situated in hills from 300 to 600 feet high above the level of the surrounding rivers and canals, and consequently easy of transportation to all parts of the Union. It exists in horizontal beds, from 15 to 40 feet in thickness and covered merely by a few feet of gravelly loam. This coal has been found in several European countries, and exists abundantly in Ireland; but the great supply of anthracite for this country is found in that part of the great coal formation which environs Swansea and Carmarthen Bays, and which forms a part of the great coal-field of South Wales. Here it exists in immense quantities.

It is, however, but very recently that the attention of engineers has been turned to the use of this fuel for locomotive engines: a short time since, a trial of it was made under the sanction of the directors of the Liverpool and Manchester Railway, and the following is the report of the talented engineer of that company:—

In the first instance, the engine ran out with a load about 6 miles, and the coal was found to do very good duty without any difficulty being experienced, either with the tubes, or in the getting up of the fires. The engine brought back a load of coal waggons from the Hetton Colliery, and acquired a speed of 21 miles an hour, thus loaded. Another trial was made in the evening with the same engine for the whole distance to Manchester, taking 5 loaded waggons; the journey was performed in 1 hour and 29 minutes.

The consumption of anthracite was only 5½ cwt: although a large portion was wasted from the fire-bars being too wide apart for the economical use of this fuel. The engine would have used upwards of 7½ cwt. of coke for the same journey, with the same load."

The trial with locomotives, then, must be considered quite conclusive and the next object most deserving the attention of practical men, is the application of anthracite to the marine engines of sea-going steam vessels. When it is considered that 30 per cent. at least is saved in the stowage by this description of fuel, the importance of this subject will be at once made manifest, and there can be little doubt that with certain trifling alterations, in the construction of the boiler and furnace, the object may be attained.

It is not suprising that, considering the importance which has of late years been attached to every means of economising fuel, the attention of scientific and practical men should have been directed to various methods for accomplishing this object, and numerous alterations and improvements have been effected in the furnaces and boilers of steam engines, by which the heat given forth by combustion has been made more available, but much remains yet to be done, as a very large quantity of heat is lost from; the smoke which is wasted, the heat which passes up the chimney, and from the imperfect manner in which coal is generally consumed.

An ingenious invention for intercepting and returning to the boiler-fire a large portion of the heat which would otherwise pass up the chimney and be dissipated, was brought into notice in England a few years ago, by a German named Schauffelen, and was denominated "Schauffelen's Hot-air Furnace Feeder." The invention consists in the use of a number of metal pipes or tubes open at the bottom, but closed at the top. These pipes are placed in a vertical position in the chimney, and the air in passing through them becomes heated from the current of hot air passing up the chimney, and in this state is supplied to the fire, all ingress of cold air being carefully excluded by means of closely fitting iron plates attached to the ash-pit.

With respect to the amount of saving in fuel effected by this apparatus, it is stated by the inventor as varying from 20 to 25 per cent., when in good working order, and its advantages are not entirely confined to a saving of part of the heat which would otherwise escape up the chimney, but moreover a more intense heat in the fire-place is maintained, and consequently a more complete combustion of the fuel and smoke takes place.

Another invention of great simplicity for the economy of fuel, and the prevention of smoke, is described in the *Mining Review* of August 31, 1838. The process consists merely in the introduction into the furnace of steam in small quantities, through a tube taken from the boiler, and discharged over the fuel at any convenient place. The end of the tube should be formed with a fan-shaped termination, perforated with minute apertures, so as to throw the steam in small jets down upon and over the fire. One effect produced is *the absolute prevention of smoke;* another, the operation of the fire is fully doubled, and the steam employed itself consumed. The employment of steam also greatly increases the draft of the chimney.

"It is held by competent authorities, that 1lb of Newcastle coal (supposing the whole of the heat omitted by its combustion was made available), should drive off in steam 14lbs *of water.* This however, is very far beyond what is actually done in practice, by ordinary steam-engine boilers. Indeed it is found by experience to require as much as 1lb of coal to convert into steam 4 to 6lbs of water, 6lb being considered a high product. By means of Mr. Ivison's method however, it is found that an average of 13lbs. of water are evaporated by 1lb. of ordinary Scotch coal, thus more than doubling the results heretofore obtained, and consequently effecting a saving of upwards of 50 *per cent* of fuel."—*Mining Review*, August. 31, 1838.

Our great source of loss of heat and, consequently of fuel, in most large establishments where steam power is extensively employed, arises from the radiation of heat which is constantly taking place from the boiler, where, as is most frequently the case, no means are adopted for preventing it. When we consider the large surface that is exposed by each steam-engine boiler, and that from this there is continually going on a powerful radiation of heat into the surrounding atmosphere, it is evident that the loss from this source alone, must be immense. If, therefore, this large body of heat can, by any means, be intercepted and returned to the boiler, it is clear that there will be a saving of all that fuel which was required to raise that heat in order to disperse it again. The method of doing this is simple, and attended with very little expense. All that is necessary to be done is to surround the boiler with a jacket or casing of wood or brick, leaving a space of a few inches between it and the boiler, to be filled with some substance which is a slow conductor of heat. The material that has been employed for this purpose, is a mixture of sawdust and ashes, rammed in so as to lay close to every part of the boiler; and where this system is carried to its full extent, which is in the large pumping engines, used in the mines in Cornwall, not only the boiler, but also the cylinder and the steam-pipes, are, in the Cornish engines, completely encased with some non-conducting material, which renders the engine and boiler-houses as cool as the interior of a dwelling-house, where there are only ordinary fires,—a sure proof that little or no heat is lost by radiation.

Another proof of the efficacy of this system is, that even after the engine has been standing still for 12 hours, very little heat is lost, and if it is necessary to start it suddenly, as in case of emergency, scarcely any time is lost in raising the steam, and *one fourth* the fuel only is required; whereas in the common engines and boilers, where every vessel containing steam is exposed to the atmosphere, it takes from 20 minutes to half an hour, firing hard, to raise the steam to the requisite pressure.

It would occupy too much time, and swell these remarks to too inconvenient a length, were I to enter into the details of all the inventions that have been proposed for economising fuel, although many of them are of great value, as their general adoption sufficiently testifies; whilst others, either from the complexity of their parts, or their general inapplicability, have soon fallen into disuse. It is hoped, however, that sufficient has been said in this paper, to point out the great importance of the subject, and to show, that however much may have been hitherto done, much yet remains to be done, before we can confidently state that the whole *inherent virtue* residing in one pound weight of coal or other fuel, is made available.

FREDERICK S. PEPPERCORNE.

15, Buckingham-street, Adelphi,
April, 8 1839.

PUBLIC COMPETITIONS.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Extract from Report of the Committee appointed to consider the subject of Public Competitions for Architectural Designs. Laid before the Special General Meeting, held 24th January, 1839.

THE Committee appointed on the 9th October, 1838, to consider the subject of Public Competitions for Architectural Designs, beg leave to report.

The arguments advanced in favour of competition are sufficiently forcible. Emulation is said to be the soul of excellence in the arts and sciences—the recognised talents of the elder professor are supposed to be maintained in activity and progressive improvement, and his employers to be protected from the *routine* manner, which security in public patronage and private practice are too apt to produce:—while an opportunity is afforded to the young aspirant, to take that place in public estimation to which his talents may entitle him.

The formation of the programme, upon which competitors are required to frame their designs, becomes the first essential point for consideration, and a deficiency on this point is perhaps the most general evil in the present system. The precise objects to be attained, the most desirable means of attaining them, the circumstances that must control the plan with regard to the site and other localities, the sum of money to be expended, and many other particulars of which every case of competition brings its own, are seldom ascertained and settled, so as to lay the groundwork of well-defined instructions upon which competitors may proceed. When the decision is to be made, the judges discover for the first time, that they have been ignorant of their own intentions; their loose and ill-digested instructions are abandoned altogether, and the architect, who has acted with the greatest good faith in adhering to them, is the first to be deprived of his reward. In another view of the case, an architect, who may have suggested a design not reconcileable with the crude, undigested, and perhaps contradictory preconceptions cast into the programme, may virtually exclude himself from the competition, and his employers from the adoption of his ideas.

When we consider architecture as a combination of science and art requiring great experience and taste, together with the important essential in its professors, of character and conduct in the execution of their works—when we consider the variety of attainment necessary for the production of an architectural design, it is not too much to expect some corresponding qualifications, together with deep and patient consideration, on the part of those, who take upon themselves to sit in judgment upon it.

To read a plan is admitted by the most practised to be the result of great experience and knowledge. To pursue the clue through the labyrinth of ichnography, and to follow out arrangement and economy of space, and the combination of convenience and beauty, require not only great intelligence and discrimination, but a long course of analogous study. Even the experienced professor must go through the whole subject minutely. How often does any scruple or doubt of their own competency embarrass a committee appointed to judge of architectural designs? Do they consider any further qualification necessary, when they have assumed to themselves the undefined and flattering attribute of *taste?*

Again, it is well known to experienced architects how difficult it is to form a correct judgment upon designs on different scales and in different styles of drawing—and yet committees do not hesitate to select a design, without suspecting it in the slightest degree, that they may have been captivated by the meretricious allurements of the artist, and that they may have admitted the accessories of pictorial representation to have the weight of argument and reason, particularly when coloured views and scenery, aided perhaps by false perspective, or taken from impossible points of sight, are introduced to the destruction of any common ground of comparison. The delusion is only eventually detected when it is past remedy.

Another evil, which the necessary inexperience of committees, as at present constituted, renders it difficult for them to meet, is, that a design may be selected for its decorative character, which it afterwards proves inexpedient to carry into effect, on account of the expense attending it. In this case it frequently happens, that, in preference to encountering the inconveniences of retracing their proceedings, the committee suffer the design to be stripped of every thing, which originally recommended it to their notice; thus disappointing the expectations of the public, and inflicting a flagrant injustice upon the other competitors.

In proceeding to consider what remedies may be suggested for the evils here enumerated, they will be found to arise naturally out of the statement itself.

It is not to be doubted that the proposers of competitions may prescribe any terms they think fit. Whether, therefore, they prefer laying down precise instructions on every point, or leaving themselves a certain latitude in their decision, or making it entirely open to competitors to offer any suggestions that may occur to them, it rests entirely with the professor to decide for himself, whether the conditions, and the personal character of those who propose them, are satisfactory.

But whatever the conditions may be, they ought to be clear and explicit, that the competitor may know precisely and unequivocally upon what he has to rely. Whenever it may be expedient to lay down definite instructions, they ought to be strictly adhered to, when judgment is to be founded upon them, and every design rejected, which shall be found not to conform to them.

In framing instructions care should be taken to distinguish accurately between the objects to be attained, and the means of attaining them. The former cannot be too accurately ascertained, or too explicitly described; but the latter should be left as much as possible to the architect, for otherwise a proper scope will not be afforded for the exercise of a variety of suggestions, and one great end of competition will be frustrated. If, however, there should be a decided bias in favour of any particular style or mode of composition, it ought to be ascertained and stated in the instructions.

As the formation of definite preliminary instructions, and a decision strictly founded upon them require more experience and knowledge of architecture than miscellaneous committees may be generally supposed to possess, it is suggested that in all cases competent professional advisers should be referred to upon these and other points connected with the duties of the Committee: but without taking the final decision out of the hands of the original parties to the competition, or relieving them from its responsibility.

Professional opinions are especially requisite in regard to practical construction, also to minute arrangements, as of light, ventilation, and warming, in reference for example to prisons, hospitals, and places for public meetings. The maximum amount of the intended expenditure should be given, and when a selection is made, proper means should be employed to ascertain that the cost of executing the design will not exceed the estimate.

In order to assist the judgment by establishing an uniform comparison, the drawings presented for competition should always be made to one scale; and limited to one style of finishing, as in Indian ink, with no colour, unless for such a purpose as that of distinguishing different materials in sections. Perspective drawings, if correctly made, are certainly desirable to show the proper effect of designs; but they should be restricted to specified points of view. Models should be received with caution, as not being unexceptionable tests of the merits of a design.

But they must advocate the principle, that as much publicity as possible should be given to the proceedings in all cases. For although the public at large cannot be accepted as a competent judge upon cases requiring peculiar attention and information, yet the exhibition alone of the drawings, accompanied by the instructions upon which they are founded, cannot fail to render those, to whom judgment is confided, both diligent and scrupulous in the discharge of their duty. To effect this object, however, experience has shown, that the expression of the public opinion must precede, as well as follow, the decision of the judges. The public exhibition of designs, previously to the final decision upon them, might render it expedient to follow generally the practice, now only partially adopted, of concealing the names of competitors under a motto or cypher. On any other ground the practice is scarcely worthy of mention, and is liable to the objection of being deceptive; for your Committee have sufficient evidence to prove, that, though apparently fair, it is absolutely futile in effect.

Although the inquiries, which may be addressed by professional men to the institutors of competitions, must necessarily be dictated by the peculiar circumstances of every case, yet the following, although merely proposed as explanatory of the intentions of the committee, may be found generally applicable.

By whom are the designs to be examined and selected?

Have any designs been laid before the parties previously to the competition being proposed?

Have the parties any architect, or person professing to be an architect, in their employ?

Will any means be adopted to ascertain that the designs can be executed for the sums estimated?

Will the parties undertake to lay aside all designs which cannot be executed for the sum estimated?

Is it the intention of the parties at once to exclude from the competition all designs not in strict conformity with their instructions in every respect?

Will the architect, whose design is selected, be employed to execute the work, provided his character and standing in the profession be such as to render him unexceptionable?

REVIEWS.

Illustrations of Science by Professors of King's College, London; Mechanics. By the Rev. H. Moseley, M. A., F. R. S., Professor of Nat. Philosophy. London: Longman, Orme and Co., 1839.

One of the most convincing arguments perhaps in this commercial country against any single institution for engineering education in this city, or indeed in any other, is the listlessness which results from the want of competition. Competition is one of the grand principles evolved by the investigations of the political economists,—perhaps the truest, and one that influences not only trade, but many other economical pursuits. Lord Brougham, applying this to politics, has, in his recent work on Eminent Statesmen, pointed out the mathematical operation of this law, if we may so term it, by asserting that the result is to produce an action neither of one side nor of another, but compounded of the two, just like the movement of two physical powers. We may leave to others to discuss that question, but perhaps some of our philosophical friends may be able to demonstrate that thus of two wrong courses a right one may be produced. If we consider the working of this competition in other branches of professional education we see at once in what a different position we stand from other countries. At Paris there is the only medical school for all France; and it certainly presents opportunities for ensuring the selection of the highest talent, and concentrating everything in one magnificent establishment. In London there are no less than fourteen complete schools: at Dublin three; besides nearly a score provincial establishments. The effect of this, some would say, would most certainly be to ensure mediocrity, by the employment of so many individuals, while the dispersion of talent would very much enfeeble the whole course of medical education. The operation, on the contrary, is, by the maintenance of an energetic competition, ever to elevate the standard, and ensure the ascendancy of men of talent; and every school is obliged to make the greatest exertions to command pupils, since it is only by securing able professors that they can maintain their standing. It must be remembered, that none of these schools have the privilege of giving licenses to practice, and that the examining body is totally distinct from the instructive. At Paris it is a principle something like this, and totally distinct from the system adopted, which maintains the superiority of that school; for from the turbulence of the pupils, they as speedily put down an obnoxious professor as the incipient surgeons of London; and thus counteract the evils of a stagnant system and government control; although it is not an impossible occurrence for a professor to be absent from his chair a year, or even two. The beauties of a non-competing system were most admirably illustrated in the recent proceedings at Oxford, and bear almost too much the appearance of irony even to be quoted with seriousness. The case was briefly this; Professor Daubeny, and other teachers of the natural sciences—who are the only professors who teach at all, in consequence of the miserable paucity of their auditors, (Daubeny's chemical class being ELEVEN!!) brought forward a law to render attendance on one of the scientific courses imperative on students proceeding to a bachelor's degree of arts, and making in consequence some proformal alterations, increasing the number of lectures of the professors. Upon which proposition, the decision of the learned authorities was, that no compulsory attendance on the courses should be enacted, but that the *proposed regulations as to more frequent lectures should be enacted*; by which solemn farce, an important question was eluded, and well-deserving men were entrapped into unnecessary duties. The zeal of such men as Daubeny, and his colleagues, cannot indeed be too highly commended; when, instead of profiting by the do-nothing example of their brethren, they continue to devote their talents to audiences of *eleven*, in the First University of the World.

To come, however, to the instance presented by the volume before us, we have every reason to congratulate ourselves upon possessing the house divided within itself, instead of that founded upon the rock, or rather pillow. University College came first into the field pledged to the adoption of the most enlightened principles; and King's College was brought in as its opponent; and most nobly has the contest been carried on. University College has been equally unfettered, both as to principles, and as to men, while from its very constitution the other establishment at once imposed upon itself leaden chains; at best placed in a go-cart, in the way of right, and certainly hampered by many superstitions and absurdities, it was additionally fettered by being obliged to select its professors from those very establishments whose stifling influence was most sought to be evaded. The result, however, even those who hoped most for its success, could never have anticipated; and the conductors of King's College, supporters as they are *ex-officio* of nepotism and patronage, deserve the highest credit for the discrimination and disinterestedness which they have shown in the choice of professors, who by finding out new paths, have emancipated themselves from the trammels in which they had been placed, and secured their own fame and the prosperity of the institution. It is not our desire to elevate the one institution at the expense of the other; and if from deference to the work before us our remarks are restricted to King's College, it must not be considered that we detract from another establishment the labours of whose members have ensured it a high meed of fame.

We cannot better illustrate the justice of the remarks we have made than by referring to the outlines of the courses, which are those proposed to be delivered before the class of Civil Engineering, and they mark a new era, when science is no longer to be conventional, but practical; when it is to leave off its Procrustean propensity of an artificial standard, and to adapt itself as it ought to do to every capacity and every pursuit. Pedantry of all kinds is most disgusting, but the pedantry of science is positively injurious, for it causes a waste of time to the practical man too often irreparable, and it is indeed time that we should get rid of this clog upon our progress. The courses proposed for this year are of course introductory; and all, like those on mathematics and natural philosophy, special: we have occasion afterwards to revert to Professor Moseley, on "Natural Philosophy;" so that we shall at present consider some of the other subjects.

Professor Daniell has arranged his course in a manner totally different from the general run of university lectures, and with an ability which shows his desire of promoting the instruction of his pupils rather than maintaining the dogmata of science, merely filling up the dull routine of official duty. His first year's course contains a preparatory view of the forces which concur to the production of chemical phenomena. An endeavour, says the Professor, will be made to systematize what the beginner already knows from common experience, and to lead him on to increase this knowledge gradually by the results of experiment; to teach him the inductive method of reasoning from phenomena; and to explain to him the general views and theories of the science. The display of these forces in the grand operations of nature will form principal objects of illustration, and particularly in the constitution of the atmosphere, the phenomena of thunder and lightning, winds, rain, &c. In the second year it is proposed that the students shall attend a course of practical chemistry, in which the application of the science to the arts will be taught, and the processes of the different manufacturers, of metallurgy, and of domestic economy will be explained and illustrated. This is a method which ought long since to have been adopted, and it is one which promises to rescue the physical sciences from being a mere set of empirical processes, and placing them in the hands of the students as they ought to be—sciences, and not arts. Science is one, but arts are many; and so long as the student is only taught a series of processes, without being properly grounded in the principles, so long will his progress in science be limited, and he remains a journeyman where he might be a master. There are few sciences indeed, of which many important principles are not sown in the human mind by observation, and it wants but little instruction to bring out these, and systematise the stores of knowledge. Instead of considering the mind of the student as ground entirely to be made, another course should be adopted, and it should be regarded as a soil which possesses many of the elements of fertility, and to which only the complementary addition is necessary to make it productive. Taking, too, nature as a basis, the student is put on the road not only to learn from the experience of the past but to profit from the events of the future; for there is perhaps no science in which the observation of nature is not the grand foundation of all greatness and all excellence; because, indeed, in nature, as in a storehouse, we find treasured up the perfections of an omniscient and unerring Deity. The discovery of the principles of specific gravity by Archimedes—musical mathematics by Pythagoras, the pendulum by Galileo, and terrestrial gravitation by Newton; all of these (and many more might be accumulated) are derived from the observation of the commonest phenomena—the bath, the blacksmith's anvil, a swinging cord, or a falling apple—while from them have been derived laws from the constitution of a universe to the arrangement of the most plodding machine. Teaching the students likewise, as Professor Daniell proposes, to reason on the phenomena presented to them, affords them a perpetual and available resource in all difficulties; and one, than which nothing could be more appropriate to the mental habits of an engineer. It is to be regretted indeed that in too many cases it is thought sufficient to cram a youth with a quantity of facts, and leave him to digest and apply them in what manner he can, as if man were supplied with a whole stock of logic from nature.

The other courses are also marked by the same happy desire to obtain the most effective ends by the application of the soundest principles, and they cannot fail to promote the results they so zealously attempt. In the program to the course on Geometrical Drawing, where, under most circumstances we should be the last to expect to find such an admission, Professor Bradley truly observes, that considerable facility in the power of drawing by eye, with precision and freedom, is requisite to constitute a good draughtsman, and is to be attained by constant practice in sketching objects of any kind from nature. It seems however to be thought generally, both by architects and engineers, that to stick a rule and compasses in a boy's hand is quite enough to qualify him, although, independently of the artificial training which is thus effected, no attention is paid to the fact that the human eye is the most delicate instrument in nature. Professor Wheatstone takes up the subject of experimental philosophy, and it can be believed, by those who know him, with what practicability and good effect. Professor Tennant lays out an admirable course on Geological Mineralogy; and indeed the whole arrangements are admirably calculated to effect the objects proposed on the institution of the class. We are happy indeed to see that there is no pretence to teach civil engineering, but that they wisely leave to those best qualified to teach those parts which are susceptible of being communicated by practical instruction, and only take on themselves such accessory portions as they can effect with credit to themselves and without injury to the pupils.

We may now come at last to the work before us, and we shall have no reason to regret any attention that we may pay to it, as it is quite worthy of the ability of the well-known author. The professors of King's College, it seems, have determined upon publishing a course of works on science, for popular instruction and they have acted very justly in confiding to Mr. Moseley the task of being their herald in the field; and, as his introduction may be regarded as that to the whole course, we think that we cannot better express its objects than by favoring our readers with some extracts from this able production:—

The author has proposed to himself the development of that system of experimental facts and theoretical principles on which the whole superstructure of mechanical art may be considered to rest, and its introduction, under an available form, to the great business of practical education. To effect this object, and to reconcile, as far as it may be possible, the strictly scientific with the popular and elementary character of the undertaking, a new method has been sought, the nature of which is sufficiently indicated by its title—Illustrations of Mechanics. The work consists, in fact, of a series of illustrations of the science of mechanics, arranged in the order in which the parts of that science succeed each other, and connected by such explanations only, as may serve to carry the mind on from one principle to another, and enable it to embrace and combine the whole. Throughout, an attempt is made to give to the various illustrations an entirely elementary and practical character.

It is an idea which presents itself to the mind of every man who has children to educate and provide for, which is a constant subject of comment and discussion, and which prevails through all classes of society, that a portion of the school life of a boy ought to be devoted to the acquisition of those general principles of practical knowledge of which the whole business of his subsequent life is to form a special application; that there ought, in fact, to be commenced by him at school a common apprenticeship to those great elements of knowledge, on which hang all the questions of interest which are to surround him in nature, and which are destined, under the form of practical science, to take an active share in the profession, trade, manufacture, or art, whatever it may be, which is hereafter to become the occupation of his life.

It is the object of this work, and of the series of which it forms part, to promote this great business of practical education, by supplying to the instructors of youth a system of elementary science, adapted to the ordinary forms of instruction. No one can doubt that the same capabilities in the scholar, united to the same zeal in the master, which now suffice to carry the elements of a classical education to the very refinements of philological criticism, would be equal to the task of instruction in the nomenclature of the physical sciences, their fundamental experiments, their elementary reasonings, and their chief practical results; nor can it be questioned that the ordinary intelligence of youth, and common diligence on the part of their teachers, would enable them to master the secrets of the more important of the arts, and the chief processes of the manufactures; and would place within their reach the elements of natural history, the general classification of the animal and vegetable kingdoms of nature, and their various ministries to the uses of man. These are elements of a knowledge which is of inestimable value in the affairs of life; and the interests of this great commercial and manufacturing community claim that they should no longer be left to find their way to the young mind (if, indeed, they reach it at all), rather as a relaxation of the graver business of education than as a part of it.

The illustrations of the mechanical properties of matter and the laws of force are drawn promiscuously and almost equally from art and nature. It is not by design that examples taken from these distinct sources thus intermingle, but simply because they suggest themselves as readily from the one source as the other—from nature as abundantly as from art. There is a relation between art and nature—a relation amounting to more than a resemblance;—a relation by which the eye of the practical man may be guided to that God who works with him in every operation of his skill, and mechanical art elevated from a position which is sometimes unjustly assigned to it among the elements of knowledge. It is from this relation between the Author of nature and the being in whom the works of art have their origin that arise those relations, infinitely remote, but distinct, between the things themselves, of which the evidence is every where around us. These are necessary relations: it is not that the works of art are made by any purpose or intention in the resemblance of those of nature, or that there is any unseen influence of nature itself upon art; the primary relation is in the causes whence these severally proceed. Thus it is possible, that in the infinities of nature, every thing in art may find its type; this is not, however, necessarily the case, since the causes are infinitely removed, since, moreover, in their operation, these causes are independent, and since nature operates upon materials which are not within the resources of art. How full of pride is the thought, that in every exercise of human skill, in each ingenious adaptation, and in each complicated contrivance and combination of art, there is included the exercise of a faculty which is akin to the wisdom manifested in creation! And how full of humility is the comparison which, placing the most ingenious and the most perfect of the efforts of human skill by the side of one of the simplest of the works of nature, shows us but one or two rude steps of approach to it.

The arrangement of the work will perhaps be better understood by leaving it in the author's own words, so that we have selected for our readers the following detail of it:—

Matter is composed of elements, which are inappreciably and infinitely minute; and yet it is within the infinitely minute spaces which separate these elements that the greater number of the forces known to us have their only sensible action. These, including compressibility, extensibility, elasticity, strength, capillary attraction and adhesion, receive their illustration in the first three chapters of the following work. The fourth takes up the Science of Equilibrium, or Statics; applies in numerous examples the fundamental principles of that science, the parallelogram of forces, and the equality of moments; then passes to the question of stability, and to the conditions of the resistance of a surface; traces the operation of each of the mechanical powers under the influence of friction; and embraces the question of the stability of edifices, piers, walls, arches, and domes.

The fifth chapter enters upon the Science of Dynamics. Numerous familiar illustrations establish the permanence of the force which accompanies motion; show how it may be measured; where in a moving body it may be supposed to be collected; exhibit the important mechanical properties of the centres of spontaneous rotation, percussion, and gyration; the nature of centrifugal force; and the properties of the principal axes of a body's rotation; the accumulation and destruction of motion in a moving body, and the laws of gravitation.

The last chapter of the work opens with a series of illustrations, the object of which is to make intelligible, under its most general form, the principle of virtual velocities, and to protect practical men against the errors into which, in the application of this universal principle of mechanics, they are peculiarly liable to fall: it terminates with various illustrations of those general principles which govern the reception, transmission, and application of power by machinery, the measure of dynamical action, and the numerical efficiencies of different agents—principles which receive their final application in an estimate of the dynamical action on the moving and working points of a steam engine.

The Appendix to the work contains a detailed account of the experiments of Messrs. Hodgkinson and Fairbairn upon the mechanical properties of hot and cold blast iron: and an extensive series of tables referred to in the body of the work, and including, 1. Tables of the strength of materials; 2. Tables of the weights of cubic feet of different kinds of materials; 3. Tables of the thrusts of semi-circular arches under various circumstances of loading, and of the positions of their points of rupture; 4. Tables of co-efficients of friction, and of limiting angles of resistance, compiled and calculated from the recent experiments of M. Morin. The results of these admirable experiments, made at the expense of the French government, are here, for the first time, published in this country.

A Dictionary of Arts, Manufactures, and Mines. By Andrew Ure, M.D. London. Longman and Co.

We have now come to a final notice of this work, and we cannot dismiss it without presenting to our readers a few more extracts. The following is from the article on slate, and gives a brief sketch of the localities in which that material is found:—

Clay-slate.—This substance is closely connected with mica; so that uninterrupted transitions may be found between these two rocks in many mountain chains. It is a simple schistose mass, of a bluish-gray or grayish-black colour, of various shades, and a shining, somewhat pearly internal lustre on the faces, but of a dead colour in the cross fracture.

Clay-slate is extensively distributed in Great Britain. It skirts the Highlands of Scotland, from Lochlomond by Callender, Comrie, and Dunkeld; resting on, and gradually passing into mica-slate throughout the whole of that territory. Roofing-slate occurs, on the western side of England, in the counties of Cornwall and Devon; in various parts of North Wales and Anglesea; in the north-east parts of Yorkshire, near Ingleton, and in Swaledale; as also in the counties of Cumberland and Westmoreland. It is likewise met with in the county of Wicklow and other mountainous districts of Ireland.

All the best beds of roofing-slate improve in quality as they lie deeper under the surface; near to which, indeed, they have little value.

A good roofing-slate should split readily into thin even laminæ; it should not be absorbent of water either on its face or endwise, a property evinced by its not increasing perceptibly in weight after immersion in water; and it should be sound, compact, and not apt to disintegrate in the air. The slate raised at Eisdale, on the west coast of Argyllshire, is very durable.

Cleaving and dressing of the slates.—The splitter begins by dividing the block, cut lengthwise, to a proper size, which he rests on end, and steadies between his knees. He uses a mallet and a chisel, which he introduces into the stone in a direction parallel to the *folia*. By this means he reduces it into several manageable pieces, and he gives to each the requisite length, by cutting cross grooves on the flat face, and then striking the slab with the chisel. It is afterwards split into thinner sections, by finer chisels dexterously applied to the edges. The slate is then dressed to the proper shape, by being laid on a block of wood, and having its projecting parts at the ends and sides cut off with a species of hatchet or chopping-knife. It deserves to be noticed, that blocks of slate may lose their property of divisibility into thin laminæ. This happens from long exposure to the air, after they have been quarried. The workmen say, then, that they have lost their waters. For this reason, the number of splitters ought to be always proportioned to the number of block-hewers. Frost renders the blocks more fissile; but a supervening thaw renders them quite refractory. A new frost restores the faculty of splitting, though not to the same degree; and the workmen therefore avail themselves of it without delay. A succession of frosts and thaws renders the quarried blocks quite intractable.

This account is, however, rather meagre, as it totally omits one of the great districts, that of Furness, in Lancashire, which supplies slate of excellent quality, and much used in that neighbourhood. There is no distinction made between the several varieties, and the manner in which the locality is determined by the colouring of the slate, the slates of Cornwall and Westmoreland differing totally in respect to colour. The application of slate also as a paving material, and its applicability in solemn decoration, as for tombstones, library chimney-pieces, slabs, &c., are not alluded to. The ensuing account of the manufacture of stained glass is rather more chemical than practical:—

Stained Glass.—When certain metallic oxides or chlorides, ground up with proper fluxes, are painted upon glass, their colours fuse into its surface at a moderate heat, and make durable pictures, which are frequently employed in ornamenting the windows of churches as well as of other public and private buildings. The colours of stained glass are all transparent, and are therefore to be viewed only by transmitted light. Many metallic pigments, which afford a fine effect when applied cold on canvas or paper, are so changed by vitreous fusion as to be quite inapplicable to painting in stained glass.

The glass proper for receiving these vitrifying pigments, should be colourless, uniform, and difficult of fusion; for which reason crown glass, made with little alkali, or with kelp, is preferred. When the design is too large to be contained on a single pane, several are fitted together, and fixed in a bed of soft cement while painting, and then taken asunder to be separately subjected to the fire. In arranging the glass pieces, care must be taken to distribute the joinings so that the lead frame-work may interfere as little as possible with the effect.

A design must be drawn upon paper, and placed beneath the plate of glass; though the artist cannot regulate his tints directly by his pallet, but by specimens of the colours producible from his pallet pigments after they are fired. The upper side of the glass being sponged over with gum-water, affords, when dry, a surface proper for receiving the colours, without the risk of their running irregularly, as they would be apt to do, on the slippery glass. The artist first draws on the plate with a fine pencil, all the traces which mark the great outlines and shades of the figures. This is usually done in black, or, at least, some strong colour, such as brown, blue, green, or red. In laying on these, the painter is guided by the same principles as the engraver, when he produces the effect of light and shade by dots, lines, or hatches; and he employs that colour to produce the shades, which will harmonize best with the colour which is to be afterwards applied; but for the deeper shades, black is in general used. When this is finished, the whole picture will be represented in lines or hatches similar to an engraving finished up to the highest effect possible; and afterwards, when it is dry, the vitrifying colours are laid on by means of larger hair pencils; their selection being regulated by the burnt specimen tints. When he finds it necessary to lay two colours adjoining, which are apt to run together in the kiln, he must apply one of them to the back of the glass. But the few principal colours to be presently mentioned, are all fast colours, which do not run except the yellow, which must therefore be laid on the opposite side. After colouring, the artist proceeds to bring out the lighter effects by taking off the colour in the proper place, with a goose quill cut like a pen without a slit. By working this upon the glass, he removes the colour from the parts where the lights should be the strongest; such as the hair, eyes, the reflection of bright surfaces and light parts of draperies. The blank pen may be employed either to make the lights by lines, or hatches and dots, as is most suitable to the subject.

By the metallic preparations now laid upon it, the glass is made ready for being fired, in order to fix and bring out the proper colours. The furnace or kiln best adapted for this purpose, is similar to that used by enamellers.—[See ENAMEL, and the *Glaze-kiln*, under POTTERY.] It consists of a muffle or arch of fire-clay or pottery, so set over a fireplace, and so surrounded by flues, as to receive a very considerable heat within, in the most equable and regular manner; otherwise some parts of the glass will be melted; while, on others, the superficial film of colours will remain unvitrified. The mouth of the muffle, and the entry for introducing fuel to the fire, should be on opposite sides, to prevent as much as possible the admission of dust into the muffle, whose mouth should be closed with double folding-doors of iron, furnished with small peep-holes, to allow the artist to watch the progress of the staining, and to withdraw small trial slips of glass, painted with the principal tints used in the picture.

The muffle must be made of very refractory fire-clay, flat at its bottom, and only 5 or 6 inches high, with such an arched top as may make the roof strong, and so close on all sides as to exclude entirely the smoke and flame. On the bottom of the muffle a smooth bed of sifted lime, freed from water, about half an inch thick, must be prepared for receiving the pane of glass. Sometimes several plates of glass are laid over each other with a layer of dry pulverulent lime between each. The fire is now lighted, and most gradually raised, lest the glass should be broken; and after it has attained to its full heat, it must be kept up for 3 or 4 hours, more or less, according to the indications of the trial slips; the yellow colour being principally watched, as it is found to be the best criterion of the state of the others. When the colours are properly burnt in, the fire is suffered to die away, so as to anneal the glass.

The description of an Artesian well, at Mortlake, is interesting, but it appears to us that it should be received with some caution as an example, for it seems by no means satisfactory as a general rule that water would be found in the soft chalk.

ARTESIAN WELLS.—The following account of a successful operation of this kind, lately performed at Mortlake, in Surrey, deserves to be recorded. The spot at which this undertaking was begun, is within 100 feet of the Thames. In the first instance, an auger, seven inches in diameter, was used in penetrating 20 feet of superficial detritus, and 200 feet of London clay. An iron tube, 8 inches in diameter, was then driven into the opening, to dam out the land-springs and the percolation from the river. A 4-inch auger was next introduced through the iron tube, and the boring was continued until, the London clay having been perforated to the depth of 240 feet, the sands of the plastic clay were reached, and water of the softest and purest nature was obtained; but the supply was not sufficient, and it did not reach the surface. The work was proceeded with accordingly; and after 55 feet of alternating beds of sand and clay had been penetrated, the chalk was touched upon. A second tube, 4½ inches in diameter, was then driven into the chalk, to stop out the water of the plastic sands; and through this tube an auger, 3½ inches in diameter, was introduced, and worked down through 35 feet of hard chalk, abounding with flints. To this succeeded a bed of soft chalk, into which the instrument suddenly penetrated to the depth of 15 feet. On the auger being withdrawn, water gradually rose to the surface and overflowed. The expense of the work did not exceed 300*l*. The general summary of the strata penetrated is as follows:—Gravel, 20 feet; London clay, 250; plastic sands and clays, 55; hard chalk with flints, 35; soft chalk, 15;= 375 feet.

We cannot leave this work without again expressing our opinion of its general utility. Executed as it is under the guidance of one man, it must necessarily partake of the defects of his limited experience; but in all those departments which may be considered Dr. Ure's own, the matter possesses more than average merit. The chemical portions are essentially good, but in many of the technical parts a want of acquaintance with the latest processes is observable. In our own branches we have before remarked on this deficiency, and of course the same observation extends to many arts and manufactures beyond the limits of our critical sphere. Thus, the article on button making is extremely erroneous, and in that on black dyes we find no mention of the French processes, although it is notorious that there is a marked difference between their method and our own. Generally we think that the Doctor might have paid more attention to the French and German Encyclopedias of Trades, from which many interesting illustrations might have been obtained. As the first work of its class in the field, however, it possesses merits peculiarly its own, and a right of exemption from blame, where one has done so well; and it may be consulted usefully by all, as containing a mass of information nowhere else to be found.

British Critic and Theological Review.—No. 50.

Do not let our readers be startled by this title, or imagine that we are going to *edify* them by a theological disquisition; no, we merely call their attention to the last number, because it contains two architectural papers, which might, but for our doing so, quite escape their notice. One of them is entitled "Interior Decorations of English Churches," the other is a review of "Pugin's Contrasts;" and it is to this latter that we shall confine our remarks, not having as yet perused the first one, except in a very hurried manner. Whether Welby Pugin will think proper to bring out a pamphlet in reply to this article, as he did in answer to—or, rather, by way of attempt at answering—certain Strictures upon his book in *Fraser*, remains to be seen. But the reviewer certainly does not spare *Mrs. Candour* Pugin, as he has been styled in some other publication; the most he does is to throw him a sop by praising his drawings, which, he says, "exhibit an exquisite taste, and confirm us in our previous opinion, that Mr. Pugin is the first Gothic architect of the age." It is difficult to make out whether this be intended as ironical or not: yet, if it be actually intended as praise, it puzzles us still more, for coarser scratches than are the plates to the "contrasts" can hardly be imagined; while, as every one at all acquainted with the style must admit, no little of the character and charm of Gothic architecture depends upon the beautiful forms and execution of the details. It is, besides, chiefly with respect to detail and decoration —in which he is said to be unsparing—that Mr. P. has much pretension to the name of architect;—at least, we have not seen any designs, or heard of his having ever done any thing, except in mere fittings up. We do not say that he is capable of achieving nothing more, but merely mean that there is no evidence to show that he is fairly entitled to the praise of being "the first Gothic architect of the age," since, had he executed any thing which would sanction it, it would hardly remain a secret; unless Mr. Pugin's buildings are to be classed among those things whose fate it is "to be," as some one has observed, "exceedingly famous, yet little known." A little further on he gets another *sop*, where it is said, "Homer was blind, and Mr. Pugin cannot argue;"—it might have been added, nor can he spell. The reviewer has pointed out his peculiar mode of spelling Windsor on one of his plates, and in another he has converted Mr. Brayley into Mr. Bragley, which howe er may pass as one of those unaccountable intentional blunders people are apt to fall into. The principle upon which Mr. P. planned his "Contrasts" is well exposed, and shown to be one by which any person may make good any argument, merely by bringing forward all that makes for it and taking no notice of the ugly facts that make against it.

"Of the remaining 'Contrasts,'" says the reviewer, "we will only ask whether it is fair to compare a common cast-iron pump with a handsome stone conduit, or Sir John Soane's house with the work of any sensible architect of any age or country?" That last remark touches us to the very quick, for it puts us quite out of conceit with the "house, No. 13, Lincoln's-inn Fields;" which, belonging as it does, or is fancied to do, to the public, is the house of every Englishman.

However, we will venture to prescribe the article to our readers, who may wash it down either with "*Vin. Port,*" or "*Aq. pura.*"

Penny Cyclopædia: Article, "London."

The 74th part of this publication deserves to be pointed out by us to our readers, as containing, under the head of "London," an able though brief architectural review of the principal buildings in the metropolis; accompanying which there is an excellent table of them, arranged chronologically in centuries, with the respective dates and architects' names, and further remarks on them in a separate column. Such an architectural synopsis is a quite novel and no less happy idea; and it is so exceedingly useful for reference, that we have no doubt the same plan will be henceforth adopted in other works. Such a table ought, in fact, invariably to accompany the *Guide Book* of any city, if merely to serve as an index, pointing out at a glance all the buildings most worthy of note, and the architects by whom they were erected.

The table we are now speaking of does not profess to be a complete list of all the public edifices in the metropolis, but merely of such as have pretension to rank as works of architecture; whereas in the other case, a great many would have been included which possess no architectural interest whatever. It is, as we have said, divided into centuries, beginning with the seventeenth; and of the seventy-three buildings mentioned in it, no fewer than fifty-three have been erected in the course of the last thirty years, or from 1808 to 1838; a tolerably striking proof how much more than at any former period has been done in our own time, especially if we further take into account street architecture and general improvements. As a specimen, we shall extract this table:—

TABLE OF PUBLIC BUILDINGS MOST WORTHY OF NOTICE FOR THEIR ARCHITECTURE.

	Date.	Architect.	Remarks.
Seventeenth Century.			
Whitehall Chapel	1619	Inigo Jones	Chiefly admirable as the finest specimen of pure Italian.
York Stairs	1626	Ditto	
St. Paul's, Covent Garden	1631	Ditto	Tuscan, distyle in antis.
Temple Bar	1670-2	Sir C. Wren	
The Monument	1671-7	Ditto	Fluted Doric column; total height, including pedestal, &c., 202 feet.
St. Stephen's, Walbrook	1672-9	Ditto	Exterior concealed by houses; interior over-praised; chiefly remarkable for its dome.
St. Paul's Cathedral, begun	1675	Ditto	Extreme length, 500 feet; height to top of cross, 360.
Eighteenth Century.			
St. Paul's finished	1710	J. James	Style Italo-Roman; exterior both magnificent and picturesque, though not faultless.
St. George's, Hanover-square	f. 1724	J. Gibbs	Portico hexastyle, Corinthian.
St. Martin's	1721-6	Ditto	Portico hexastyle, Corinthian; the general style bad.
St. George's, Bloomsbury	f. 1731	Hawksmoor	Ditto, ditto; Campanile excellent.
Mansion House	1739-53	Dance	
Westminster Bridge	1739-50	Labelye	Length 1066 feet.
Ironmongers' Hall	1748	Holden	Italian Ionic on basement.
Horse Guards	1751	W. Kent	
Blackfriars Bridge	1760-70	R. Mylne	Length 1000 feet.
Excise Office	1769	James Gandon	Plain in design, but of most commanding aspect.
Adelphi	1770	Adams	Admirable in design and character
Newgate	1770-82	Dance	Though poor in parts, a good example of Italian. River front 590 feet.
Somerset House	1776	Sir W. Chambers	East front handsome.
Clerkenwell Sessions House	1780	Rogers	Very picturesque in parts.
Bank	1789-1826	Sir J. Soane	Hexastyle loggia, Grecian Ionic, sculptured frieze and pediment.
India House	1799	R. Jupp	
Nineteenth Century.			
Covent-Garden Theatre	1808-9	Sir R. Smirke	Grecian Doric; tetrastyle portico.
Drury-Lane Theatre	1811-12	B. Wyatt	
Opera-House, altered	1818	Nash and Repton	
Bethlehem Hospital	1812-15	J. Lewis	Portico hexastyle, Ionic. Length 560 feet.
Waterloo Bridge	1811	J. Rennie	Length 1326 feet.
Mint	1811	Sir R. Smirke	Grecian Doric on a basement.
Custom House	1813	D. Laing	The Long Room and centre of the river front quite altered after the accident in 1826. Length 484 feet.
London Institution	1815-19	W. Brooks	
St. Pancras Church	1819-22	W. and H. W. Inwood	The finest copy of Athenian Ionic.
Post-Office	1823-9	Sir R. Smirke	Hexastyle, Ionic portico; extent of front 390 feet.
Hanover Chapel, Regent-street	1823-5	R. C. Cockerell	Tetrastyle Ionic portico.
British Museum (new buildings)		Sir R. Smirke	
Buckingham Palace	1825	Nash and Blore	
College of Physicians and Union Club-House	1825-7	Sir R. Smirke	Grecian Ionic.
Board of Trade	1824-6	Sir J. Soane	Roman Corinthian.
Colosseum	1824	D. Burton	Hexastyle, Grecian Doric portico attached to a polygon 130 feet diameter.
London Bridge	1825-31	J. Rennie	Length 920 feet.
St. Mark's, North Audley-street	1825-8	Gandy-Deering	Florid Grecian Ionic; façade small, but of rich design.
St. Katherine's Hospital	1826	Poynter	Chapel Gothic; the rest Old English Domestic.
Hall, Christ Church Hospital	1826	J. Shaw	Later Gothic.
Scotch Church, Regent-square	1827-8	W. Tite	Gothic.
St. George's Hospital	1827	W. Wilkins	Portico tetrastyle, with square pillars.
London University	1827-9	Ditto	Façade not completed; decastyle portico, and dome.
New Corn Exchange	1827-8	G. Smith	Grecian Doric, with pleasing originality of design.
St. Paul's School	1827	Ditto	Hexastyle, Tivoli Corinthian on a basement.
Law Institution, Chancery-lane	1827-9	L. Vulliamy	Grecian Ionic hexastyle.
Archway, Green Park	1828	D. Burton	
Fishmongers' Hall	1827-34	H. Roberts	Grecian Ionic.
Athenæum Club	1829	D. Burton	Its bas-relief frieze, the only specimen in London.
Goldsmiths' Hall	1829-35	P. Hardwick	Italian; magnificent, yet somewhat heavy, and basement poor.
Exeter Hall	1830-1	Gandy-Deering	Greco-Corinthian, distyle in antis.
St. Dunstan's in the West	1830-32	J. Shaw	Gothic; handsome Louvre tower.
York Column	1830-36	B. Wyatt	Total height, including statue, 137 feet 9 inches.
Lowther Arcade	1830	J. Turner	Greco-Italian, with pendentive domes.
Hungerford Market	1831-3	C. Fowler	
Travellers' Club	1831	C. Barry	Choice specimen of the best Italian style, particularly the design of garden front.
Charing-Cross Hospital	1830-1	D. Burton	
St. George's, Woburn-square	1832	L. Vulliamy	Gothic; handsome spire.
Westminster Hospital	1832	Inwoods	Modernized Gothic.
National Gallery	1832-7	W. Wilkins	Grecian; total extent of front 458 feet.
State-Paper Office, St. James's Park	1833	Sir J. Soane	One of his chastest productions. Style, Italian.
Pantheon Bazaar	1834	S. Smirke	
School for Indigent Blind	1834-7	J. Newman	Style Tudor, white brick and stone; central tower of rich design.
St. Olave's School	1835	J. Field	Style Elizabethan, red brick and stone.
College of Surgeons	1835-6	C. Barry	Italianized Grecian.
United University Club	1836-7	Sir R. and S. Smirke	Style a modified Italian; bas-relief panels.
St. James's Theatre	1836	S. Beazley	
Railway Terminus, Euston-square	1837-8	P. Hardwick	A Grecian Doric propylæum on an imposing scale.
London and Westminster Bank	1837-8	Cockerell and Tite	Style modified Italian; singular but pleasing.
Synagogue, Great St. Helen's	1837-8	J. Davies	Style Italian; interior rich and tasteful.
Reform Club	1838	C. Barry.	Italian.

1. *The Laws of Harmonious Colouring.* By D. R. HAY. London: W. S. Orr. 1839.
2. *Lectures on Colour.* By HYDE CLARKE, Esq.
3. *Transactions of the Society of Arts for* 1838.

The subject of light and colour is one of the most important which now engages the scientific world; and in consequence of the sensation created by photography, hardly a day elapses without some new or startling discovery. It is only, indeed, of late, and we hardly know if we may say unanimously, that a theory of light has been adopted which is at all satisfactory. Hypothesis and system, like the marshalling of an army, is the first step for the advancement of a science, and we may well wonder, after so many brilliant discoveries made by the greatest men, to find the science of light less advanced than chemistry and geology, which are things of yesterday. This has arisen primarily from the adoption of a bad system, which is tantamount to no system at all, or worse; for until recently, the corpuscular theory, or that which teaches the direct procession of light from the sun, ruled with all the weight which the name of its great patron, Newton, could give to it. Its supporters also forgot the principles of their master, the man who considered himself like a loiterer, picking up pebbles on the shores of the vast ocean of science, and blindly maintained the justice of his opinions, without any compunction that he too might err; and it seems, indeed, a principle derived from the weakness of human nature—that we must ever worship men, and not truth. This ridiculous calling ourselves of Paul and of Cephas was never perhaps carried to a more extraordinary length than when lately before the Ashmolean Society a defence of Newton's opinions was read, and it was endeavoured to be proved that he was a supporter of those principles which now have the predominance. A blind result of our wretched ignorance, that we cannot judge for ourselves, but must follow a leader, whom, if we had but judgment, we should know how to be guided by; but one error found out, rather than again be exposed to the consequences of our neglect, we dash our once-favoured idol on the ground. Another important cause which has doubtless contributed to the retardment of this science has been the circumstance that it has been courted primarily and almost exclusively by mathematicians; whereas, from its being the disposition of naturalists to observe, and of mathematicians to reason, the wholesome course of a science is to collect facts, in the first instance, and to arrange them afterwards. In good truth, optics has been studied as by a foreigner, who trusting to his memory rather than his knowledge, speaks English from a vocabulary, instead of with the freedom of common life.

It is doubtless from this want of progress of the science, and from its not having attained a popular and practical form, that we must attribute that continued neglect of colour in decoration, which was first caused by the puritanical destruction of the arts. Even the commonest principles of contrast and harmony, which would not take an hour's teaching in a common school, are not diffused, and it cannot be astonishing if we suffer from a universal ignorance in our houses and our manufactures. The Egyptians, however, possessed by observation what neither science nor observation has taught us; and although they used only the simplest colours, yet the manner in which they were applied in their temples and in their tombs may justly excite our admiration. Although so restricted in the number of their colours, the Egyptians produced many bold effects, when they had comparatively no media to soften down their great masses. Harmony is the general characteristic of Greek decoration, and, by the employment of weak tints, they managed to attain great delicacy of expression. Blue, from its coolness, they used very much in masses, and it greatly aided the purity of their designs. They were very happy, too, in the management of black and its contrasts, yellow and white, and used them much more aptly in the decoration of objects than we do. They also made colour a handmaid to the sculptural arts, as may yet be seen on some of the statues in the British Museum, and in other places; and they even mixed different coloured marbles for such objects, as the leopard with black marble spots in the Museum at Naples. They used painting also very extensively on the exterior of their edifices, and with the most happy effect. With regard to the manner in which the Moors used this delightful vehicle of harmony, nothing can be more attractive than the specimens of their internal decoration with which we are acquainted. We are happy to see the increasing use of fresco, but we want more public examples, such as may animate the public taste which already exists. The painted ceilings at Greenwich and Hampton Court never fail to attract the attention of the public, and there can be no doubt that they would fully appreciate whatever might be done. No places can be more appropriate for this improvement than the public museums, and however wretched may be their condition we still feel more comfortable in the old rooms at the British Museum than in the barren walls of the new. The walls indeed should be a running commentary on the contents, like the Glyptotheca and the Pinacotheca, or like in the Palace of the Conservatori, in the Capitol at Rome, where the Roman statuary is accompanied by friezes illustrative of the history of the republic. It cannot be said that this would detract from the contents of the Museum, as we have the example of the Louvre, where no one turns away from the immortal works to the gorgeous ceiling. By this employment of painters and sculptors an impulsive force would be given to architecture, and architects would more than regain what they might expend in the first instance. The fine arts, indeed are not to be promoted like the livers of French geese, by an artifical plethora of one member, nor are they like a tree where the remaining limbs profit by the pruning down of the rest, but they must be cultivated in common, and to neglect any individual branches is to strike at the roots and destroy the nourishment of the rest.

The operations of colour are determined by strict mathematical laws, and colours possess, if it may be so termed, an atomical constitution. Newton, it may be remembered, determined by the prismatic experiment that there were seven simple colours, because he could not decompound any of them; but practical artists had long rejected this doctrine, from being able to produce the whole from three. Before the determination of this question Mr. Hay had performed some very ingenious experiments, which he relates, by which he mixed the yellow and red rays and produced orange, the yellow and blue green, and so on through the others; thus producing by synthesis what Newton could not effect by analysis. The subject has now been determined by Sir David Brewster, and it is now taught that light is composed of only three simple colours, yellow, red, and blue; that if these be reflected in their due proportion, which is in an active state, white is produced; if absorbed, which is a passive state, black is the result.

The powers of these, as determined by Field, are yellow, three; red, five; and blue, eight. Mr. Hyde Clarke has given an analysis of the prismatic spectrum, by which much the same result is produced. Arranging the simple and compound colours under the heads of yellow, red, and blue, and dividing them by twenty, the following is the result:—

	Yellow.	Red.	Blue.
Simple . . .	48	45	60
Orange	10	17	
Green	16	0	44
Indigo, &c. . .	0	54	66
Divide by 20	74	116	170
	3	5	8

These three simple colours, by their combination, form the secondary, red and yellow, orange, 8; yellow and blue, green, 11; red and blue, purple, 13. The simple colours are softened down by the secondaries which they form in combination with the other two colours, yellow by orange and green; red by orange and purple; blue by green and purple; and they are contrasted by a combination of the two colours, necessary to make up the triad, which forms the compliment of the colour with 16; as yellow 3 by green 13, 16; red 5 by green 11, 16; and blue 8 by orange 8, 16. The same principle prevails in nature in many extraordinary phenomena, as, for instance, in that discovered by Buffon, when if you look steadily for some time on a spot of yellow colour, placed on a black or white surface, it will appear surrounded by a purple tinge; and so in the phenomena of polarised light also, if the ordinary ray be red or blue, the extraordinary ray will be green or orange. Sir John Robison related before the French institute a remarkable instance of this contrasting power in nature: a surgeon of his acquaintance bled a patient in a porcelain basin having green flowers at the bottom, and some time afterwards it was observed that on the surface of the blood were formed red flowers corresponding to the green; and this experiment was repeated several times to ensure its not being an accident. In music the same thing occurs, where there are three simple notes, C E and G, and if any one of them be sounded it will be accompanied by the other two as the harmonics; this may be perceived in the sound of a bell in succession, and in an accompaniment on the string of a violincello. From the combination of the secondaries proceed the testiaries, orange and green form citron, 19; orange and purple, russet, 21; and green and purple, olive, 24. These act with regard to the secondaries as the secondaries do to the primaries, and their neutralising power is 32: thus orange, 8, is contrasted by olive, 24; green, 11, by russet, 21; and purple, 13, by citron, 19. Besides their perfect intensity, all the colours can be raised towards darkness, which is called shade, and lowered towards light, called tint; and the compound colours have besides the variation of hue, by which is meant a greater admixture of any of the composing colours—thus orange may be made from the yellowest to the reddent. In a composition a strict equality must be preserved in these variations of shade, tint, and hue.

Light holds a most intimate connection, both in its constitution and operations, with all the other sciences, and must ultimately attain a most important rank among the sciences, and repay back to them what it has received from them. Many of the phenomena are only to be explained by reference to hydro-dynamic principles, and it is from them that the undulatory theory, under the fostering care of Young, attained its present preponderance. The relation of the laws of light to acoustics and music are most astonishing in their resemblance; and Field, has arranged octaves of a musical and chromatic. The phenomena called polarised light, however beautiful, are not confined in their application to an entertaining exhibition, but present philosophers with the most delicate instruments for ascertaining the constitution of bodies. It is an optical law that all transparent bodies become coloured when they are formed into plates attenuated beyond certain limits, and moreover, that the particular colours, which under these circumstances they show, are dependent upon the degree of attenuation. It was thus that Newton determined that the thickness of the thinnest part of the soap-bubble, when colours are first visible, is no more than $\frac{1}{25000}$ of an inch, and that before it bursts it attenuates to $\frac{1}{40000000}$; and by the same means we know that the transparent wings of some insects are not more than $\frac{1}{100000}$ of an inch in thickness. For an admirable explanation of the laws of interference, and for a beautiful apparatus for polarising light, for which he received the silver medal, we cannot do better than to refer to the paper, No. 1, of Mechanics on the "Transactions of the Society of Arts," by Mr. Goddard, of the Polytechnic Institution. In this he ably demonstrates all the paradoxes of waves producing stillness; sound, silence; and light, darkness.

The chemical relations, however, present features which become of practical interest to the architect and engineer, and their full extent is yet unascertained. M. Mitzcherlich observed that light influenced crystallisation, and produced dimorphism, and from prismatic forms changed the crystals of sulphate of nickel into that of the square octahedron, without any apparent change in external form or appearance. Light appears to possess two properties, sometimes separate and sometimes conjoined; namely, that of illumination, and that of warmth. Herschel, Wollaston, Ritter, and Scheele have shown that there are rays transmitted from the sun which do not illuminate, and yet produce more heat than the visible rays, while there are other invisible rays distinguished by their chemical effects. Scheele discovered that a glass mirror, held before the fire, reflected the rays of light, but not those of caloric; but that when a metal mirror was placed in the same position, both light and heat were reflected. Herschel found that the invisible rays emitted by the sun have the greatest heating power. In an experiment on the heating power of the different rays of the spectrum, he found that when the thermometer was placed out of the range of the colored rays, it rose still higher than in the red ray, which he considered the strongest; the heating power of these invisible rays was greatest at the distance of half an inch beyond the red ray, but it was sensible at the distance of an inch and a-half. The relative powers of colours in absorbing light and heat vary very much; and Franklin's experiment illustrative of this is well known:—He laid on the snow four pieces of paper, white, yellow, blue, and black, and when he went to see the effect, he found that the black paper had sunk an inch or two deep, the blue a good deal, the yellow very little, the white not at all. The relative chemical power of the several colours is not however known, very few experiments having been made, and those conflicting. Mrs. Somerville considered the violet ray as the strongest, and the green as the most sluggish; and the experiments of Mr. Robert Mallet, related last year before the British Association, are to the same effect. He gives the following as the period of complete decoloration of recent solutions of caustic potass, by the chemical action of light under different shades:—

Violet glass exposed to air	30 hours
Ditto closed	50
Transparent flint glass	80
Ditto closed	115
Yellow	170
Blue	185
Orange	190
Red	200
Green unchanged in	200

The recent experiments of Sir John Herschel, however, lead us to expect very different results, and the establishment of more satisfactory laws. The way, in which his law of colour acts as an agent or reagent in economical pursuits will perhaps however be better illustrated by extracts from the following able paper by Mr. W. Kennish, carpenter on board H.M.S. Victory, at Portsmouth, at p. 101. of the "Transactions of the Society of Arts:"—

There is nothing that will prove this evil more than by observing the black streaks of a ship after being in a tropical climate for any length of time. It will be found that the wood round the fastenings is in a state of decay, while the white work is as sound as ever: the planks that are painted black will be found split in all directions, while the frequent necessity of caulking a ship in that situation likewise adds to the common destruction; and I am fully persuaded, that a piece of wood painted white will be preserved from perishing as long again, if exposed to the weather, as a similar piece painted black, especially in a tropical climate.

I have heard many men of considerable experience say, that black is good for nothing on wood, as it possesses no *body* to exclude the weather. This is, indeed, partly the case; but a far greater evil than this attends the use of black paint, which ought entirely to exclude its use on any work out of doors, viz., its property of absorbing heat. A black unpolished surface is the greatest absorber and radiator of heat known; while a white surface, on the other hand, is a bad absorber and radiator of the same: consequently, black pain is more pernicious to the wood than white. * * *

Wood, having a black surface, will imbibe considerably more heat in the same temperature of climate than if that surface was white; from which circumstance we may easily conclude, that the pores of wood of any nature will have a tendency to expand, and rend in all directions, when exposed under such circumstances,—the water of course being admitted, causes a gradual and progressive decay, which must be imperceptibly increasing from every change of weather. The remedy to so great an evil is particularly simple, viz., by using white, instead of black paint, which not only forms a better surface, but is a preventive to the action of heat, and is more impervious to moisture. The saving of expense would also be immense, and I am convinced that men of practical experience will bear me out in my assertion.

Two striking circumstances, which have fallen under my own immediate notice, deserve mention. The first was the state of H. M. Sloop Ringdove, condemned by survey at Halifax, N.S., in the year 1828.

This brig had been on the West India station for many years. On her being found defective, and a survey called, the report was to the effect that the wood round all the fastenings was totally decayed in the wake of the black, while that in the wake of the white was as sound as ever; a striking proof of the different effect of the two colours.

The next instance I shall mention relates to H. M. Ship Excellent, of 98 guns (formerly the Boyne).

This ship is moored east and west, by bow and stern moorings; consequently, the starboard side is always exposed to the effects of the sun, both in summer and winter. In this situation her sides were painted in the usual manner of a ship of war, viz., black and white, of which by far the greater part is black; this latter portion on the starboard side I found it impossible to keep tight; for, as often as one leak was apparently stopped, another broke out, and thus baffled the skill of all interested. In the meantime, the side not exposed to the rays of the sun remained perfectly sound. I then suggested to Mr. Kennaway (the master caulker of her Majesty's dockyard at Portsmouth), who had previously given the subject consideration, the advantage likely to be derived from altering the colour of the ship's side from black to white Captain Hastings having approved of the alteration, the ship was painted a light drab colour where it was black before, upon which the leaks ceased, and she has now continued perfectly tight for more than twelve months; and, indeed, I can confidently state that the ship will last as long again in her present situation, as she had begun to shrink and split to an astonishing extent when the outside surface was black, and which has entirely ceased since the colour was altered.

This result of black we may readily believe, when we recollect Saussure's experiments on the Alps, when he placed on a mountain a box, lined with black cloth, with the side next the sun, closed by three panes of glass at a little distance apart the one from the other, and found the thermometer rise 30° in two hours from the concentration of the sun's rays. We might give a greater number of examples, and particularly of the manner in which it bears upon agriculture, but it may perhaps be sufficient if we remind our readers that Mr. Kennish's experiment is going on at a fearful scale on many extensive pieces of woodwork, to which the attention of architects and engineers might be directed.

Mr. Hay's book is the fourth edition of a work decidedly esteemed for its practicability, cheapness, and the soundness of its principles, and to it is added in this edition an excellent Treatise on House-painting. It is indeed the cheapest and best work on the subject, and one to which our readers of all classes may refer with advantage and delight.

To diffuse a taste for this neglected branch of art, and we should be indeed pleased to see the people waken up from this lethargy and call on our architects to revive the beauties of internal decoration. King Louis' architects are alive in Bavaria, painting houses, inside and out, in lithochromy, and why should painting in England remain where it was in Sir James Thornhill's time, at the top of the dome of St. Paul's, instead of being in our palaces, our public buildings, and our houses.

A Practical Treatise on Bridge Building. By E. Cresy, Esq. Arch. C.E., F.S.A., &c. London: John Williams.

We hail with pleasure the appearance of this work on Bridges, which is got up with great care, and with numerous plates, beautifully and clearly engraved. The first part now before us contains twenty plates, which will be found of great value both by the architect and the engineer.

The first series relates to London Bridge, constructed by Sir John Rennie; a work with which we know no other that can stand in comparison, except perhaps Waterloo Bridge. It is a monument indeed equally interesting from its grandeur, the boldness of the span of the arch, the simplicity of its style, and the durability of its material; one which must command admiration in future ages to as great a degree as it does now. It is interesting, no less from its own merits, than as a triumph over the obstacles which it had to overcome. The drawings consist of the plan, elevation and section, drawn to a small scale, and of the cofferdam, section, and centre, of one of the arches, the elevation of the centre arch, and section and plan of an abutment, drawn to a scale of twelve feet to an inch.

We have next the drawings of Stoneleigh Bridge in Warwickshire, constructed by the late John Rennie, and consisting of one arch, with two land arches in the abutments. The design of this work is beautifully balanced. We have also another drawing of a bridge by John Rennie over the River Earn in Scotland, consisting of three elliptical stone arches.

Of Bow Bridge, constructed by Messrs. Walker and Burgess, there are two plates. In our last number we gave the elevation of this bridge; but of course these engravings exhibit the design far better than our wood-cuts.

There is a plate of one of the brick arches of 70 feet square, constructed by Mr. Braithwaite, on the Eastern Counties Railway, for a viaduct over the River Lea. This bridge we have often admired for its symmetry and simplicity, and for the excellency of the workmanship. As a pendant to this is a plate of the Iron Bridge, constructed by Mr. Buck, over Fairfield-street, on the Grand Junction Railway: it is of 128 feet span, and 35 feet wide, and exhibits much ingenuity and peculiarity in its construction. We shall not be content with this single plate, but we expect, in the subsequent part of the week, to see more of the details. A few wood engravings of the iron-work, drawn on a large scale, and interspersed among the text, would exhibit it to advantage, and render it a peculiar object of study and interest.

We then have one of Perronet's celebrated works, the bridge of Saint-Maxence in France. This consists of three stone arches of 76 feet 9 inches span, and only 2 feet 7 inches rise. We are however by no means favourable to this mode of construction; for the arches are rendered so very flat, that the stone-work may be considered little better than a stone girder. If, too, the abutment should give way in the slightest degree, the disarrangement of the whole bridge would undoubtedly follow; nor are we greater admirers of the centering, for the fewer pieces of timber in a center is far better than having them cut up into short lengths and distributed as they are in the design before us.

Three plates exhibit sections of the naves of Bath Abbey church and of Wells cathedral and of Wells Chapter-house. These exhibit very clearly the construction of the vaulting and the advantages of the buttresses. Mr. Cresy has bestowed considerable pains in obtaining their correct dimensions from admeasurements taken on the spot, and he has endeavoured to show by diagrams the peculiar method adapted by the old architects in constructing the vaulting of our great churches. We regret that we have not time or space to devote to the examination of his portion of the work at present, although it is apparently of some value to architects, but we shall on a future occasion take a more extended view of it.

The present number seems rather to be intended as a sample of the future volume, than as a defined part of the work; the plates being taken indiscriminately so as to show the intended mode of procedure. As a specimen it excites high expectations, and if the remainder of the work exhibit the same skill it cannot fail to be an important accession to the libraries of both professions. The letter-press we understand will form one thick volume, and we shall look forward to it with some anxiety for the specifications and the descriptions of the plates; for until they are given it is almost impossible for us to enter satisfactorily into a consideration of the several bridges published in this work.

We have much pleasure in recommending the work to our professional readers, and doubt not that they will derive the same gratification from it, which we have ourselves. We must earnestly recommend to the Editors, as we did in noticing a similar work last month, the great utility of giving the specifications and full descriptions of the works, interspersed with wood engravings, showing the details at greater extent. Another most important feature, which cannot be neglected without injury, is, to give a particular description of the difficulties which occurred in the progress of the work, the peculiarities of the construction, the nature of the foundations, the velocity of the rivers and the thrust of the arch. Such particulars go far to decide the individual character of each work, are of incalculable use to the profession, and can not fail to render the volume doubly valuable.

Appendix to Railway Practice, containing a copious Abstract of the whole of the Evidence given upon the London and Birmingham and Great Western Railway Bills, when before Parliament, by S. C. Brees, C. E. &c. London: John Williams, 1839.

The advance of engineering as a profession, of course increases the extent of its social relations; and it has now, like many others, a body of jurisprudence, exclusively its own. The knowledge of this professional law is essential to the engineering student much more than to any other class of professional men; for the engineer is necessarily called upon to support, in their progress through parliament, bills for public works; and the manner in which evidence is given, and the effect which it produces, must of course depend upon the witness's acquaintance with previous practice. He is engaged too repeatedly in similar pursuits, before the courts of law, at the Quarter Sessions, and the other local tribunals; and has, in fine, much more to do with law than the surgeon, or any profession which has its own peculiar code.

For one branch of this pursuit the work before us presents us with a preparation, and it is executed with an ability which makes the profession highly indebted to Mr. Brees. He has here presented us with a condensed abstract of the evidence given on the London and Birmingham, and Great Western Bills, which in the original reports occupy three or four volumes. Mr. Brees has effected this by suppressing the irrelevant nonsense of counsel, and the repetition of the same questions, which it is sickening to read, and painful to hear.

Appended to the work is a very useful Glossary, so as to render it equally valuable to the non-professional reader; and at the end are six plates, r presenting the details of a six-wheel locomotive engine, constructed by Messrs. Hawthorne, of Newcastle-upon-Tyne. These plates are copied from the original drawings, furnished by the inventors, and give a very clear view of the arrangement of the machines.

Hints relative to the Construction of Fire-proof Buildings, and on the Failure to produce Sound and Estimable Architecture by the means at present usually adopted. By Alfred Bartholomew, Architect. London: John Williams.

This is a work written in a terse style, which will doubtless prove interesting to the profession. It contains much valuable matter on the present modes of construction, from which we make the following extract relative to fire-proof buildings:—

2. Buildings both public and private as now usually constructed, with their bond-timber, beams, rafters, joists, floorings, and other combustible materials, are, in fact, like little else than so many enormous fire-grates with wood and coals laid and prepared in them ready to be ignited by accident or design, to spread loss and ruin, and often the cruelest of deaths; and if the shells and other parts of buildings be of stone from Portland or from Bath, or of ordinary marble, or from any other of the calcareous quarries, such buildings form in fact but lime-kilns, ready to be brought into use by the first application of flame; and in this respect, edifices walled with the most beautiful calcareous free-stones and marbles fare the worst.

3. Sometimes in modern works, a pretence is made of rendering buildings fire-proof, by the adoption of a breast-summer, a girder, or some other small part of their fabrics, of cast-iron; but these applications, amid conflagration becoming heated by the masses of flaming timber about them, have the same effect as the insertion of an iron in a grate of blazing coals, and indeed increase the heat and danger, and generally by the application of water while hot snap and increase the ruin.

4. Security in public buildings can alone be obtained by the total abolition from them of combustible substances, except for the most immaterial parts of them:—centuries ago our ancestors having made this discovery, by the costly and immense loss of most of their sacred fabrics, rebuilt them with scarcely any wood in their composition, except in their roofs; and to this wisdom of experience, we almost owe the very existence of most of our churches.

5. The most poignant feelings of regret must take hold upon us, when we reflect, that our museums and other national and municipal depositories, are but expensive pyres for the future immolation of Grecian and Italian marbles, of Indian, Egyptian, and Mexican reliques, of Oriental and European manuscripts beyond price, and of scarce and irrecoverable literature gleaned from the whole world.

The timber floors and roofs of the Royal Library, that noble relict of the virtuous George the Third, are fated, notwithstanding the admirable care of the learned officers of the British Museum, piteously to perform its Suttee,—for fires mostly occur where they are least expected, and ravage most amid deposits the most precious.

Some persons may fancy, that to erect buildings fire-proof, will of necessity render them uncouth, inconvenient, and un-architectural:—nothing could be more erroneous.

Is the Pantheon at Rome either uncouth, inconvenient, or un-architectural? Do the same condemnations apply to the vaultings of St. Paul's, London, and to those of our other cathedrals? or, indeed, *is* the new lath and plaster ceiling to the minster of York architectural?

It may rather be said, that beauty of form and structure absolutely require them to be made fire-proof.

10. Roof-trusses may be made entirely of cast-iron, as are those to the new choir of St. Saviour's Church, Southwark; and a covering of tiles, of slates, or of metal, may be laid upon horizontal rafters of iron, without the intervention of any combustible material whatsoever.

14. One of the excellencies of vaulting is that in addition to affording the means of rendering edifices fire-proof, it adds very great architectural beauty to fabrics. There is scarcely any form which may not be covered in a graceful manner with vaults and domes, so as to fit exactly the walls, and afford the means of spanning every side of an apartment, whatever be its shape, with correct and strong arches, without distortion either on the plan or in the elevation, and combining justly with the architecture of the edifice. In fact, when an attempt is made, with deal, lath and plaster to render a modern apartment respectable in its decorations, it is frequently performed but by a costly yet fragile and consumable imitation of fire-proof vaultings.

We hope to have occasion, at a subsequent period, again to refer to it, and shall for the present dismiss it with a recommendation of its utility and conciseness.

Theoretical and Practical Essay on Bitumen; setting forth its uses in remote ages, and revival in modern times, and demonstrating its applicability to various purposes. London: Effingham Wilson.

This is a very useful pamphlet describing the various asphalte, their properties, and its application. We shall, in some future number, examine into the qualities of asphalte introduced in London, and see how far that material is applicable to engineering and architectural purposes.

MIXTURE TO PREVENT THE INCRUSTATION OF STEAM BOILERS.

MEMORANDUM.

Admiralty, 8th Jan., 1839.

The Lords Commissioners of the Admiralty, in calling the particular attention of all officers in command of steam vessels to the annexed abstract of a report from Lieut. Kennedy, late commanding Her Majesty's steam vessel Spitfire, and Mr. Johns, the first engineer of that vessel, are pleased to direct that the mixture therein described, which has been proposed by the latter officer to prevent incrustation on the inner surfaces of boilers, be generally made use of for that purpose in all Her Majesty's steam vessels. The directions as to the proportions of black lead and tallow are to be strictly followed, and the mixture is to be applied as often as circumstances will admit of it, every opportunity being taken as heretofore to remove from the boilers the small deposit which will still be formed.

Report of Lieut. Kennedy and Mr. Johns, engineer of Her Majesty's steam vessel Spitfire.—We beg leave to state that the proportion for a first class steamer should be about sixteen pounds of melted tallow and two of powdered black-lead, well mixed and laid on with a common tar-brush over the inside of the tubes and fireplaces, and other inside parts of the boilers that can be got at, every time after a passage of any length, as the more often it is done the better. *The boilers are to be blown out as usual every two hours*, for it is not to be supposed that, without proper attention being paid to this necessary duty, this mixture will prevent the incrustation from forming; the blowing off takes great part of it away while in solution, and what remains, after short trips, may be swept off by hand with a piece of oakum; and after long trips, should a thin incrustation remain on the plates, the slightest blow will cause it to fall off in large flakes covered with black-lead on the inner side, without the use of the chipping hammer, which only makes the plates rough and more ready to receive and retain the deposit, and otherwise injures the boilers, causing much labour to the men. Ten pounds of tallow and one and a half of black lead would be enough for the smaller steamers after each voyage; or, after a very long voyage, that quantity used twice.

The Spitfire ran from Malta to Corfu, from Corfu to Malta, from thence to Gibraltar, and back to Malta, with only one application of the mixture, from want of time.

We consider that the said mixture, if *frequently and properly applied, the same attention being paid to blowing, off as before* will cause the boilers to last at least a *fourth* longer, and will be found a great saving in coals and labour, doing away with the necessity of fresh water, (the Spitfire having had only one supply in her boilers for eighteen months); and we find that the longer and more often it is used the cleaner the boilers look inside.—*Nautical Magazine.*

FAILURE OF THE HYTHE BRIDGE AT COLCHESTER;

Mr. Braithwaite's Report thereon to the Corporation.

This bridge was erected from the plans of a local architect, over the river Colne, at a place called the Hyth, adjoining the town of Colchester, and up to which point the river is navigable for sailing vessels. The structure was completed, and the road formed and open for traffic by the latter end of March in the present year; although up to that time the centres had not been eased. On the 1st of April, on their attempting to remove the centres, the arch followed it; and in their cutting away a bracing-piece the whole structure suddenly fell in—the centres being then unable to sustain the weight thrown upon them. The dimensions of the bridge were as follows;—Span of the arch (which was segmental,) 58 feet—the rise or versed sine being ten feet thickness of arch throughout 1 foot 6 inches; and from face to face of ditto 23 feet. The longitudinal depth or thickness of the abutments 10 feet; vertical thickness of the abutments 5 feet—resting on planking laid transversely insills, which were bedded in a foot and a half of concrete, below which, was a loosish strata of gravel. The arch was turned in four half brick rings in cement, with about ten pieces of hoop-iron, bedded longitudinally between each ring, and four iron tye-rods with washers placed transversely through the arch; the spandrells were filled up with loose earth, and two small counterfeits, which were carried up in spandrell walls (with the addition of the face walls) had to resist the whole thrust of the arch. Mr. Braithwaite, the Engineer in Chief of the Eastern Counties Railway, was applied to by the corporation to report on the cause of the failure; and, after minutely examining the plans and remains of the structure, he gave it as his decided opinion, that the former were so radically bad that it was impossible for the structure to have stood; and on the other hand, that the workmanship was so defective, that with the best and most carefully prepared plans, it must have fallen. Mr. Braithwaite's estimate for a new bridge is £2,200—the cost of that just destroyed, was about £1,300.

The reverse quoins of the abutments have subsided about an inch and a half; the cement in the arch, it is apparent, was quite killed by the too great admixture of sand; at the keying-in of the arch, such a monstrous want of care was exhibited, as to be worthy of notice,—it appears they did not guage their courses, or if so, did not work to it; as, when they arrived at the course of key bricks, there was a space of about 4½ or 5 inches left: now instead of taking out about half-a-dozen or more courses of bricks—picking out the largest, laying them dry, and then grouting them in—they keyed-in with three-quarter ragged batts, laid longitudinally!

PUBLIC WORKS IN BELGIUM.

The public works projected in Belgium in the course of this year are numerous and of great utility, both in Brussels and the principal cities. The capital is to be embellished with four remarkable monuments; the new palace of justice, the plans for which promise one of the finest buildings of the kind in Europe; the glassed gallery of the passage St. Hubert, which will surpass in architectural beauty any thing of the kind either in Paris or London; the new public hospital of St. John; and the house of industry in the quartier Leopold. This last-named district is likely to be ornamented with a great number of hotels and first-rate houses, especially if, as may be expected, the Palais de Justice is erected in it. The new streets opened during the last year to the Faubourg of Saint Josseten Noode will be entirely finished this year, and at their point of union the new house of industry of the Faubourg will be built.

The construction of the station des Boyards, and that projected in front of the rue Neuve, will give birth to two other quartiers, traced on a regular plan, and ornamented with spacious squares and wide streets. A fourth quartier will be formed beyond the Boulevard of Waterloo, and several new streets are marked out in the fauxbourgs d'Ixelles, de Scharbeck, and de Flandre. Finally, it is proposed to complete the Boulevards, the abattoire, and, generally, all the public works which the state of the finances of the city have hitherto suspended. Twenty thousand workmen will not suffice to execute all the plans proposed to render Brussels one of the finest capitals in Europe.

At Ghent a new casino is to be built, which will not yield in beauty to that built two years since after the plans of M. Roelaudt. The new Palace of Justice and the new theatre will be completed, and in front of the railway station a new and large square will be constructed, in which several new streets will terminate. It is probable also, that the foundation for a new hospital will be laid this year.

No city in Belgium, however, will profit more by the advantages of peace than that of Liege. Vast plans are projected for the enlargement and embellishment of this rich city. A great number of new streets are to run through the old quartiers, and the works for the extension of the Meuse will add a new quartier, and constitute one of the finest parts of Liege. Among the public establishments which will be erected in the course of this year, are the new botanical garden and the conservatory of music in front of the façade, of which will be raised the statue of Gretry.

At Antwerp the quays on the Scheldt are to be finished, and a new fish-market will be built, together with the interior station of the railroad, and several streets leading to it. The colossal statue of Rubersh will be cast this year, but will not be raised on its pedestal before 1840.

At Louvain the public hospital will be entirely rebuilt, and replaced by an edifice as remarkable for its extent as the beauty of its architecture. The wide extent of land at present in cultivation, which extends from the Porte du Parc, to the Porte de Diest, is already being covered with buildings, and will shortly become one of the most populous frontiers of Metonia. This new feature will be principally owing to the railroad.

At Mons a new theatre is projected, also an abattoir, covered markets, and the opening of several new streets, which will afford the necessary communication between the different parts of the city. At Courtui also, numerous improvements will take place, and without entering into any further enumeration, we may say that the confidence produced by the approach of a settled order of things, will sufficiently manifest the wisdom of that division, which, leaving Belgium integrally free, leaves her at the same time the mistress and the architect of her future glory.—*Courier Belge.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

March 19, 1839. The President in the Chair.

On Mr. Smeaton's "Estimate of Animal Power, extracted from his MS. Papers." By JOHN FAREY, M. Inst. C. E.

The amount of mechanical power has been frequently over-stated, in consequence of the conclusions being drawn from efforts continued for too short a time. Desaguliers estimated the power of a man as equal to raising 5507 lbs one foot high per minute; this was found by Smeaton to be too high; several experiments are recorded, in which different values are assigned to the power of a man, and he ultimately fixed it at about two-thirds of the above, or 3672 lbs. Several experiments are recorded of the estimate of the power of a horse, and of the quantity of water raised by various machines.

The communication is accompanied by a letter in Mr. Smeaton's handwriting, dated 21st Feb. 1789.

"*Account of the firing of Gunpowder under Water, by the Voltaic Battery at Chatham, March 16, 1839, under the Direction of Col. Pasley.*" By F. BRAMAH, Jun., A. Inst. C. E., and C. MANBY, A. Inst. C. E.

Exp. I.—A tin canister containing 45lbs of powder was sunk in deep water, and the coil containing the conducting wires, one-fifth of an inch in diameter, by which the powder was to be fired, was vered out to its whole length of 500 feet from the boat in which the voltaic battery was placed. The connexion being made the explosion was instantaneous, and the concussion was felt very sensibly on the shore.

Exp. 2.—Three canisters, each containing a charge of 5 lbs., were sunk at a distance of 50 or 60 feet from each other, and a pair of connecting wires, 100 feet long, were attached to each; the ends of these wires were soldered together by threes, and on the connexion being made only one of the canisters was fired. The wires in this experiment were of common copper bell wire, about one-sixteenth of an inch in diameter. The voltaic battery used was one of Professor Daniell's improved construction. The preparation of the conducting wires, and the manner of discharging the battery, appeared the same as described in Mr. Bethell's communication of last Session.*

March 26, 1839. The President in the Chair.

The following were ballotted for and elected; G. A. Oldham, as a Graduate; Sir John Scott Lillie, Captain Vetch, and J. C. Shaw, as Associates.

"*Description of a Sawing Machine for cutting off Railway Bars.*" By JOSEPH GLYNN, M. Inst. C. E.

The advantage of having the ends of the railway bars cut as nearly square as possible, that they may truly abut against each other, is so great, that many attempts have been made to effect it. The author in this communication describes the method which is adopted at the Butterley Works in the manufacture of the rails for the Midland Counties Railway. In general the ends, rough and ragged as they come from the rolls, are separately reheated and cut off by the circular saw; but the accuracy in this case depends on the workmen presenting the bar at right angles to the plane of the saw. As this cannot be insured, the difficulty may be obviated as follows:—The axis of the saws and the bed of the machine, which is exactly like that of a slide lathe, are placed at right angles with the line of the rolls in which the rails are made; the saws are fixed in headstocks and slide upon the bed, so as to adjust them for cutting the rails to the exact length, and are three feet in diameter and one-eighth of an inch thick, with teeth of the usual size, in circular saws for wood, and make 1000 revolutions per minute; the teeth are in contact with the hot iron too short a period to receive any damage, but to prevent all risk the lower edge of the saw dips in a cup of water. The saw plate is secured between two discs of cast iron faced with copper and exposed only at the part necessary for cutting through the rail. The rail on leaving the rolls is hastily straightened with wooden mallets on a cast-iron plate, on which it lies right for sawing and sufficiently hot; thus a considerable saving of time, labour, and heat, is effected. The rail is brought into contact at the same time with the two saws, and both ends are cut off by one operation. If the saws be sharp and the iron hot, the 78 lb. rails are cut through in twelve seconds. The rail, on leaving the saws, is placed in a groove planed in a thick cast-iron plate; thus all warping is prevented. The author then describes certain mechanical arrangements, which are exhibited in detail in the drawing accompanying the communication.

"*A Description of the Turnbridges on the Herefordshire and Gloucestershire Canal.*" By STEPHEN BALLARD, A. Inst. C. E.

In taking to pieces the old turnbridges on the Herefordshire and Gloucestershire Canal, the author observed that the spikes used to fix the planks down to the carriers had caused the decay of the timber; that the balance weights of stone confined in a box under the planks kept the timber very moist; that the timbers near the ground where there was not a free circulation of air, and the wood wherever it was pierced with iron, were decayed.

In the bridges now described, no spikes are used to fix down the planks, but the planks are held in their places by two flat rods extending the whole length of the planking. The author then describes in detail, by reference to the drawing accompanying the communication, the peculiar method of construction which he has adopted. The planks are three-eighths of an inch apart, so that dirt and wet may not lodge in the joints. The bridge is balanced by two stones hung at the ends of the swing poles of about six cwt. each. The four principal carriers are supported by three cast-iron bearers fixed to a grooved circle, which rests on cast-iron balls running in another grooved circle. By this construction no planks are pierced with spikes; the box of stones is got rid of, and a free access of air is obtained; and the peculiar causes of destruction to which turnbridges are exposed, are, it is conceived, in a great measure obviated.

"*Description of an Instrument for setting out the Width of Cuttings and Embankments of Railways, Canals, or Roads, as particularly applicable to falling or side-lying ground.*" By HENRY CARR, Grad. Inst. C. E.

The object of this instrument is to facilitate the operation of determining the distance of the outer lockspit from the centre line of a cutting or embankment, by avoiding all calculation, and reducing the usual threefold operation into one. The principle of its construction is the formation of a half cross section, which may be easily altered to suit all cases with regard to base, side slope, and inclination of surface. The construction of the instrument is described in great detail by reference to the drawing accompanying this communication. The author states that he set out a portion of the South Eastern Railway with this instrument, and found it answer exceedingly well. The experience of the first instrument has suggested some improvement in its construction, which is represented in another drawing,

Observations on the present Mode of executing Railways: with Suggestions for a more economical, yet equally efficient System of both executing and working them. By FRANCIS WHISHAW, M. INST. C.E.

The author, at the commencement of this paper, alludes to the principal causes of the great differences between the original estimate and cost of railways. Among these he enumerates the imperfect knowledge of the strata, which occasions the cuttings and embankments to be formed with slopes, which are dangerous, and add to their cost; the imperfect formation of the embankments, especially in clayey soils, which, in the opinion of the author, ought to be carried up in layers or courses of from one and a half to two yards in thickness, sufficient time being allowed for subsidence before the next layer is added; the cost of stations, which, in some of the great lines, forms a considerable proportion of the whole cost.

The author then proceeds to suggest means for effecting a considerable saving in the original cost of railways; a certain method of preventing accidents by collision; a saving in the annual expenditure; and a better adaptation of the locomotive engine to its work.

With these views he proposes a single line of rails; that the line should be divided with intermediate engine stations (three on the London and Birmingham, for instance), the engines at each being suited to the prevailing gradient of each. Thus a line of railway may be more easily laid out, as one or two unfavourable inclines will not affect the working of the whole. At each station there must be a small portion of an additional line of rails, and also at other convenient intervals. The mode of working such a line is as follows:—Engines start simultaneously in each direction for the terminal and intermediate stations. These engines will pass each other at one of the portions of the double line, and the engine being turned, and taking the other train, will return to the station whence it started, when another exchange of trains takes place. Thus there is a regular interchange of loads throughout the day, and each engine is confined to its own portion of the line, and then it is impossible that a collision can take place. Equal accommodation would be afforded to the public, and the engine-man, from being always confined to the same small portion of the line, would be perfectly conversant with every part of it. The saving which would on this system be effected on the original cost, is estimated at more than 500*l.* per mile.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

At an ordinary meeting, held on Monday, 8th April, 1839, H. E. KENDALL, fellow, in the chair, Monsieur Zocher, of Haerlem, member of the Institute and Royal Academy of Fine Arts at Amsterdam, pursuant to the recommendation of the Council, founded on the application of Monsieur Reijers, of the Hague, was elected honorary and corresponding member.

The following donations were announced:—From Cavalier Pietro Bianchi, honorary and corresponding member, a drawing of the plan and section, and engraved view of the great church of S. Francesco de Paolo, at Naples, erected by him. From Signor Nicolini, of Naples, specimens of Nicolo Litofagi. By H. Gally Knight, Esq., M.P., a copy of his illustrations to the Normans in Sicily, entitled Siracenic and Norman Remains, folio, &c.

Mr. Donaldson read a description of the Breakwater at Plymouth, by Sir John Rennie, accompanied by drawings at large, illustrative of the subject, which we have inserted in another part of the Journal.

Mr. Smith, of 25, Great Charles-street, Birmingham, attended, and explained several samples of locks and other furniture.

Mr. Richardson continued his series of lectures on Geology—subject, the tertiary formation, geographical extent and distribution of the tertiary deposits; classification of Mr. Lyell; Eocene; Miocene; Pliocene; basins of London, Paris, and the Isle of Wight; organic remains of the English and Paris basins; Cuvierian Pachydermata; Palæotheria Anoplothenia; deposits of Aix Æningen, Monte Bolca; extinct volcanoes of Auvergne; of the Rhine; tertiary deposits of North and South America, &c. &c.

* See "Minutes," April 24, 1838.

As in my last discourse I entered on a consideration of the Zoological relations of the strata and the connection which they bear to animated nature, I purpose, in the discussion of this evening, to consider the rocks as so much inert matter, adapted, however, for the purposes of mankind, in particular as regards that art of which you are professors. We commence then with a view of these substances which are comprised under the convenient name of rocks, and which, in fact, chiefly consist of indurated sands, clays, and limes—which, as I have already stated, once existed in the state either of sand, or mud, or fluid; and I will commence by pointing out the nature of these substances and the principles by which they are combined together. All bodies are divided by the chemist into simple and compound; simple substances being those out of which nothing different from themselves can be obtained; the compound, those which contain two or more elements. The number of elementary bodies at present recognised is 53, the amount was formerly greater, but has been materially reduced by the investigations and experiments of modern science, bodies, which some time since were considered simple, being proved, by recent analysis, to be compound. Although the number of elements amounts to 53, yet that of minerals, which they form, does not reach 400; a fact which affords a beautiful analogy, with similar restrictions imposed on the animal kingdom. We know that certain limits are assigned on the production of animals so as to prevent the intermixture of species and the consequent confusion of races. In like manner the multiplication of minerals is governed by strict laws, with the obviously similar design of preventing the confusion which would arise from their combination being left wholly unchecked. The chief ingredients of the rocks are the nine earths, silex, alumina, lime, glucine, zircon, yttria, barytes, strontia, and magnesia, which, with the non-metallic substances, oxygen, hydrogen, nitrogen, carbon, sulphur, chlorine, fluorine, and phosphorus, with potassium and sodium, constitute the principal part of the generally prevailing minerals and rocks. The common sedimentary rocks are usually composed of the three first of the above named materials; flint, clay, or lime; and they each possess a peculiar cleavage or fracture, which is invariable in each class of substances. Thus, if a flint be broken, it has a glassy or conchoidal fracture, and a cutting edge; but if chalk or marl be fractured, they have a dull or earthy edge, while on fracturing a chrystal of carbonate of lime every fragment preserves more or less distinctly a rhomboidal form; a fact which shows the powerlessness of man over nature, and his subjection to the laws which regulate matter; since it has justly been observed we cannot break a stone but in one of nature's joinings. The lecturer then proceeded to the subject of stratification. He observed, that a stratified rock is one whose bounding surfaces are parallel, or nearly so, for great distances, thus composing a larger or tabular mass, which is called a stratum or bed; and a number of these strata, possessing a common character, and having a common origin, are called a formation—as the chalk formation, lias formation, &c. The beds, as already mentioned, must have been deposited in a horizontal position, but they have since been subjected to so many changes and revolutions, to so many liftings, sinkings, and movements, by a force acting from below, that they may either be horizontal, inclined, vertical, curved, contorted, or even as Mr. Murchison has lately shown, reversed, and completely overturned. Stratified rocks are usually large, and sometimes especially lacustrine deposits, thinly laminated. The unstratified rocks present none of this parallelism of bounding surface, they exhibit in general the appearance of shapeless lumps, and though they are sometimes divided into blocks—granite in particular, which assume the appearance of beds—this structure may be distinguished both by the character of the rock itself and the comparatively small extent to which these extend. When the height of these blocks very much exceeds their breadth the structure is called columnar, as is frequently the case with basalt, porphyry, and greenstone. Veins and fissures in modern rocks are filled with bones; in ancient with minerals, as silver, lead, tin, &c. If the fissure be such as to cause a displacement of strata, it is called a fault; these have their disadvantages and advantages; they counteract the tendency of beds to plunge to depths inaccessible to human power and skill; they divide a bed of coal into several stages, and render it accessible; and when filled with clay, act as a dam to keep out water, and prevent the mines from being flooded.

Geographical distribution is most widely developed on the continent of Europe—France, Italy, Germany, Hungary; on the continents of Asia and America, and in Australia. They present, among other phenomena, the fact that from the prevalence of lacustrine deposits the beds of vast bodies of fresh water, this part of the world appears to have been for a vast period the site of lakes as vast as those which exist in the North American continent at the present day; and from the remains of extinct volcanoes, volcanic power seems to have been called forth to an immense scale. In this country we have only pliocene represented by the crag of Norfolk and Suffolk, a vast accumulation of sand and gravel deposits lying in chalk. The miocene is altogether wanting in any well-defined bed. Eocene exists in the London basin. This vast gulph of an ancient sea of chalk is bounded on the south by the North Downs, the hills of Reigate, Sutton, and Godstone, and extends on the west beyond High Elm Hill, Berkshire, and on the north-west is flanked by the chalk hills of Wiltshire, Berkshire, Oxfordshire, Buckinghamshire, and Hertfordshire; it spreads over Essex, a considerable part of Suffolk. Epping, and Hainault forests, the whole of Middlesex, and a portion of Buckinghamshire. On the east it is open to the sea, the Isle of Sheppy being an outwork of the same deposit. It is conceived to have been an estuary, from the vast number of fossil fruits and other spoils of the land. The stiff blue or black clay, called London clay, contains marine exuvia, shells, sharks, teeth, fish, &c. The heaths in the neighbourhood of London are marine sands, as Bagshot, Frimly, Purbright, and Hampstead.

In alluding to the geology of Auvergne, Mr. Richardson observed that, in addition to the other attractions of Auvergne, he was indebted to Mr. Delabehce for information that the architect will there find samples of the earliest style of Byzantine architecture. Mr. D. adds, that as an architect is compelled to travel, in order to complete his education, an attention to geology will enable him to understand the nature of the stone employed in architecture, and the reasons why employed. And allow me to add, that these advantages will not be confined to mere profit; but will tend to invigorate our faculties, and extend the horizon of our mind. If, as who can doubt, the aphorism of Lord Bacon be true, that all study is valuable, what study so instructive, so fitted to improve us, as that which teaches us the comparative insignificance of ourselves, and the wisdom and power of our great Creator?

22d April, 1839—Earl de Grey in the chair.

The secretary announced that the Council had admitted Alfred Batson as student. Robert William Mylne, Esq., of New River-head, and Samuel Lapidge, of Derby-street, Westminster, were elected associates.

The following donations, &c., were announced:—By the Institute of Civil Engineers, Transactions of the Institution, Part 1 of vol. 3. By M. Carl Tottie, Elevation of Royal Palace at Stockholm (drawing); copy of 1st voll of Sepulchral Monuments. By B. Wyon, Esq., engraving of the great sea. of England. By H. E. Kendall, fellow; select views of Roman antiquities, by George Wightwick: Palazzi di Genova, Jacobi; Lauri Autiquæ urbis splendor. By Sir Jeffry Wyatville, hon. fellow; Terra cotta figure of Iuigo Jones. By Ruysbeck; original bust of James Wyatt, architect. By Rossi; architectural allegory, by Angelica Kauffman; and the Transactions of the Society of Arts, 85 vols. By T. L. Donaldson, hon. secretary, Vitruvius Bipontine edition, 1807. By J. B. Papworth, fellow, Vitruvius Delaet edition.

Mr. Godwin took occasion to mention the establishment at Oxford of a society for promoting the study of gothic architecture among the clergy, and commented on the probable good results. Mr. Fowler and Mr. Donaldson spoke on the same subject.

His Lordship, the President, then proceeded to distribute the medals awarded as follows:—In delivering the medal to Mr. Robinson, V. P., the representative of the first candidate, absent in the country, his lordship observed that he felt happy in conferring another tribute of respect on the same individual who had again deserved it. As it was the desire of the Institute that a candidate who received two medals should consider the second as an advance upon the first, they had granted the augmentation of a gold rim, which he felt happy in saying that Mr. Sharpe highly deserved.—To Mr. Pocock, the Earl remarked, that it was also for the second time that a distinction was conferred on him, and that in order not to relax competition, the Institute had determined in all cases of candidates previously distinguished, gaining a prize, to confer a similar one also on the candidate next in merit. If, said the noble Earl, addressing Mr. Hall, we feel a pleasure in rewarding our own members we feel one equally sincere in conferring our prizes on those from a distance, as thus we are assured of the extension of our influence, and particularly in a case where your father holds the high position of president of a similar institution at Manchester.

We felt great pleasure at seeing the numerous attendance, and among the company we recognised the Marquis of Northampton, Sir Henry Ellis, and Sir Jeffrey Wyatville.

To Samuel Sharpe, associate, for the restoration of the baronial castle of Sheriff Hutton, the Soane medallion with a gold rim.

To William Willmen Pocock, associate, and Edward Hall, of Manchester, for their essays on the peculiar characteristics which distinguish Roman from Grecian architecture, with particular reference to the works of the ancient Romans—the medals of merit.

A paper was read by Ambrose Poynter, fellow, on the parallel styles and periods of Gothic architecture in France and England.

The lecturer commenced by apologising for intruding upon the attention of his audience on a subject so hacknied as the progress of the Gothic style in England, but observed that this progress was most efficiently illustrated by referring to the course of architecture in France. It is then seen that through a great portion of the architectural histories of the two countries that there is a great coincidence in each in the durations of epochs of style; and, in fact, in many instances we can only explain the phenomena of architecture here by its cognate works in the Norman provinces of France. This relation the accompanying table will serve to illustrate, of which the French portion is derived from M. Comon of the Antiquarian Society of Caen, and the English is modified from the works of Mr. Rickman.

COMPARATIVE CHRONOLOGY OF FRENCH AND ENGLISH MEDIEVAL ARCHITECTURE.

English.	*Years.*	*French.*	
	950	Romanesque.	
	1000		
	1050		
Norman	1100	Transition.	
	1150		
Early English	1200	Primordial Gothic.	
	1250	1st epoch.	Secondary or Gothique Rayonnant.
Decorated English	1300		
	1350	2d epoch.	
Perpendicular	1400	1st epoch.	Tertiary or Gothique Flamboyant.
	1450		
	1500	2d epoch.	
	1550		

In the middle and South of France there still exist many remains of Romanesque of a very early date. In Auvergne, Baron Taylor remarked a curious church of that era, of which the arch was decorated with the chevron moulding. At Pontoise, the cathedral, although altered in the sixteenth century, still show marks of great antiquity, and to the tower in particular it is impossible to assign a date.

We then come to the Transition period corresponding to our Norman, and we see its progress from the Romanesque. We can perceive as it were, the principles of Gothic architecture developing themselves in an infant existence. These are after all inseparable from the Transition styles, and although they may, like colour, in some cases be unimportant, yet they are still an essential of the design. The identity of the Norman and the Anglo-Norman is perfect, although in the latter less advanced. At the same time, the English style is free from that meanness which too often degrades the original Norman, and is extremely perceptible in St. Etienne, at Caen, and St. Julien; the elaborate doorways also, which we possess in England, are rare in France. The difference in the execution of the ornamental details it is difficult to account for, unless on those principles of the subdivision of labour, which we know to have prevailed in Gothic architecture. Thus these details being left to native artists, there is a considerable diversity between them. In France, the Byzantine style long exercised an influence peculiar to that country, and we see, in the Anglo-Saxon missals, that the English possessed a mode of decoration having its distinct peculiarities.

The period of the transition, from the circular to the pointed arch, is the same in the two countries, although undoubtedly earlier in France, yet not to the extent which the zeal of the Norman antiquaries would endeavour to make us believe. No sound proofs have ever been brought forward by them of the authenticity of the dates they assign to the origin of the pointed style, and we cannot therefore, in the absence of such evidence, recognise these extraordinary claims. In the middle of the twelfth century, we find the lancet arch coming into use, although the round arch was retained in both countries for occasional use. The Cathedral of Lisieux is one of the earliest specimens of this style, and the porch has some remarkable dovetail mouldings. The Cathedral of Coutances, in Brittany, be it said, without offence to Salisbury, is one of the best examples of lancet architecture, and it also has the rare circumstance of aisles in the transept, greatly conducing to the beauty of the effect. Perhaps not six English travellers have seen this building, and it is one which is as interesting as it is rare.

We now come to the rayonnant corresponding to the decorated English style, one of the earliest and best specimens of which we see at Amiens. These styles we find appearing together both in France and England, and gradually developing their beauties. This period the French authorities divide into two epochs, of the first of which the Sainte Chapel at Paris, is an example. This building also is remarkable for containing some of the earliest and most extensive specimens of painted glass, well worthy of the attention of the visitant. In the second epoch we find the finest cathedrals in France constructed, but in attempting to mark its limits we must not suppose that these are to be defined by any strict line, nor that these eras practically exist, but like the epochs of geology are conventional arrangemetns for general convenience. In the gradual development of this period, it is remarkable that its influence was not exerted upon those members which are usually affected, but that it was removed to others. Thus the windows of the choir, which are a general criterion, suffered little change in this time, as we may see for instance in Exeter. This period in France derives its name of Rayonnant from the ornaments of the windows being formed by the evolution of circles so as to give the appearance of rays, as the Flamboyant does from its forms resembling flames. The church of St. Ouen at Rouen is one of the noblest examples of this period, and the eastern portion is particularly worthy of attention.

In the fourteenth century we find the connection between English and French architecture to cease, and that each follows an independent course. The claims of the English perpendicular style have perhaps been overated, if indeed it possess sufficient distinction of character to claim for it the title of a style. It seems indeed as if it were conceived, but miscarried, and is everywhere full of the grossest anomalies. Even its proudest examples, the cathedrals of Dorchester and Gloucester, and Merton College, Oxford, are open to the severest criticism. The Flamboyant has adopted the depressed arch like the perpendicular style, but is principally characterised by dividing the windows from three centers, four being rare. It has the appearance of being composed only of windows and buttresses and hence its imposing effect; its fault, however, is an exuberance of decoration. It must be observed that although during its career it maintained a superiority over the English Perpendicular, yet that it fell into a degeneracy, to which the latter was never subjected. The tower of the church of Verneuil is well worthy of attention, and is even a greater rarity to English travellers than that of Coutances.

Mr. Poynter concluded by pointing out the peculiarities in the composition of the Flamboyant style. Five aisles are common in France, although in England we have no such instance except at Chichester, otherwise they affixed a range of external chapels, and both of these processes greatly tend to destroy the outline. The French raised the doorway in the west front, while the English lowered it, and the former made their portals occupy the centre compartment. The spires in Normandy, of whatever it period, seem to be cast in one mould, and possess a general uniformity which is very remarkable. Thus those of St. Etienne at Caen, and St. Leu at Coutances, and many others, although of different epochs, have much the same appearance. In vaulting the English have a great superiority, and their fine ceilings are without rivals in France, although the deficiency of the French did not proceed from ignorance. The French churches also are remarkable for being without battlements. In conclusion, Mr. Poynter remarked that he presented these notes as the results of his own observations, and expressed his gratification if he should have contributed to the stores of knowledge, which must increase from such contributions like the accumulation of geological masses.

ARCHITECTURAL SOCIETY.

Monthly Meeting of the Society, held on Tuesday Evening, the 9th of April.
Wm. Tite, Esq., President, in the Chair.

E. W. Brayley, jun., Esq. F.G.S., F.L.S., delivered his fourth and concluding lecture of his present course; the subject of which was, "On those Physical and Chemical properties of Building-stones, on which their use essentially depends."—This lecture, like the former ones, entered very fully into the matter under consideration, and was very clearly exemplified by tables of experiments, by drawings of various kinds, and by specimens of the stones themselves.

After the lecture, the President called the attention of the meeting to the sketches produced by the student members for the subjects announced at the last meeting: he then announced the subject for the next sketch as follows:—viz., A Design for an Ornamental Bridge in a Park—to be in one Arch of 50 feet span, and the style to be either Gothic or Italian.

Some very beautiful specimens of locks and other fastenings of a superior nature were lying upon the table, and were furnished by Messrs. C. Smith and Son, of Birmingham. Many of the hinges and fastenings were exceedingly clever, and obtained general approbation.

There were also several other specimens of art, besides drawings arranged about the rooms. Among the latter was one by Mr. A. W. Hakewill, showing the manner proposed for laying out the grounds of the Royal Horticultural gardens at Chiswick.

At the conclusion of the meeting the President gave notice that a special meeting of the members would be held on Monday evening the 15th April, to take into consideration the printed resolutions of the Gresham Committee, issued as instructions to architects furnishing designs for the New Royal Exchange.

ROYAL SOCIETY.

March 21.—The Marquis of Northampton, President, in the chair.

Thomas William Fletcher, Esq., and the Rev. Thomas Gaskin, were elected Fellows.

The following papers were read:—

1. *Description of a Compensating Barometer, adapted to Meteorological Purposes, and requiring no Corrections either for Zero or for Temperature.* by Samuel B. Howlett, Esq.

In the instrument here described, there is provided, in addition to the ordinary barometric tube inverted, in the usual way, in a cistern of mercury, a second tube of the same dimensions, placed by the side of the former, and likewise filled with mercury, but only to the height of twenty-eight inches above the level of the mercury of the cistern. This tube is closed at its lower end, and fixed to a float supported by the mercury in the cistern; and it bears at its upper end, an ivory scale three inches in length. The elevation of the mercury in the barometric tube is estimated by the difference between its level and that of the mercury in the closed tube, and is measured on the ivory scale by the aid of a horizontal index, embracing both the tubes, and sliding vertically along them. As the float which bears the closed tube to which the scale is attached rests freely on the mercury in the cistern, and consequently always adjusts itself to the level of that fluid, no correction for the zero point is needed; and, as every change of temperature must similarly affect the columns of mercury in both the tubes, after the scale has been adjusted so as to read correctly at any given temperature, such as 32°, which may be effected by comparison with a standard barometer, every other reading will correspond to the same temperature, and will require no correction. The author considers the error arising from the difference of expansion corresponding to the different lengths of the two columns of mercury, and which will rarely amount to one four-hundredth of an inch, as too small to deserve attention in practice, being in fact, far within the limits of error in ordinary observations. Subjoined to the above paper is a letter from the author to Sir John Herschel, containing a statement of comparative observations made with a mountain barometer, and with the compensation barometer, from which it appears that the use of the latter is attended with the saving of a great quantity of troublesome calculation. The comparative observations are given in a table, exhibiting a range of differences from +.012 to —.016 of an inch.

2. *An Account of the Fall of a Meteoric Stone in the Cold Bokkeveld, Cape of Good Hope;* by T. Maclear, Esq., *in a letter to Sir J. F. W. Herschel.*

The appearance attending the fall of this aerolite, which happened at half-past nine o'clock in the morning of the 13th of October, 1838, was that of a meteor of a silvery hue, traversing the atmosphere for a distance of about sixty miles, and then exploding with a loud noise, like that from artillery, which was heard over an area of more than seventy miles in diameter—the air at the time being calm and sultry. The fragments were widely dispersed, and were at first so soft as to admit of being cut with a knife, but they afterwards spontaneously hardened. The entire mass of the aerolite is estimated at about five cubic feet.

3. *Chemical Account of the Cold Bokkeveld Meteoric Stone:* by MICHAEL FARRADAY, Esq., D.C.L., *in a letter to Sir John F. W. Herschel.*

The stone is stated as being soft, porous, and hygrometric; having, when dry, the specific gravity of 2.94, and possessing a very small degree of magnetic power, irregularly dispersed through it. One hundred parts of the stone in its natural state, was found to consist of the following constituents: namely—

Water	6.5	Alumina	5.22
Sulphur	4.24	Lime	1.64
Silica	28.9	Oxide of Nickel	.82
Protoxide of Iron	33.22	Oxide of Chromium	.7
Magnesia	19.2	Cobalt and Soda, a trace.	

4. *Notes respecting a new kind of Sensitive Paper:* by HENRY FOX TALBOT, Esq.

The method of preparing the paper here referred to, consists in washing it over with nitrate of silver, then with bromide of potasium, and afterwards again with nitrate of silver; drying it at the fire after each operation. This paper is very sensitive to the light of the clouds, and even to the feeblest daylight. The author supplies an omission in his former memoir on photogenic drawing, by mentioning a method he had invented and practised nearly five years ago, of imitating etchings on copper plate, by smearing over a sheet of glass with a solution of resin in turpentine, and blackening it by the smoke of a candle. On this blackened surface a design is made with the point of a needle, the lines of which will of course be transparent, and will be represented by dark lines on the prepared paper to which it is applied, when exposed to sunshine. The same principle may be applied to make numerous copies of any writing.

GEOLOGICAL SOCIETY.

March 13.—Rev. Dr. BUCKLAND, PRESIDENT, in the chair.

A paper was read:—

On the Geology of the North western part of Asia Minor, from the Peninsula Cyzicus, on the Coast of the Sea of Marmora to Koola, with a description of Katakekaumene,' by W. J. HAMILTON, Esq., Sec. G.S.

The line of route taken by Mr. Hamilton from Cyzicus (lat. 40 deg. 22 min.) ascends the valley of the river Macetus to its sources, near Simaul, then crosses the Demirgi chain (lat. 39 deg. 5 min.), and afterwards passes by Karakeui and Selendi to Koola, on the eastern confines of the Katakekaumene; the whole of the distance being about 170 miles. The principal physical feature of the district is the Demirgi range, which extends from Pergammon on the west to the lofty mountain of Ak Dàgh or Shapkan Dàgh on the east, but the country is intersected by various ranges of hills, sometimes exceeding 1200 feet in height. The geological structure of Mr. Hamilton's line of route is simple, being composed of only schistose rocks, with saccharine marble, a compact limestone, resembling the scaglia of Italy and Greece, tertiary sandstones and limestones, granite, peperite, trachyte, basalt, and other igneous rocks. Between Kespit and the foot of the Demirgi hills, are also remains of an ancient lacustrine deposit, and in the valleys are extensive alluvial accumulations. The schists consist of mica-slate, gneiss, and clay-slate, and they occur chiefly near Cyzicus. The strata dip at high angles from the granite, to the protrusion of which the inclination is apparently due. The marble was formerly worked to a very great extent, and Cyzicus was indebted to it for being ranked among the most splendid cities of antiquity. The compact limestone, resembling scaglia, was observed only at the foot of the hills north of Maniyas. It is associated with beds of shale, and is apparently destitute of organic remains. The micaceous sandstone is extensively distributed south of Maniyas, also towards the eastern extremity of the Demirgi mountains at the point crossed by Mr. Hamilton, and between it and Koola. The stone is fissile, and alternates sometimes with shale; and the beds are, occasionally, much dislocated by the protrusion of igeneous rocks. About half-way between the pass over the Demirgi range and Koola, the upper beds of the sandstone alternate with the lower layers of an overlying deposit of peperite. Mr. Hamilton has no doubt that this formation belongs to the one which himself and Mr. Strickland examined between Ghiediz and Ushah. The white tertiary limestone, Mr. Hamilton considers to be a part of the great lacustrine formation, which occupies so large a portion of Asia Minor; but within the range of country described in this memoir, it appears to be totally devoid of organic remains. It is sometimes soft, resembling chalk, but, at its contact with the igneous rocks, it becomes hard, and at one line of junction, a layer of serpentine was interposed between the two formations. Thin beds of white opaque flints, resembling those of the lacustrine limestone of Auvergne, were noticed by the author a little south of Kefsut. The strata have been, in many places, very much dislocated by the protrusion of trachyte. The granite was observed only near Cyzicus and in the Demirgi chain. It is composed of quartz, felspar, and mica, but it contains large masses of hornblende, and is traversed by veins of felspar. The schistose rocks are thrown off by it near Cyzicus at high angles, and with a quâquâversal inclination. The perperite, or volcanic tuff, appears to be of intermediate age between the micaceous sandstone, and the white limestone, as it rests upon the former, and is overlaid by the latter. It is distinctly stratified, and varies much in character, being sometimes earthy, occasionally conglomeratic, and not unfrequently hard or semicrystalline. It is chiefly developed south of the Demirgi range. The beds are generally horizontal, or slightly inclined, but they are disturbed where igneous rocks have been protruded through them. Trachyte and basalt rise to the surface at many places between the Demirgi hills and Koola, dislocating the stratified deposits, and producing changes both in their structure and hardness. On the banks of Hermus, basalt overlies the white limestone. Mr. Hamilton also described the hot springs, situated about seven miles to the east of Singerli at the northern foot of the Demirgi chain. Their temperature, he conceives to be equal to that of boiling water, and they are discernible, at a considerable distance, by the great volumes of steam which they throw off. Extensive accumulations, several feet thick, of a white fibrous sediment, occur around the mouth of the springs. A strong sulphurous smell accompanies the emission of the water; but, at a point where the stream had lost enough of its temperature to be tasted, no peculiar flavour was perceived. After turning several mills, and at the distance of a mile and a half from the spring-head, the water is collected and used by the Turks as a warm bath. Copious hot springs are likewise thrown out near the Katakekaumene: the water is tasteless, and the temperature 123 deg. of Fharenheit, but no sediment is deposited around the mouths. Mr. Hamilton then proceeded to describe the Katakekaumene,—a district singularly interesting on account of its extinct volcanoes, and its great resemblance to Auvergne. He first visited it in company with Mr. Strickland, who laid an account of some portions of it before the Geological Society, in 1836. The district extends from Koola, westward, about nineteen miles, and for about eight miles from north to south. The formations included within this area, are the schistose rocks, and crystalline limestone, which occur near Cyzicus, the white lacustrine limestone, basalt, and lavas of two perfectly distinct ages. The leading physical features of the district are ridges of schistose rocks, with intervening alluvial plains. On the former are seated all the ancient volcanic cones, or craters, and in the latter the modern. This important distinction, Mr. Hamilton is of opinion, may be explained, on the supposition that the elevation of the schistose ridges produced fissures, through which, as lines of least resistance, the first eruptions of lava found vent. That these openings becoming, afterwards, plugged up, by the cooling of injected molten matter, the schistose ridges were rendered so compact, that, when the volcanic forces again became active, the line of least resistance was transferred to the valleys. Of the relative periods when the eruptions took place, no opinion can be formed: the more modern must have been long anterior to tradition, though the streams of lava present all the ruggedness of the most recent *coulees* of Etna and Vesuvius; and the craters preserve, to a great extent, their form and internal cavities. The more ancient lava-currents are covered by sedimentary matter, and are, therefore, considered by Mr. Hamilton to have been, at one period, covered with water: the cones have also lost, in part, their form, the craters being nearly obliterated. The paper concluded with a comparison between this part of Asia Minor and Auvergne, as described by Mr. Scrope. 1. The great ancient volcanic group of Mont Dore, the Cantal and Mont Mezen, Mr. Hamilton conceives, is represented by Ak Dàgh Morad Dàgh, the trachytic hills east of Takmak, Hassan Dàgh, and Mont Argæus. 2. That the more modern volcanic period of Central France may be compared with the Katakekaumene, both as respects the composition of the lavas, their arrangement at different levels, and the cones being scattered, and not collected in great mountain masses. 3. With respect to the disposition of comparatively recent volcanos being coincident with the strike of the granitic axes, from the interior of which they have burst forth, Mr. Hamilton stated, that the Katakekaumene affords additional illustration. 4. In central France, as well as the district described in this paper, there are deposits of lacustrine limestone, which have been separated, by the action of bodies of water, into table lands surmounted by beds of basalt and lava; and, in both countries, currents of lava, of more modern date, have flowed into the intervening valleys. In two points, however, there are differences between the volcanic phenomena of Asia Minor and central France. In the latter, streams of igneous products may be traced from the most ancient system of cones, or that of Mont Dore; but, in the former, none have yet been discovered which issued from Ak Dàgh, or the other contemporaneous volcanic mountains. In France, also, trachitic eruptions took place during the deposition of the lacustrine limestone; but, in the Katakekaumene, they appear to have preceded the deposition of the white limestone, or are associated with only its lowest beds.

MEETINGS OF SCIENTIFIC SOCIETIES FOR MAY.

Royal Society, Thursday, half-past eight, P. M., 2nd, 9th, 23rd, and 30th.
Society of Antiquaries, Thursday, eight, P. M., 2nd, 9th, 23rd, and 30th.
Institution of Civil Engineers, 25, Great George-street, Westminster, every Tuesday, eight, P. M.
Royal Institute of British Architects, 16, Grosvenor-street, Monday, eight, P. M., 6th and 20th.
Society of Arts, every Wednesday, half-past seven, P. M.

LUBRICATOR.

In our last number we gave an extract from Dr. Ure's Dictionary, describing a lubricator, which the Doctor states was kindly communicated to him by Edward Woolsey, Esq. We understand that Mr. Barton was the original inventor, and that he took out a patent for it 20 years ago, and which has been lately renewed.

PARLIAMENTARY PROCEEDINGS.

House of Commons.—List of Petitions for Private Bills, and progress therein.

	Petition presented	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour	Feb. 6.	Feb. 27.	Mar. 12.	April 15.	—
Aberdeen Harbour	Feb. 8.	Mar. 15.	April 15.	—	—
Ballochney Railway	Feb. 12.	Mar. 14.	April 8.	—	—
Barnsley Waterworks	Feb. 21.	—	—	—	—
Bath Cemetery	Feb. 22.	—	—	—	—
Belfast Waterworks	Feb. 22.	—	—	—	—
Birmingham Canal	Feb. 20.	Mar. 15.	April 12.	—	—
Birmingham & Gloucester Railway	Feb. 21.	Mar. 15.	April 8.	—	—
Bishop Auckland & Weardale Rlwy.	Feb. 22.	Mar. 18.	April 16.	—	—
Blackheath Cemetery	Feb. 22.	Mar. 18.	—	—	—
Bradford (York) Waterworks	Feb. 21.	—	—	—	—
Brighton Gas	Feb. 21.	Mar. 18.	—	—	—
Brighton Cemetery	Feb. 21.	Mar. 18.	—	—	—
Bristol and Gloucestershire Railway	Feb. 21.	Mar. 7.	Mar. 19.	—	—
British Museum Buildings	Feb. 22.	—	April 12.	—	—
Brompton New Road	Feb. 22.	Mar. 18.	—	—	—
Cheltenham Waterworks	Feb. 22.	Mar. 12.	Mar. 22.	—	—
Commercial (London and Blackwall) Railway	Feb. 14.	Mar. 8.	Mar. 21.	—	—
Dean Forest Railway	Feb. 19.	—	—	—	—
Deptford Pier	Feb. 22.	Mar. 18.	—	—	—
Deptford Pier Junction Railway	Feb. 22.	Mar. 20.	—	—	—
Deptford Steam Ship Docks	Feb. 22.	—	—	—	—
Edinburgh, Leith, and Newhaven Railway	Feb. 19.	Mar. 11.	Mar. 27.	—	—
Eyemouth Harbour	Feb. 12.	—	April 8.	—	—
Fraserburgh Harbour	Feb. 20.	—	April 8.	April 16.	—
General Cemetery	Feb. 20.	Mar. 11.	Mar. 21.	—	—
Gravesend Gas	Feb. 21.	Mar. 18.	—	—	—
Great North of England Railway	Feb. 18.	Mar. 13.	Mar. 25.	—	—
Great Western Railway	Feb. 14.	Mar. 4.	Mar. 13.	—	—
Great Central Irish Railway	Mar. 12.	—	—	—	—
Herefordshire and Gloucestershire Canal	Feb. 20.	Mar. 13.	—	—	—
Herne Gas	Feb. 22.	—	—	—	—
Liverpool Docks	Feb. 21.	—	—	—	—
Liverpool Buildings	Feb. 21.	—	—	—	—
Liverpool and Manchester Extension Railway	Feb. 14.	Feb. 28.	Mar. 12.	—	—
London and Birmingham Railway	Feb. 8.	Feb. 22.	Mar. 6.	—	—
London Bridge Approaches, &c.	Feb. 19.	April 11.	—	—	—
London and Croydon Railway	Feb. 19.	Mar. 18.	April 8.	—	—
London Cemetery	Feb. 19.	Mar 18.	—	—	—
London and Greenwich Railway	Feb. 21.	Mar. 18.	April 8.	—	—
London and Southampton (Guildford Branch) Railway	Feb. 22.	—	—	—	—
London and Southampton (Portsmouth Branch) Railway	Feb. 6.	Feb. 25.	Mar. 7.	—	—
Manchester & Birmingham Railway	Feb. 18.	Mar. 18.	April 23	—	—
Manchester and Birmingham Extension (Stone & Rugby) Railway	Feb. 11.	—	—	—	—
Manchester and Leeds Railway	Feb. 18.	Mar. 8.	Mar. 19.	—	—
Marylebone Gas & Coke Company	Feb. 22.	Mar. 18.	—	—	—
Monkland & Kirkintilloch Railway	Feb. 12.	Mar. 14.	April 8.	—	—
Necropolis (St. Pancras) Cemetery	Feb. 21	Mar. 16	—	—	—
Newark Gas	Feb. 14.	Feb. 28.	Mar. 11	April 18.	—
Newcastle-upon-Tyne and North Shields (Extension) Railway	Feb. 18.	Mar. 15	—	—	—
Northern & Eastern (No 1) Railway	Feb. 22.	Mar. 18.	—	—	—
Northern & Eastern (No. 2) Railway	Feb. 22.	Mar. 27.	April 16.		—
North Midland Railway	Feb. 11.	Mar. 4.	Mar. 14.	—	—
North Union Railway	Feb. 22.	—	—	—	—
Nottingham Inclosure and Canal	Feb. 19.	Mar. 18.	—	—	—
Over Darwen Gas	Feb. 21.	—	April 12.	—	—
Perth Harbour and Navigation	Feb. 14.	—	—	—	—
Port'shead Pier	Feb. 22	—	—	—	—
Preston Gas	Feb 6.	Feb. 20.	Mar. 6.	Mar. 19.	—
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	—
Preston and Wyre Railway, Harbour, and Dock	Feb. 21.	Mar. 18.	April 12.	—	—
Redcar (No. 1) Harbour	Feb. 19.	—	—	—	—
Redcar (No. 2) Harbour	Feb. 22.	Mar. 27.	—	—	—
Rishworth Reservoirs	Feb. 21.	Mar. 6.	Mar. 26.	—	—
Rochdale Waterworks	Feb. 7.	Feb. 21.	Mar. 6.	—	—
Rochester Cemetery	Feb. 22.	Mar. 18.	—	—	—
Sawmill Ford Bridge and Road	Feb. 21.	Mar. 18.	—	—	—
Slamannan Railway	Feb. 12.	Mar. 18.	Mar. 27.	—	—
South Eastern Railway	Feb. 11.	—	Mar. 26.	—	—
South Eastern (Deviation) Railway	Feb. 22.	Feb. 27.	—	—	—
Teignmouth Bridge	Feb. 21.	—	—	—	—
Tyne Dock	Feb. 22.	Mar. 16.	—	—	—
Tyne Steam Ferry	Feb. 21.	—	—	—	—
Walsall Junction Canal	Feb. 22.	—	—	—	—
West Durham Railway	Feb. 21.	Mar. 18.	April 8.	—	—
Westminster Improvement	Feb. 21.	—	—	—	—
Wishaw and Coltness Railway	Feb. 12.	Mar. 14.	April 8.	—	—
Wyrley and Essington and Birmingham Canal	Feb. 18.	—	—	—	—

STEAM NAVIGATION.

Steam Communication to America by Her Majesty's Mails.—The ships, as finally determined on, are to be upwards of 1,200 tons register, propelled by engines of 430-horse power, all of the most substantial and approved construction, combining speed, safety, and easy sea-going qualities. The work is already commenced, and there is now no doubt of their being ready to start for Boston and Halifax on the 1st of April, 1840. There will be splendid accommodations for about seventy cabin passengers, with room for carrying a limited quantity of goods. Passengers to Canada and New Brunswick, immediately on the arrival of the steamship at Halifax, will be conveyed by coaches to Pictou and Windsor; from Pictou other steamvessels will be ready to start for Miramichi, Quebec, and from Windsor to St. John's, St. Andrew's, &c., thus affording passengers to our American colonies an opportunity of arriving at their respective destinations in the shortest possible time, while those for the States, on their arrival at Boston, will be able to reach any place in the Union by the various railways, canals, &c. from that city.—*United Service Gazette.*

Iron Steamer Union.—This splendid steam vessel has left the Broomielaw on her voyage to Santa Martha, in New Grenada, commanded by an experienced captain, with a full complement of engineers, and other mechanics. She was built by Messrs. James and William Napier, engineers of known celebrity in this city, expressly for the navigation of the river Magdalina; under the directions of Messrs. Plock and Logan, of London, who are the agents of the Anglo-Grenadian Steam Navigation Company; and her construction is so peculiar, that the proprietors are sanguine she will reach at least 800 miles up that magnificent river: where it may not be improper to inform the public, the trade has been hitherto carried on in a most laborious manner, by heavy flat boats, constructed in the country, whose average passages in ascending the river was from three to four months; but is now calculated that the Union, with her powerful machinery, will perform the voyage in less than seven days. We, therefore, wish this interesting expedition the success it merits, for we understand that nopains nor expense has been spared in fitting out this vessel.—*Glasgow Chronicle.*

PROGRESS OF RAILWAYS.

Hull and Selby Railway.—Of this important undertaking we are enabled to give some particulars from a correspondent who lately went over the whole of the line. Considerable activity pervades every department, and as the whole of the land required is now in the company's possession, there is nothing to prevent the contractors proceeding with their respective contracts as rapidly as the weather will admit. With regard to the principal station at Hull, the buildings connected witth it are commenced, as are also the workshops and other erections required for the future accommodation of the traffic. On the embankment of the Foreshore, next the river Humber, near Hull, a great number of men are employed, a large portion of the stone facing is carried up to its full height, and the embankment is nearly ready for the rails. For the next three miles to Hessle, the earth-work has been ready for ballasting for some time, and is now to be immediately finished. The cuttings through Hessle-cliff and Ferriby-hill are also well advanced, and the stone from the former is used in the works of the Foreshore, and for ballasting the line, and the excavation from the latter for making up the low ground. Two bridges in this district are completed, and a third in a very advanced state. The railway for the next six miles is in course of being formed, and a part is ballasted, ready to receive the rails; a small portion however, of the embankment near the Market Weighton Canal remains to be finished. The bridge over the canal is completed—it consists of brick abutments with an arch of cast iron, 70 feet span, and has a very light and pleasing effect. After passing this embankment, the line is nearly level for seven miles, which is now being ballasted, while the bridges for passing the several roads over the railway are either finished or nearly so. This brings us to the river Derwent, which the railway is to be carried over by a cast iron bridge of 70 feet span, raised sufficiently high to allow the navigation to pass under. Of this bridge one abutment is built, and a coffer-dam is being constructed on the eastern side for the other. The foundations of the piers for the flood arches are also commenced: and the forward state of this work ensures the entire completion of this bridge in the course of the summer. The railway between the Derwent and the river Ouse (a distance of about five miles) is in course of being formed, and an extensive deviation of the York turnpike road is commenced. Over the river Ouse a bridge of considerable magnitude is being constructed of four arches; one 45 feet span, is to open, for the passing of vessels going up to York. The abutments and piers have been ready for the iron work of the superstructure some time, but owing to the land waters in the river, a beginning was only made during the last month in fixing the iron work. This portion of the work will speedily be completed, as the whole of the castings for the piers are upon the ground, and the iron work of the arches is in a very advanced state at the Butterly Iron Works, where the whole will be put together before being brought to the spot. This work is also expected to be finished during the summer. The company have made contracts for the greater part of the iron work of the rails, a large proportion of which are now on the ground. The timber for the longitudinal sills and sleepers is also contracted for, and deliveries will be made in the course of a month, so that there is every probability of the railway being opened for passengers in the early part of next spring. The locomotive engines and carriages are all in a very forward state; the former are from the factory of Messrs. Fenton & Co. of Leeds, where several of them are to be seen complete.

Croydon Railway.—It is stated that this railway will be opened on the 14th instant.

Great Western Railway.—That part of the railway between Maidenhead and Reading is expected to be finished in the course of the month, and ready to be opened to the public.

Morecambe Bay Embankment.—We are enabled to state, on undoubted authority, that Sir John Rennie has expressed a very decided opinion with respect to the practicability of crossing Morecambe Bay, on the plan and principles laid down by Mr. Hague.—*Whitehaven Herald.*

Great Western Railway.—The greatest activity continues to prevail upon that portion of the line between Reading and Didcot; and the railway is progressing so rapidly towards completion, that we should not be surprised if that part of the road is ready for traffic before the opening of the line from Maidenhead to this town, Reading. We think that the public have great reason to complain of the narrowness of the bridges which the company have built in those places where the railway crosses the turnpike road; and if this principle is generally adopted, many accidents may be expected to occur. Messrs. Grissell and Peto are the contractors for that portion of the work between "Littlejohns," near Reading and Streatley; from which place a bridge is erecting; and the railroad then traverses to the Oxfordshire side of the river to Southstoke; this part is contracted for by Mr. Custans. From thence to Didcot, Messrs. Bedborough, of Windsor, have the formation of the road, nearly the whole of which, is, we understand, in a very forward state, and will in all probability be completed before the expiration of the time originally agreed on. The extensive nature of the cuttings at Shooter's-hill, and the embankments at Pangbourn have been executed by Messrs. Grissell & Peto with such extraordinary rapidity, as to excite universal surprise, strongly contrasting with the numberless hindrances and impediments existing elsewhere. The cuttings at Sunning-hill, under the direction of Mr. Brotherhood, the contractor, are proceeding as vigorously as the nature of that great undertaking will admit, and the most energetic efforts are put forth to speedily complete it, and thus open a direct line of communication between this town and the metropolis.—*Berkshire Chronicle.*—Nothwithstanding the temporary obstruction to the traffic, caused by the accident at the Hanwell-road bridge (not the Viaduct, as reported in the papers), the number of passengers on this line during the last week, amounted to nearly 8,000, and the receipts were larger than in any week since October. No impediment to the regular passing of the trains will take place from the removal of the defective iron girder, the cost of replacing which falls wholly upon the contractor. The laying of the permanent way to Twyford is now proceeding steadily, the rails being already laid from the Maidenhead station to the bridge over the Thames. The eastern arch of this bridge has been reconstructed with improved materials, and now stands perfectly sound, the centerings having been completely eased for some weeks. The Directors have just taken contracts for the construction of about 14 miles of the line extending from Didcot, near Oxford, to Uffington, the boundary of the London division of the line, on which the contract works are so light as not to average more than 6,000*l.* per mile. The Bristol Directors have also advertised for tenders for four miles of the line between Bath and the Box-tunnel, and it is expected that contracts for the whole of the remainder of this division of the line beyond Chippenham, will soon be entered into. We are glad to hear that the bill for which the company are applying, for the purpose of completing the required capital, has passed the committee of the House of Commons without any opposition, and will be read a third time immediately after the Easter recess.—*Bristol Gazette.*

Eastern Counties Railway.—The deepest part of the cutting for our railway in the vicinity of this town, we understand, will be near Widford-mill, where the rails will be laid at a depth of about sixty feet below the present surface. The London coach road at the crossing will pass over the cutting by a bridge, and there will also be bridges across Crozier's and Cherry Garden lanes. At the termination of the cutting the low land and river will be crossed by a viaduct about five hundred feet in length, and the railway will be continued upon an embankment until within a short distance of King-street, Chelmsford, where there will be another viaduct, upon which it will again cross the high road to the town or Fair Field, where the station will be formed. Soil for the embankments will be brought from a cutting through the village of Springfield, upon temporary rails, which, we understand, will be laid early in the summer.—*Essex Herald.*

Newcastle and North Shields Railway.—This undertaking is now advancing rapidly towards completion, and the line to North Shields will, it is fully expected, be opened to the public in the early part of the month of June. The company contemplate extending the line to Tynemouth; and a bill for that purpose is now before Parliament. Extensive preparations are being made by the company in order to afford the public every accommodation; and for that purpose they have entered into contracts for the supply of several first-rate engines, embracing all the latest improvements and discoveries in mechanical science. A splendid engine, called the "Hotspur," from the manufactory of Messrs. R. and W. Hawthorne, civil engineers, of this town, was placed on the line near Heaton on Monday; and a similar engine will shortly be delivered from the manufactory of Messrs. Stephenson and Co. Several other powerful engines are in the course of erection. The carriages for the conveyance of passengers are being manufactured in first-rate style, and will combine every improvement which can add security, or contribute to the convenience and comfort of those who may travel in them.—*Newcastle Journal.*

London and Brighton Railway (Shoreham Branch).—It is expected that the Shoreham Branch of the London and Brighton Railroad will be completed by August. The engine performs from fifteen to eighteen journeys in the day, taking on each occasion about twenty waggons laden with earth. The contractors are making rapid progress with the work, and the operations attract crowds of people to the spot.—*Sussex Advertiser.*—The works on the railway are proceeding with increased activity. New England farm has been so altered in appearance, by the progress of the cutting commenced on Easter Monday to connect the Shoreham branch with the terminus, as to be scarcely recognised. The tunnel is rapidly lengthening, and the cutting in Mr. Chatfield's farm is fast approaching Lashmar's mill. A second engine, called the "Shoreham," arrived in Brighton the 17th ultimo, and will commence running in a few days.

Sheffield and Rotherham Railway.—We hear that the directors of the Sheffield and Rotherham Railway, ever wishful to give satisfaction and safe accommodation to the public as far as possible, are about to place three or four additional engines on their line; and, in order to ensure the greatest possible degree of safety to the passengers, have ordered them to have flanges on all the six wheels, the driving wheels as well as the others, thereby diminishing the risk of an engine getting off the rails in the proportion of cent. per cent. Even if any of the end wheels or axles should break, the remaining wheels will keep it upon the rails—an excellent arrangement as compared with the old plan of only four flanged wheels out of the six.—*Sheffield Mercury.*

Birkenhead and Chester Railway Company.—The Bebbington contract embraces a distance of two miles and 32 chains; the earth work amounted to 253,000 cubic yards, of which 82,000 cubic yards have been already executed, leaving 171,000 yet to be done. The Bromborough and Eastham contract extended to Plumyard Brook, a distance of 3 miles and 37 chains. The earthwork comprised in this contract amounts to 288,000 cubic yards, of which 116,000 cubic yards have been executed, leaving 172,000 yet to finish. Post and rail fences are erected throughout nearly the whole of this contract; 220 men and 41 horses are employed on this portion of the line. The Sutton contract, a distance of 3 miles and 17 chains, is also proceeding satisfactorily, although some delay has arisen in opening new quarries, and waiting for bricks; but with due diligence on the part of the contractors, the whole may be finished during the summer; 150 men and 1[illegible] horses are employed in this district. The Mostyn and Chester contract extends 5 miles and 39 chains, and contains the greatest quantity of unexecuted work. It was let in August last to contractors who did not prosecute the work in a satisfactory manner, and, after remaining in their hands for upwards of six months, the company commenced working it themselves, providing waggons, rails, and suitable materials. In the event of the summer proving favourable, little doubt existed that this part of the line would be ready by May, 1840. There are 447 men and 22 horses employed on this division. The total number of men employed throughout are 1,117; horses 98.—*Extract from the Engineer's Report.*

London and Southampton Railway.—We feel great pleasure in being able to announce, on competent authority, that it has been positively determined to open that portion of the railway extending from this place (Southampton) as far as Winchester during the coming summer. We may therefore expect to be shortly in full possession of the advantages of railway communication. The erection of the terminus on the Marsh is proceeding with extraordinary rapidity.—*Hampshire Independent.*—The buildings and works for the railway station here (at Basingstoke) are proceeding with great rapidity; a number of hands are employed, and the scene at present is one of the utmost bustle and activity. The site selected is on a gentle eminence, within a stone's throw of the old chapel ruins and of Brook-street, commanding a fine view of the town and the highly picturesque scenery adjacent. It is already a conspicuous object from a distance, and will speedily form an important feature of the landscape from the neighbouring hills. A spacious carriage-way is forming to connect the station in a direct line from Oak-street. which will be the leading thoroughfare; other roads and footways are in progress, to render it of convenient access from various parts of the town.—*Salisbury Journal.*

FOREIGN INTELLIGENCE.

Paris.—A preliminary inquiry has been commenced by order of the Municipal Council of Paris on proposals for establishing two railroads from the capital, one to St. Maur, and the other to Sceaux. The first is intended to commence at the Rue Traversiere St. Antoine, passing through Bercy, St. Mande, Charenton, and Vincennes; and the second at the Place de l'Observatoire, running through Gentilly, Arcueil, Bagnieux, and Bourg la Reine.

Most of the great works commenced in Paris are at present suspended.—*Commerce.*

Havre Railroad Company.—At a late meeting it was decided, at the pressing instance of M. Aguaudo, that, in case it became impossible to give entire execution to the undertaking, it should be carried into effect as far as Rouen, and that the road should terminate, not at St. Sevres, as originally intended, but on the heights of Beauvoisin, passing by Blainville, and the branch lines on Louviers and Elbeuf being suppressed. This decision was definitely adopted, and no consideration, it is said, will induce the company to modify it.

Railway between the Danube and the Black Sea.—The establishment of a railroad between Tschernowoda and Kostendsche, which was to open a direct and speedy communication between the Danube and the Black Sea, will not be continued this year, or even for some time, and in fact will not be completed till the Porte gives its assent to the project. The marshy ground unfavourable to canalisation has been inspected, and the operation compared with the measurement already made by some Prussian officers in the Sultan's service, but the project of opening a canal appears to be abandoned. The railroad in question is not to go from Tschernowoda, but from Hirsowa, which is at no great distance, to Kostensche, where the rampart or wall of Trajan formerly commenced, a spot famous in ancient history as the place of Ovid's exile. Meantime the railroad in its present state is to be made use of for the transport of goods and provisions. Were the railroad once executed, a distance off more than two days would be gained, and the undertaking would also be of great importance for the trade and navigation of the Lower Danube.

The Young Egyptians.—Of the twenty Egyptians sent to this country by their government about nine years ago, to learn our arts and sciences, the last of them, Seid Achmet, left this on Monday, 1st ultimo, for Liverpool, to return to his native country. He had been five years learning millwright work under Mr. Graham at Partick, and civil engineering for about three years, under Mr. Macquisten. The climate disagreed with some of them, and they remained but a short time in this country. We understand two of them died; four paid their attention principally to plumber-work, two to ship-building, and the others chiefly to machinery-making and cotton-spinning. The Pacha wisely left them to choose trades or professions to suit their own tastes, and he paid for their education liberally. It is rather surprising that only one of them had the idea of studying civil engineering, being a profession so much required in that country, and where it is generally believed to have had its origin, but has long since been extinct; and it is rather an odd circumstance that this young gentleman should have been taught in Glasgow, and that when he returns to Egypt he will be the first native civil engineer who has appeared there for many generations. He is a very interesting young man, and was much esteemed here by people of all ranks. A number of respectable and scientific persons took leave of him at the steamer, and his former fellow-workmen fired a farewell salute from a number of guns as the steamer passed the Kelvin.—*Glasgow Herald.*

MISCELLANIA.

Nelson's Monument at Castle Townsend.—"Sometimes," says Lady Chatterton, in her *Rambles in the South of Ireland*, "we caught glimpses of the distant rocky headlands which render this part of the coast so magnificent. At the summit of one is a lofty arch, erected to the memory of Nelson by a party of officers. It is formed of large stones without cement, and I was told was entirely constructed after church one Sunday. If this account be true, it reminds me of the marvellous tale related in Ireland of every colossal structure, that it was the work of a night! This wonderful arch, however, forms a fine object in most of the views about Castle Townsend, and as I first saw it towering above the mist which concealed the base of the mountain height on which it stood, its appearance was supernatural.—*Evening paper.* [We have reason to know that this was the first monument erected to the memory of Nelson; it was sketched and planned by Captain Joshua Rowley Watson, R.N., who at that time commanded the Sea Fencibles on that part of the Irish coast, and built by them, as above stated, in one day, after great preparations, under his superintendence.—*Times.*]

Druidical Remains.—In the mountains of Ardes, some very curious remains of Druidical worship have been found. The spot is very wild, and is supposed to have been the site of a forest now destroyed. On digging below the grass, a layer of charcoal, mixed with a pounded vitrified substance, presented itself, in the midst of which was buried an urn, containing a second, also vitrified, and of a square form, in which were placed those fragments of bones which were not consumed by fire. Round this vase, at equal distances, are three lamps. Within the excavation are fragments of vases of different forms, resembling the most beautiful Roman Pottery.

Alexandria, 8th March.—Mehemet Ali has ordered the construction of barracks, &c., for the reception of troops at Fazouglou, which he intends to station there for the protection of the engineers who are to be sent thither for working the gold mines which either have been discovered in that part of Africa, or may be so hereafter.

The Bey of Tunis is constructing a magnificent palace at Tunis, at the cost of upwards of 2,000,000f. Almost all the materials are stated to have been brought from Europe, as well as the furniture, which has been made in great part at Paris. Thousands of workmen are daily employed on the edifice, the inhabitants being forced to contribute their personal labours, or else to find substitutes for this purpose.

Strasburgh.—The statue in bronze to be erected at Strasburgh in honour of Guttemburg, the inventor of printing, is fast progressing. The operation of the moulding is already terminated, and in a few days that of the casting will commence.

Encroachment of the Sea.—It has been proved by recent surveys that the coasts of Upper Normandy lose on an average a foot every year by the action of the sea on their entire development, and that it is under the truth to estimate at 400,000 cubic metres the soil washed annually by the sea into the little roadstead of Havre, at the entrance to the port, and on the banks of the Seine, close to that town.

Scottish Martyrs.—A monument is proposed to be erected at Edinburgh to the memory of the martyrs who suffered at that place before the Reformation.

New Light for Lighthouses.—A letter of the 10th March from Trieste, states that a new system of producing light for lighthouses has been invented by a serjeant-major in the Austrian artillery, named Selckonsky. The apparatus consists of a parabolic mirror, 62 inches by 30, with a twelve-inch focus, and the light is produced by a new kind of wax candle, invented by M. Selckonsky. It has been tried under the inspection of the Austrian Lloyd's Company in the port of Trieste, by being erected on the mast of a vessel. The light is said to have illuminated the whole of the port and the surrounding parts of the town equal to the moon at full, and at the distance of six hundred yards the finest writing could be read. A second trial has been made in bad weather, and the result was proportionably favourable.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 3RD APRIL, AND THE 25TH OF APRIL.

WILLIAM OVERTON, of Shovel Alley, St. George's-in-the-East, for "Certain Improvements in Machinery or Apparatus for making Ship's Bread or Biscuits."—Patent dated 3rd April; 6 months to specify.

THOMAS EDWARDS, of King-street, Holborn, writing and dressing-case manufacturer, for "Improvements in the manufacture of Hinges."—3rd April; 6 months.

HUGH LEE PATTINSON, of Bensham, near Gateshead, Durham, gent., and WILLIAM SEPTIMUS LOSH, of Walker, Northumberland, gent., for "Improvements in reducing Metallic Ores."—3rd April; 6 months.

JOSIAH MARSHALL HEATH, of Allen Terrace, Kensington, gent., for "Certain Improvements in the manufacture of Iron and Steel."—5th April; 6 months.

JOSE FRANCISCO CARLOS D'ARTENN, of the Haymarket, gent., for "Improvements in Machinery for transmitting Power, whereby the effect of such Power is increased without loss of Speed."—6th April; 6 months.

JAMES NASMYTH, of Patricroft, near Manchester, engineer, for "Improvements applicable to the bearings or journals of Locomotive and other Steam-engines, which Improvements are also applicable to the bearings or journals of Machinery in general.—9th April; 6 months.

GEORGE STOCKER and JOSEPH BENTLEY, both of Birmingham, gunmakers, for "Certain Improvements in Guns, Pistols, and other denomination of Fire Arms."—9th April; 6 months.

CHARLES ADOLPHE ROEDERER, of Strasburgh, but at present residing in Wellington-street, City, for "An Improved method, or process of manufacturing or preparing the Chemical Salts, called Acetates."—9th April; 6 months.

THOMAS PARK, of 22, New Bridge-street, Blackfriars, engineer, for "Improvements in Railroad and other Carriages, in Wheels for such Carriages, and in Roads and Ways on which they are to travel."—9th April; 6 months.

THOMAS BONSOR CROMPTON, of Tamworth, Bolton, Lancaster, for "Improvements in the manufacture of Paper."—9th April; 6 months.

LEMUEL WELLMAN WRIGHT, of Manchester, engineer, of an extension for the term of Seven Years of Letters Patent, granted to him for "Certain Improvements on Machinery or Apparatus for Washing, Cleansing, or Bleaching of Linens, Cottons, and other fabrics, Goods, or fibrous substances."—9th April.

JAMES CLEMENT, of Liverpool, carver and gilder, for "Improvements in preparing Mouldings, and in producing the effects of Chasing or Embossing various Devices or Patterns and Frames, and other work."—10th April; 6 months.

JOSEPH GILLOTT, of Birmingham, steel pen-maker, and THOMAS WALKER, of the same place, machinist, for "Improvements in Engines, and in Carriages to be worked by Steam or other motive Power."—13th April; 6 months.

LOT FAULKNER, of Cheadle, Chester, calico-printer, for "Certain Improvements in the mode of working Pumps or Valves, and which Improvements are also applicable to Fire-engines and other similar apparatus."—11th April; 6 months.

HENRY CROSLEY, of Hooper-square, London, C.E., for "A new manufacture of Paper."—15th April; 2 months.

LAURENCE ROWE, of Brentford, soap-maker, for "Improvements in the manufacture of Sulphate of Soda."—16th April; 6 months.

HENRY CURZON, of Kidderminster, machinist, for "Improvements in Presses."—16th April; 6 months

HENRY DUNNINGTON, of Nottingham, lace manufacturer, for "Improvements in Machinery employed in making Frame-work Knitting, or Stocking Fabrics."—16th April; 6 months.

JOHN SWINDELLS, of Manchester, manufacturing chemist, for "Certain Improvements in the manufacture of Prussian Blue, Prussiate of Potash, and Prussiate of Soda."—16th April; 6 months.

JAMES FERGUSSON SAUNDERS, of New Bond-street, gent., for "Improvements in the manufacture of certain descriptions of Paper, Mill-board, Papier Maché, and other matters of that kind, capable of being produced from such description of Paper Pulp."—20th April; 6 months.

WILLIAM CROFTS, of Radford, lace manufacturer, for "Improvements in Machinery used in making Bobbin-net Lace, for the purpose of making Figured or Ornamental Bobbin-net Lace, and Lace or Net of various textures."—20th April; 6 months.

JOHN POTTER, of Ancoats, Manchester, spinner, and WILLIAM HORSFALL, of Manchester, card-maker, for "An Improvement or Improvements in Cards for carding fibrous substances, part of which Improvements may be used as a substitute for Leather."—20th April; 6 months.

JAMES DAVIS, of Walcot-place, Lambeth, Esq., for "Improvements in the manufacture of Soap."—20th April; 6 months.

DAVID STEAD, of Great Winchester-street, London, merchant, for "An Improved mode or method of Making or Paving public Streets and Highways, and public and private Roads, Paths, Courts, and Bridges, with Timber or Wooden Blocks."—23rd April; 4 months.

ALFRED SNIGER, of Vauxhall, potter, and HENRY PETHER, of Wandsworth Road, Artist, for "Certain Improvements in the preparation and combination of Earthenware or Porcelain, for the purpose of Mosaic or Tesselated Work."—23rd April; 6 months.

JOHN MILLER, of Bolton, machine-maker, for "An Improved Drilling Machine."—23rd April; 6 months.

DAVID NAPIER, of Mill-wall, engineer, for "Improvements in Iron Steam-boats"—23rd April; 6 months.

ELIJAH GALLOWAY, of Water-lane, Tower-street, engineer, for "Improvements in Steam-engines."—23rd April; 6 months.

ANTONIO MOVILLOW, of Dorset-place, Dorset-square, gent., for "Improvements in Machinery for propelling Ships' Boats, and other Vessels, on water, designed to supersede the use of Paddle-wheels."—23rd April; 6 months.

GEORGE HOLWORTHY PALMER, of Surrey-square, Old Kent Road, C.E., for "Improvements in Paddle-wheels, for propelling Ships' Boats, and other Vessels navigated by Steam or other motive Power.—23rd April; 6 months.

WILLIAM EDMUNDSON and JAMES EDMUNDSON, both of Manchester, engineers, for "Certain Improvements in the Machinery or Apparatus for the manufacture of Wood-screws and Screw-bolts."—23rd April; 6 months.

JOB CUTLER, of Lady Pool-lane, Birmingham, gentleman, for an "Improved Method or Methods of Constructing chains for Suspension Bridges, Cables, Mining and other purposes, and for an "Improved Method or Methods of making the Bars, Links, and Bolts thereof."—23rd April; 6 months.

JAMES BARLOW, of Birmingham, brass founder, for "Certain Improvements in the Construction of Candlesticks."—25th April; 6 months.

JOHN JONES, of Westfield-place, Sheffield, for "A New Frying-pan and Grilling pan for the Cooking of Steaks, Chops, and other Meats."—25th April; 6 months.

JOHN BROWNE, Esq., of Castle-street, Regent-street, for "Improvements in Saddles and Stirrups for Horses and other Animals, parts of which Improvements are applicable to Apparatus for Carrying Packs by Men.—25th April; 6 months.

ERRATA.

In our last number, in the article headed "Savary and Trevithick," p. 187, line ? for "Regaud" read "Riguad."

Line 21, for "Lexicon Ledicinum," read "Lexicon Technicum."

Line 26, for "M'Reid, Charing Cross," read "M'North, Bookseller."

Line 32, for "of Boughton," read "or Broughton."

Page 138, line 1, for "7," read "17."

Line 11, for "Swebre's" read "Switzer's."

TO CORRESPONDENTS.

The communication of a "Surveyor" was received too late for insertion in this month's Journal; it shall appear in the next number.

We shall feel obliged to our country correspondents if they will forward us any account of works in progress, or any newspaper containing articles connected with the objects of our Journal.

BUNNETT AND CORPE'S CONCENTRIC STEAM-ENGINE.

Fig. 1. Elevation of a High-pressure Engine

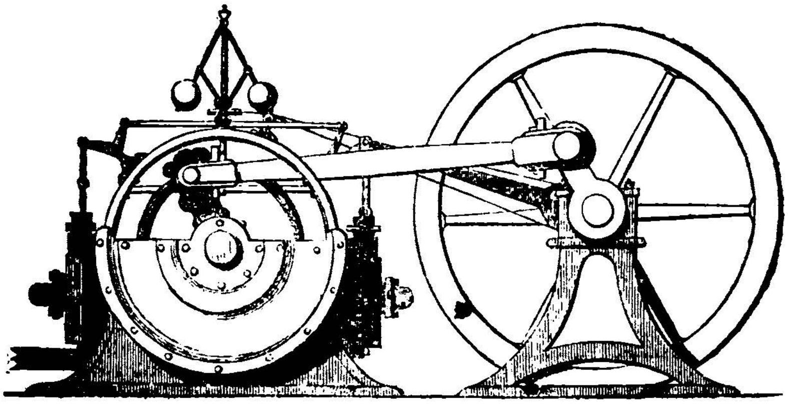


Fig. 2. A Longitudinal Section taken through the centre of the Engine.

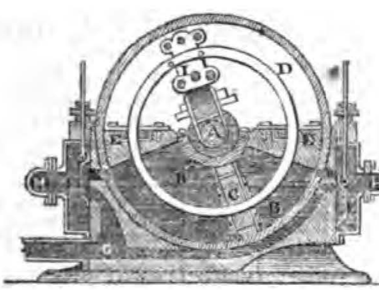
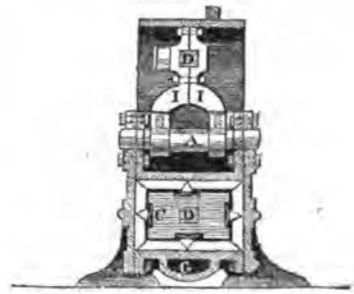


Fig. 3. Transverse Section taken through the centre of the Engine.



The letters of reference are the same in both sections.

A—Is the fixed shaft in the centre of the engine, on which the connecting arms supporting the piston rod, and carrying a cross head or pin for the connecting rod to oscillate freely upon.

B—Steam chamber in which the piston reciprocates.

C—Piston.

D—Circular piston rod, which is made of square steel, admitting of metallic packing to the stuffing boxes.

E—Blockings against which the outside covers of the cylinder are bolted, and also carrying the metallic stuffing boxes.

FF—The slide valves shewn at one-third of the stroke.

G—The Exhaust.

HH—The pipes conveying the steam to the slide valves.

II—The connecting arms oscillating on the fixed centre shaft, and carrying the weight of the piston, piston rod, &c.

KK—Are the steam ports.

BUNNETT AND CORPE'S NEW PATENT CONCENTRIC STEAM-ENGINE.

Messrs. Bunnett and Corpe, of Deptford, the patentees and inventors of the improved iron safety-shutter, now in such high estimation and extensive use, have lately taken out letters patent for a concentric steam-engine, drawings of which we have given above. We shall first state the action of the engine, as we saw it at work in the patentees' manufactory, and then proceed to point out its advantages. It will be seen, that in appearance it is similar to a rotatory engine, but its action is of a decidedly different character. The circular case, as shown in figures 1 and 2, forms in the lower part the steam-chamber, in which is accurately fitted a square piston, with Barton's patent metallic packing. Through the centre of the piston, and attached to it, is a concentric or ring-like piston-rod, which at a point opposite to it (the piston) is firmly embraced and supported above by two connecting arms, having a double bearing upon a fixed shaft in the centre of the engine; on which they oscillate sufficient to allow the piston to reciprocate freely. The piston-rod is made of square steel, and works through two metallic-stuffing boxes in the top of the steam-chamber; and from the side of one of the arms above mentioned projects a pin, to which is attached the connecting-rod transferring the power of the engine to the crank of the fly-wheel and gear. On each side of the steam-chamber are two distinct slide-valves, worthy of particular notice: they take their motion from an eccentric on the crank shaft, and have two slide-boxes or covers, by which means no steam is lost by exhaustion in the passages, as in the single slide, the exhaust is also fully open at the commencement of the stroke, and remains so to any subsequent part of it that may be desired. By this arrangement of the valves, the steam can be worked expansively or not without cams, tappet, or gear of any kind, the slides of themselves cutting off the steam at any part of the stroke. Having thus explained the structure of the engine, we will now proceed to show its mode of operation. The steam-valve being opened, and the exhaust-valve closed on one side, and the contrary on the opposite side, the steam is admitted, and propels the piston forward to the opposite side, when the steam-valves change their position, and the steam is admitted on the opposite side, which again propels the piston back to its original position,—and thus, by the backward and forward motion of the piston, it passes through two arcs of a circle, similar to a pendulum, and carries with it the annular piston-rod and the arms attached to it, thereby sets in motion the connecting-rod; the piston being entirely carried or suspended by the arms attached to the fixed centre shaft, is relieved from all tendency to wear irregularly, there being in fact, no pressure upon it beyond that of the springs necessary to keep the segments in their places.

By the simple arrangement and working of the engine the connecting rod has a direct action, without the intervention of guide rods or parallel motion of any kind, and during the time that the greatest force is required upon the crank, it never forms an angle of more than five to ten degrees; its reciprocating motion describing an arc of a circle, which so nearly assimilates to the rotatory action of the crank, the changes of motion are effected with surprising ease and rapidity; and whether it be from the direct application of the force upon the crank alone, or the absence of parallel motion, or from the power being communicated as it were, upon an inclined plane, direct to the connecting rod, or by a combination of all these, very great power is most certainly gained.

The patentees have made several experiments, some of which we witnessed, proving the advantages of the position of their connecting rod and crank motion over the methods now in use in locomotive and other engines, we have annexed a table of these experiments. By these it will be seen that in some positions of the crank, it having just passed its centre, nearly double the power is obtained, and taking the average of a whole revolution of the crank an advantage of more than one-third is gained; the experimental engine was set in motion in our presence, and with a piston of 24 inches superfices and a pressure of 20lbs. only on the square inch, it exhibited great power, driving several lathes, drilling machines, &c., while without any load the crank performed upwards of 260 revolutions in a minute. It is the intention of the patentees to carry out these experiments to a practical result in a locomotive engine they are about to build, and they are also now engaged in executing orders for fixed engines, which will afford an opportunity of fully testing their power.

We strongly recommend the engine to the notice of engineers, and advise them to avail themselves of the opportunity of forming their own judgment of its merits, by examining the engine at work at the premises of the patentees, who will be happy to explain its action.

The following is the Table of experiments above alluded to.

AMOUNT of FORCE required to move a crank, having a nine inch throw, through one-fourth of its revolution, commencing at an angle of 5 degrees from its dead centre, with a 14lbs. weight suspended at the end of the throw.				The same experiment without any weight suspended.		
Degrees.	Old Prin.	New Prin.	Difference.	Old Prin.	New Prin.	Difference.
5	179	98	81	50	27·5	22·5
10	96	54	42	29	17·5	11·5
15	66	39·5	26·5	18·5	13·5	5
20	53·5	34	19·5	14·5	10·75	3·75
25	40·75	29	11·75	12	9·75	2·25
30	33	26·5	6·5	10·5	8·5	2
35	29·5	23	6·5	9·25	7·75	1·5
40	24·75	21	3·75	8·25	7	1·25
45	21	18·25	2·75	7	6·5	·5
50	18·5	16	2·5	6·5	5·5	1
55	16	14	2	5·75	4·75	1
60	14	12	2	4·75	4·25	·5
65	11·5	10	1·5	4·25	3·5	·75
70	9·5	8·5	1	4·125	2·75	1·37
75	8	7·25	·75	3·5	2·25	1·25
80	6·25	5·75	·5	3·25	1·75	1·5
85	4·75	4	·75	3·125	1	2·125
	632	420·75	211·25 3	202·25	134·5	67·75 3
			633·75			203·25

ON THE THEORY OF THE STEAM ENGINE.

BY ARISTIDES MORNAY, ESQ.

In our April number we promised to lay before our readers a new formula for calculating the force of steam at different temperatures, which it seemed possible might represent the true law, since it contains but one arbitrary constant, and that a very simple one, and agrees pretty well with those experiments which appear most worthy of confidence, between temperatures very far distant from each other. It presents likewise, as we shall show in the ensuing number, facilities in calculation not to be met with in any other formula which has as yet been proposed; not in calculating simply the force of steam at different temperatures, (Tredgold's rule being simpler for that purpose,) but in calculating the force corresponding to different densities, or rather the variations of elastic force occasioned by changes in the density of the steam. This is principally useful in estimating the effect of expansive steam engines, for which the formula was specially sought, and if it does not give the actual density with perfect accuracy, the error, which cannot be very great in any practical case, may be almost entirely eliminated in its application to that object.

Our formula is founded in part on the two physical laws discovered by Gay Lussac and Mariotte; the former that elastic fluids receive, under a given pressure, for every additional degree (Fahr.), an accession to their bulk equal to one 480th of the volume they would occupy, under the same pressure, at the freezing point of water; the latter, that the elastic force of gases is directly proportional to their density, or inversely as their volume. If, therefore, we divide the volume of a given quantity of any elastic fluid at 32 deg. into 480 equal parts, its volume at 0 deg. will be equal to 448 of those parts, and at any temperature t, $t+448$. Thus, if a given quantity of fluid occupies at the temperature t' and under the pressure p', the volume v', it will, at any higher temperature t, and under the same pressure p', occupy a space equal to $v'\frac{t+448}{t'+448}$; but if confined to its original volume, it will support a pressure equal to $p'\frac{t+448}{t'+448}$. If now we suppose it compressed into a still smaller space, so that its density shall be increased from d' to d, its temperature being still t, its elastic force p will be

$$p=p'\frac{d(t+448)}{d'(t'+448)},$$

and if we take the density of steam generated under a pressure of 30 inches of mercury for unity, and make in the above equation $p'=30$, $d'=1$, and $t'=212$, the elastic force of steam at any temperature t will be

$$p=30\frac{d(t+448)}{660}=\frac{d(t+448)}{22}, \quad \quad \text{I}$$

the density d to be hereafter determined.

Having by this formula calculated a series of densities from the experiments of Dulong and Arago, the density seemed to increase in a geometrical ratio, while the temperature increased in an arithmetical ratio; but a formula constructed on this principle gave by far too high results at high temperatures, in consequence of which we introduced the divisor $t+448$, which in a great measure corrected that fault of the formula. It then became

$$\log.d=\frac{5(t-212)}{t+448}. \quad \quad \text{II}$$

Combining the equations I and II, we obtain finally

$$\log.\,p=\log.\,(t+448)+\frac{5(t-212)}{t+448},-1.3424227. \quad \quad \text{III}$$

The following table has been constructed for the purpose of comparing the results of experiment with those calculated by Tredgold's rule and by the above equation, affording a comprehensive view of their variations and discrepancies up to an elastic force of 24 atmospheres:—

Temperature.	Elastic force by Experiment.		Elastic force by Tredgold's rule.	Differences.	Mean Differences.	Elastic force by Formula III.	Differences.	Mean Differences.
32·00	0·25	D.	0·17	0·08 —		0·29	0·04 +	
64·00	0·75	—	0·63	0·12 —		0·83	0·08 +	
96·00	1·95	—	1·84	0·11 —		2·12	0·17 +	
132·00	5·07	—	5·07	0·00		5·39	0·32 +	
173·00	13·18	—	13·46	0·28 +		13·69	0·51 +	
212·00	30·00		30·00	0·00		30·00	0·00	
220·00	34·20	D.	34·92	0·72 +	0·345 +	34·85	0·65 +	0·275 +
—	34·95	T.	—	0·03 —		—	0·10 —	
230·00	41·51	—	42·00	0·49 +	0·450 +	41·84	0·33 +	0·265 +
234·32	45·00	C.	45·11	0·11 +		45·20	0·20 +	
240·00	50·00	T.	50·24	0·24 +	0·245 +	49 96	0·04 —	0·045 —
242·78	52·50	C.	52·75	0·25 +		52·45	0·05 —	
250·00	59·12	T.	59·79	0·67 +	0·447 +	59·38	0·26 +	0·047 +
250·30	60·00	S.	60·00	0·00		59·69	0.31 —	
250·79	60·00	C.	60·60	0·60 +		60·19	0·19 +	
251·66	64·20	D.A.	64·72	0·52 +		64·25	0·05 +	
269·87	82·50	C.	83·26	0·76 +	0·567 +	82·65	0·15 +	0·137 —
270·00	82·50	T.	83·45	0·95 +		82·72	0·22 +	
271·94	86·12	D.A.	86·10	0·02 —		85·34	0·78 —	
272·00	88·90	D.	86·20	2·70 —		85·42	3·48 —	
275·00	90·60	C.	90·44	0·44 +		89·62	0·38 —	
280·00	97·75	T.	97·92	0·17 +	0·330 —	96·99	0·76 —	1·270 —
280·94	100·21	D.A.	99·38	0·83 —		98·43	1·78 —	
292·91	120·00	C.	119·65	0·35 —	0·075 +	118·41	1·59 —	1·150 —
293·40	120·00	S.	120·50	0·50 +		119·29	0·71 —	
307·54	150·00	D.A.	149·00	1·00 —	0·560 —	147·29	2·71 —	2·290 —
307·94	150·00	C.	149·88	0·12 —		148·13	1·87 —	
320·00	179·40	T.	178·50	0·90 —	0·990 —	176.22	3·18 —	3·277 —
—	180·00	C.	—	1·50 —		—	3·78 —	
320·36	180·00	D.A.	179·43	0·57 —		177·13	2·87 —	
331·70	210·00	—	210·50	0·50 +		207·54	2·46 —	
336·87	225·00	—	226·09	1·09 +	1·195 +	222·77	2·23 —	2·120 —
336·94	225·00	C.	226·30	1·30 +		222·99	2·01 —	
340·00	231·00	D.	236·00	5·00 +		232·43	1·43 +	
341·78	240·00	D.A.	241·77	1·77 +	1·850 +	238·08	1·92 —	1·840 —
341·83	240·00	C.	241·93	1·93 +		238·24	1·76 —	
350·78	270·00	D.A.	272·86	2·86 +	3·845 +	268·36	1·64 —	0·685 —
351·32	270·00	C.	274·83	4·83 +		270·27	0·27 +	
358·88	300·00	D.A.	303·64	3·64 +	5·075 +	298·23	1·77 —	0·385 —
359·60	300·00	C.	306·51	6·51 +		301·00	1·00 +	
374·00	360·00	D.A.	368·83	8·83 +		361·30	1·30 +	
398·48	480·00	—	498·94	18·94 +		486·08	6·08 +	
418·46	600·00	—	631·61	31·61 +		611·96	11·96 +	
435·56	720·00	—	767·38	47.38 +		739·48	19·48 +	
1	2		3	4	5	6	7	8

The letters placed on the right of the second column indicate the authors of the experiments, viz:—D, Dalton, T, Philip Taylor, S, Southern, D. A., Dulong and Arrago; and the numbers in the second column which are followed by a C are taken from a table published by Clément-Desormes, and are probably calculated, but we have placed them among the experiments for the sake of comparison.

On examining this table it will be manifest in the first place that Dalton's experiments above 212 deg. cannot be very accurate; for at 220 deg. both Tredgold's and our formula give higher numbers, at 272 deg. both give much lower, and at 340 deg. again both give higher numbers, showing a want of regularity in Dalton's results; besides which, the latter differ more from other experiments at the above named temperatures than either of the formula, but on the other hand it hardly seems likely that Dalton should have made an error of five inches in 231 at 340 deg. of temperature, which renders it probable that Tredgold's rule is in excess about that temperature, particularly as it also exceeds Dulong and Arrago's experiments at that and all higher temperatures, the difference increasing very rapidly with the temperature, as shown in the table, amounting at 435.56 deg. to 47·38 inches of mercury, or nearly one atmosphere and seven-twelfths of an elastic force of 24 atmospheres. It appears to us on the whole that Tredgold's rule gives an elastic force which increases too rapidly with the temperature, and consequently that, being exact at 212 deg., it gives too low a result below, and too high a result above that temperature, as most of the differences in the table seem to prove, the few exceptions between the temperatures of 271.94 deg., and 320.36 deg., as well as those at 132 deg., 173 deg., and 220 deg., being attributable to inaccuracy in the observations. The results of our rule, on the other hand, surpass those of experiment below 212 deg., and fall short of them, in general, from that temperature to about 360 deg., above which they again exceed the experiments, the differences increasing in an almost uniform progression, until at 435.56 deg. our formula exceeds the experiments by 19.48 inches, or nearly two-thirds of an atmosphere, which corresponds to a difference of about 2.45 deg. of temperature, while the excess by Tredgold's rule corresponds to a difference of 5.66 deg.

It is obvious that, our formula being founded on the law of the dilatation of elastic fluids, the results must bear reference to the degrees of the air thermometer.

MACRAE'S PATENT HYDRAULIC GAS-HOLDER COUNTERBALANCE.

Some discussion has lately arisen respecting *Macrae's Patent Hydraulic Gas-holder Counterbalance*, assimilating its action to that of the domestic bellows, "regulating the ascending and descending motions of a gas-holder, by means of an hydraulic counterbalance," or "*hydraulic tank*," as he calls it.

The object of the patent is doubtless a most desirable one. It has long been a desideratum in gas establishments to relieve the gas-holder of a great proportion of its intrinsic weight, while the gas from the retorts is flowing into it; and, on the other hand, to restore its weight, or as much of its intrinsic weight as may be requisite, while it is sending forth its contents of gas into the street mains.

The advantages of these two conditions of the gas-holder are, if attainable, abundantly manifest to the gas manufacturer. It is quite notorious that by the present system the weight and consequent resistance of the gas-holder, while it is admitting gas from the retorts, several parts of the machinery are materially injured; time is lost in charging the gas-holder, a very unnecessary quantity of fuel is consumed in the furnaces, and the gas is not only wasted, but, by not being allowed to escape from the retorts with sufficient rapidity, it is deteriorated, in its illuminating properties, by being exposed too long to the intense heat of the retorts. Frequent and dangerous reactions are also produced from the same cause.

Many attempts have been made, at various times, to obviate these defects, and, with that view, patents have been taken out by Messrs. Malam, Outhot, Parks, and Broadmeadow. They have all been failures, and we very much apprehend that the contrivance of Mr. Macrae will not turn out to be a bit more successful than the schemes of his predecessors.

The chief objections to it are, 1. That, if there be no natural head of water existing above the utmost height to which his "*hydraulic tank*" will rise, there will necessarily be imposed the labour of pumping up water every twenty-four hours to this height, in order to fill the "*hydraulic tank*" every time the gas-holder has to be charged with gas. 2. That this "*hydraulic tank*" must necessarily discharge its contents of water, so far below the surface of the water in the *gasometer tank*, as to require another process of pumping in order to get rid of it.

Under ordinary circumstances, therefore, here are two operations of pumping every twenty-four hours; the one in charging, the other in discharging the gasometer. After this, it would appear to be entirely out of the question to add to the labour (as Mr. Macrae suggests) by "supplying the required weight of liquid to his hydraulic tank, every time the retorts are drawn."

It will hardly be credited that for a single gasometer of 50 feet in diameter, by 22 feet deep, and working at an inch pressure, an *hydraulic tank*, on Mr. Macrae's plan, if of a cylindrical shape, would require to be about 40 feet below the surface of the water in the gasometer tank!—or if it were a cube of two feet by six feet, still its depth below the surface of the water in the gasometer tank, would require to be 17 feet—either of these depths being considerably below the surface of the ground, consequently requiring the water to be pumped out every time the *hydraulic tank* empties its contents into these shafts, or wells.

To show that there is no exaggeration in this, it is well known that the ordinary balance-weights for a gasometer of the dimensions we have supposed, working at an inch pressure, would require about 13 cubic feet of cast iron, independently of the chain, or a cube of 2 feet × 2 feet × 3.3 feet. If this balance weight, however, were to be made after Mr. Macrae's plan, and instead of being composed of a solid cube of cast-iron, it consisted of a box, filled with water, its dimensions would be 2 feet by 4 feet, and 11 feet deep: for if we take 5943 lbs. as the weight of the 13 cubic feet of iron, and allow 468 lbs. for the weight of the box to contain the water, and divide the difference by 62·5 lbs., the weight of a cubic foot of water, it will give 87 cubic feet as the dimensions of the box,

$$\frac{5943—461}{62·5} = 87 \text{ cubic feet}$$

or 528 gallons. This is the weight only of the balance weights at *present in use*. But it is to be supposed, that Mr. Macrae proposes to use a much greater weight as a counter-balance than this: perhaps ⅔ or ¾ of the weight of the gasometer. In cast iron, then, ¾ would be equal to 28 cubic feet, and 208 cubic feet, or 1,248 gallons, if filled with water, including its containing box, or *hydraulic tank*. Now it has been already stated, that a cylinder adequate to hold the necessary quantity of water, according to Mr. Macrae's plan, would require to be 40 feet below the surface of the water, in the gasometer tank. But if the cylinder were only 2½ feet in diameter, it would require to be *more than* 40 *feet in depth*: for $\frac{2.5 \times 2.5 \times 11 = 4.91 \times 40}{14} =$ 196.40 cubic feet only, instead of 208 cubic feet.

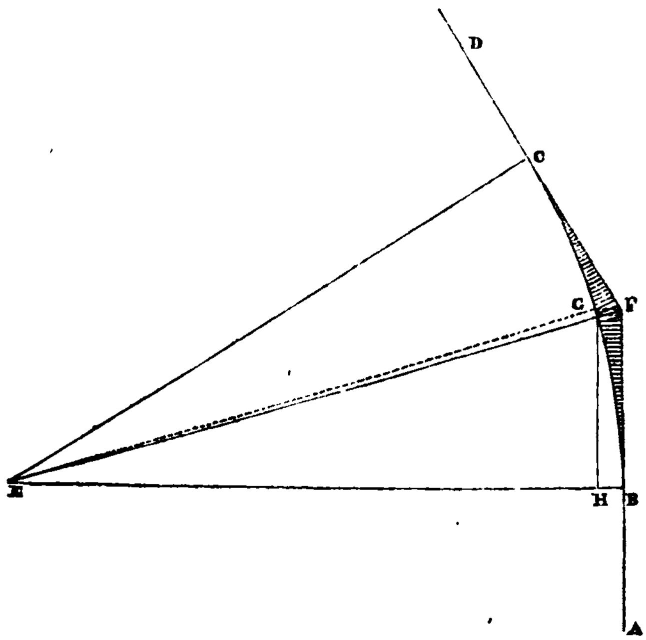
It will be quite obvious, that if the water discharged into this well, of upwards of 40 feet in depth, be not pumped out of it before the gasometer begins to fall, the gasometer will be able to descend only a few inches, until it become stationary: for the still undischarged load of the counter-balance (being ¾ of the whole weight of the gasometer), will prevent it from descending further.

Mr. Macrae's scheme, though crude and unsuitable, is not without a considerable portion of ingenuity. The object aimed at is decidedly one of great importance to the gas manufacturer. A.

The Oxford-street Experimental Paving.—On Saturday, the 18th ultimo, in accordance with the arrangements made by the Marylebone Vestry, limiting the period of the trial of the respective experimental pavements laid down in Oxford-street until the month of May, Mr. Kensett, as chairman of the Paving Committee, laid before the board the state in which each of the experiments was. The following is the result:—On examining the bitumen laid down by the Bastenne and Gaujac Bitumen Company, they found it had stood the test of the severe wear and tear of the vehicles passing that road during the whole winter, without any material alteration. That portion laid down by the Val de Travers Company, which had been studded with stone, had stood, but that portion in which the broken granite had been set in their liquid had totally failed, and must be removed immediately. The Aberdeen granite cubes laid down by the parish had proved to be in most excellent condition; that more particularly which had been set in Claridge's Asphalte was in a state of superior order, and the stones appeared immoveable. Robinson's bitumen had been taken up some months since in consequence of having proved a decided failure. The Scotch asphaltum had been repaired once, and had again become so dilapidated as to render the portion of the road which it occupies dangerous. The wooden block pavement, which had been laid down five months since by the projector, Mr. Stead had excited the minute attention and admiration of the committee. It appeared, on examination, that the blocks formed a road of a most even surface, and carriages passed over without the slightest noise, and of the 12 inches, the length of the blocks, it was found they had not been diminished one quarter of an inch. Their attention, however, was particularly directed to the bottom of the blocks, which, to the extent of about three-fourths of an inch, appeared discoloured by a blue stain, intimating (?) that the first approach of decay was making its appearance. A considerable division of opinion existed among the committee upon the above appearance being that of decay; they were, however, of an unanimous opinion that a further trial was necessary, in order to enable the vestry fairly to be satisfied as to the durability of the pavement which might ultimately be decided upon, and that any decision ought to be deferred till the autumn. It was ultimately decided in the vestry that the application of a Mr. Geary to lay down a wooden pavement, upon an improved principle, should be referred to the committee, and that the final decision upon the experiments should be deferred to the first Saturday in September.

RAILWAY CURVES.

Sir—Being myself one of those who are willing to profit (through your columns), by the experience of others, I take the liberty of forwarding a system for setting out curves by ordinates, which, being perfect in theory, only requires great exactness in the execution, and depends but little upon instruments; it is, I believe, in frequent use, but which I have recently adopted from my own deductions; these remarks may be found useful by some of your younger readers, and may lead to something better from elders in the profession.



Let AB and CD be two straight lines, which are required to be united by a curve; say for convenience of a mile and a quarter radius, or 100 chains; by producing the two lines the angle AFD must be ascertained with great exactness; (the angle of its supplement being much less, may be taken with less liability to error). With EC for the radius, the angle CEF may be ascertained, for supposing AFD is 148° 20′, EFC is 74° 10′, and therefore CEF is 15° 50′. By this means CF & BF will be found 28 36 links, B & C being the commencement of the curve. These points having been measured off from F, commencing with the odd links, viz. 36, and leaving pegs at every chain, the ordinates may be set off at right-angles according to a table to be calculated in the following manner, and which will do for any curve of a similar radius.

In the accompanying diagram, EG is the radius.
GH is the sine.
EH is the co-sine, and
HB the versed sine, of the arc BG.

Now HB = GF and BF = GH, therefore the ordinates will be versed lines, where the length on the tangent is equal to the sine.

Again, HB = EB — HE, and $HE = \sqrt{EG^2 - GH^2}$, therefore $FG = EB - \sqrt{EG^2 - GH^2}$; or, with o for ordinate, r for radius, s for sine, and v for versed sine; $o = r - \sqrt{r^2 - s^2}$, the table is then calculated thus at every chain.

The ordinate at 100 links $= 100{\cdot}00^2 - \sqrt{100.00^2 - 1.00^2}$ and with the assistance of "Barlow's Tables of Factors' Roots, &c," a table may be made to any useful length in a few hours, thus—

$100\ 00^2 =$	10000 0000	again $100\ 00^2 =$	10000 0000
$-1\ 00^2 =$	1 0000	$-2\ 00^2 =$	4 0000
	9999 0000		9996 0000
sq. root of which =	9999·4998	sq. root of which =	9997·9998
deducted from 100^2 =	·5002 of a link.	deducted from 100^2 =	2·0002

To obtain the square root of the above numbers it is convenient to drop the last four figures of o, and alter the decimal point in the root two figures:

The result of these calculations will be—

	links		links		links
at 1 chain	·50	at 11 chains	60·68	at 21 chains	222.98
2	2·00	12	72·26	22	245·00
3	4·50	13	85·86	23	268·09
4	8·00	14	98·48	24	292·27
5	12·50	15	113·13	25	317·54
6	18·01	16	128·82	26	343·91
7	24·53	17	145·55	27	371·39
8	32·05	18	163·33	28	400·00
9	40·58	19	182·15	29	429·74
10	50·12	20	202·04	30	460·61

These ordinates may be made available on the curve of any radius, by multiplying the length on the tangent, and its respective ordinate by the multiplier of the radius; thus for 80 chains the multiplier is ·8—
so at 80 links the ordinate is ·40
at 160 ——— 1·60 &c.

But it would be better to use a table calculated at every chain, and it might be worth while for some party with a little spare time to publish a set of ordinates at every useful radius, say from 10 chains to 500.

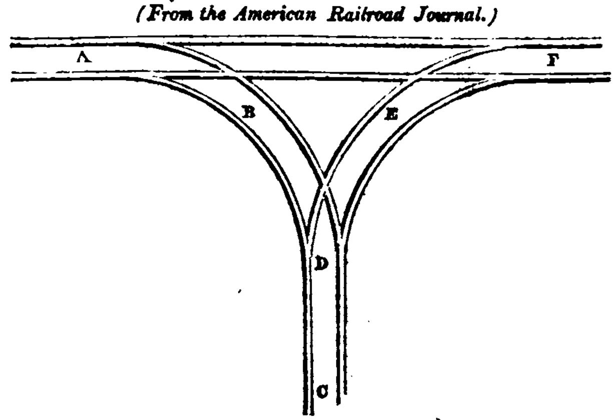
The greatest accuracy is required in taking the angle, as otherwise the starting of the curve will be incorrect, and the curves in the centre will shoot past each other.

Where the angle of the two tangents approaches a right angle, it may be advisable to work the ordinates as far as they can be correctly done, and then, by reversing them, to lay off another tangent.

I am your obedient servant,
Surveyor.

A SUBSTITUTE FOR A RAILWAY TURN TABLE.

(From the American Railroad Journal.)



Having been led, by the objections attending the running of locomotives backwards, or with their driving wheels in front, to consider some method of turning them and their trains more efficiently than the common turning-table, which only admits of one or two cars being turned at a time, and having devised a plan which would, I think, effect this desirable end, I take the liberty to solicit for it your kind attention.

That locomotives do not run as well backwards as forwards, will I think be readily conceded. That the liability to run off the rails, and that the wear of the driving wheels is much increased, have been proved upon a road which has come under my observation, beyond the shadow of a doubt.

The plan would, I think, be found simple and effective. The saving of time and manual labour would, I doubt not, be found to be considerably over the common turning-table, and at the same time it would be found to answer very well the purpose of turn-outs at water stations. The preceding diagram will explain the plan in question.

Let us now suppose the track laid, and provided with switches at the intersections, and a locomotive, with a train of cars behind it, at A. It moves over the first half of the turning track, B (which is the quarter of a circle), and stops at C, where the track is made straight for 150 or 200 feet, or for the purpose of receiving or discharging freight quite out of the way, the straight line may be extended to any convenient length. The switch is then changed at D, and the locomotive, with its train moves backwards, over the other half of the turning-track, E, into the main trunk at F, thus having been turned completely around.

That additional room would be required is true. By adopting, however, a radius of curvature for the turning track of 400 feet, which would be quite sufficient, and making 150 feet at B, straight, the whole distance out of the main trunk would be but 550 feet.

Washington Co. Geo. January 5, 1839. F. B. HOLCOMB.

WESTMINSTER BRIDGE REPAIRS.

Fig. 1. Section of Pier, showing the new Sheet-piling and Stone-capping.

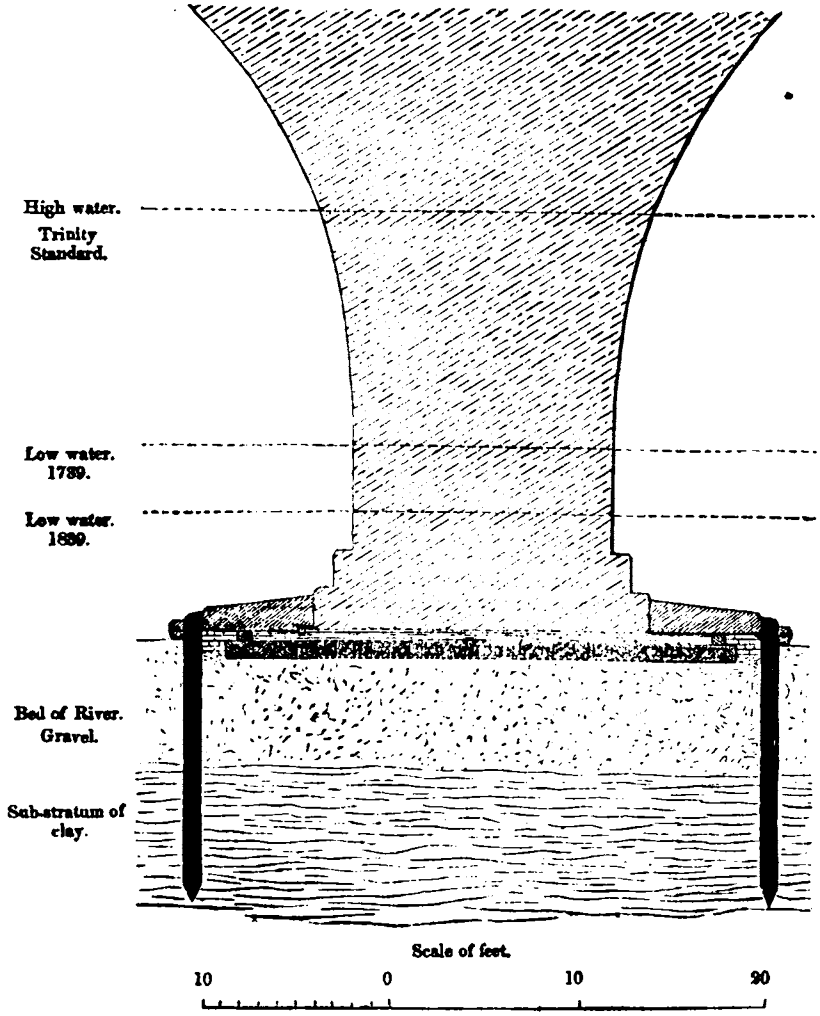
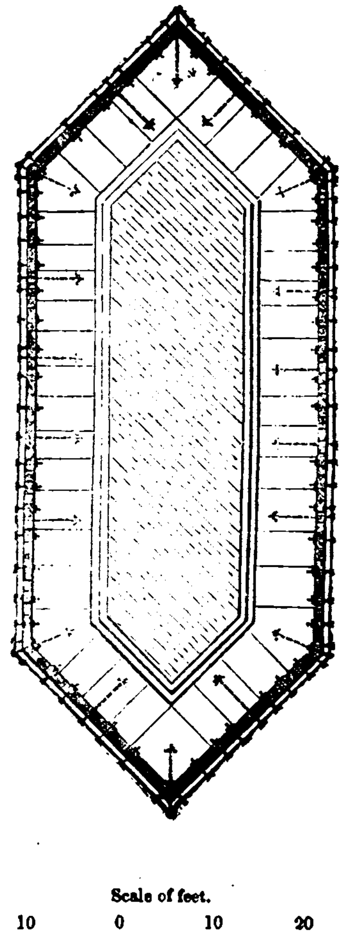


Fig. 2. Plan of Pier, showing the Sheet-piling and Stone-capping.



WESTMINSTER BRIDGE.

Before noticing the improvements which are at present being made on this structure, it may not be uninteresting to give a brief account of its construction, taken from a work published by Mr. Labelye, the engineer, in the year 1751.

In the year 1735 a petition was presented to Parliament, the purport of which was to have a bridge erected at the Horse Ferry, or at such other place as the House should think fit.

On the 20th of May, 1736, an act for this purpose received the royal assent, the commissioners appointed under it were nearly 200, and there was granted the sum of 100,000*l.* to be raised by a lottery. This lottery having proved unsuccessful, a new lottery was granted by a second act in 1737.

In August, 1737, the commissioners received plans from different persons for the proposed bridge, and Mr. Labelye was ordered to explain his method of laying the foundations of the stone piers of a bridge below the surface of the bed of the river, which he did in the following September, by means of a model, when it was resolved, "That this board do approve of Mr. Labelye's design, and are of opinion that he is a proper person to be employed in case the commissioners proceed to the laying the foundations of stone piers."

A third act was obtained in February, 1738, by which the position of the bridge was fixed at or near the Woolstaple, a little lower than New Palace Yard. In the same month Mr. Labelye again explained his method to the commissioners, which was as follows: "That the foundation of every pier should be laid on a strong grating of timber planked underneath; that this grating of timber should be made the bottom of a vessel, such as is called caisson by the French; that the sides of this caisson should be so contrived as to be taken away after the pier should be finished; that the bed of the river should be dug to a sufficient depth (none of the caissons to be laid at a less depth than five feet below the surface of the bed of the river), and made level, in order to lay thereon the bottom of the caisson."

Shortly after this the commissioners resolved that the bridge should stand upon stone piers, and fixed the number and dimensions according to Mr. Labelye's design for a stone bridge; they also appointed him engineer, but the superstructure was to be of oak wood, according to a design of Mr. James King, with whom, and his partner, they contracted for such superstructure for the sum of 28,000*l.*

On the 29th of January, 1739, the first stone of the bridge was laid by the Right Hon. the Earl of Pembroke, and on the 23rd of April the first pier was finished. In December of the same year a severe frost put a total stop to the work till the following February. The ice carried off 140 piles, and broke above one-half of them. The commissioners, after this accident, determined to drop the design of a wooden, and resolved upon an entire stone bridge.

Mr. Labelye furnished the designs from which the present bridge was built, and the work proceeded without interruption till its completion in 1746.

On the 25th of October in that year the last stone was laid by the Earl of Pembroke, and on the 14th of November, 1747, the bridge, roads, and streets on both sides were finished; the whole was performed in seven years, nine months, and sixteen days from the laying of the first stone.

The Commissioners intended soon after this to have opened the bridge for the service of the public, but were prevented by the failure of one of the piers, which occupied a considerable time in being restored.

Mr. Labelye, after giving a highly interesting account of the work during its progress, proceeds, at the request of the Commissioners, to answer the different objections that had been urged against his mode of construction. He puts them in the form of "Objection" and "Answer." The experience of 100 years has now tested the accuracy of his replies, and in only two instances has it proved him in error. We will give these here, as they are intimately connected with the present works.

3rd Objection.—"Why could not the foundations of the piers have been laid by the help of coffer dams, such as are called by the French Battardaux?"

Answer.—After explaining the construction of coffer dams, he states—"The first inconveniency attending this manner is, that if the enclosure be not strong enough, or not sufficiently propped or braced in the inside, it will not be able to support the pressure of the external water (especially if the water be agitated by stormy winds), which, by breaking and bursting in, often destroys many lives, and entirely defeats the intentions of the projectors that have not taken the necessary precautions, of which I could give a great many instances, some of which I have been an eye-witness to. But if this method had no other inconveniency, it could easily have been remedied in the execution of the intended bridge,—England, and London especially, abounding with excellent artificers of all kinds. But what would have rendered it *entirely useless or ineffectual*, is the nature of the bed under the river Thames, which at the place where the bridge is, is everywhere a gravel, covered over on the Surrey side with a soft loomy sand, all which would suffer the water to ooze up (notwithstanding the sides of the battardeau, or coffer dam, should be perfectly tight) so fast, especially the gravel, as to put it out of the power of any engine or engines to drain the battardeau or coffer dam. Indeed, where the ground under the foundation is a stiff clay, or an earth of a sufficient consistency to hold water, battardeaux or coffer dams have been used with success, though attended with an immense expense and trouble, and what I would have used if I had not foreseen that in this place it would have been in vain to attempt to come at the bottom, and much more so to reach several feet under the bed of the river by any such means. Those that have seen (or have been concerned in) buildings erected in water when the ground is a gravel, or a loose clay, or a sand, well know the inseparable difficulties that would have arisen if such coffer dams had been attempted on the Thames over against the Woolstaple, where, besides the agitation of the water, occasioned by the winds, the height of the water is perpetually increasing or decreasing from six feet to about twenty-three feet perpendicular height above the surface of the bed, which two circumstances alone would make it difficult and very expensive to provide proper materials, and construct a coffer dam sufficiently strong to resist such unequal pressures so as to keep out the ambient water."

"As to the oozing in of the water through the pores and interstices of the gravel, loose clay, or sand, it may easily be shown, that if all the interstices in the bottom of the foundation of one of the piers taken together amount only to a hole of six inches square (which is a supposition much under the truth); and, supposing the tide or head of water above the foundations, as it is at a mean or an average between the highest and lowest, about 15 feet perpendicular, it would give 770 tons per hour, which is more than 70 men could pump out, even supposing them to act always with the same strength as they do at first, and to work day and night without ceasing, and more than 150 men or 30 horses could do working as they commonly do."

7th Objection.—"Notwithstanding all the precautions that have been taken to render the foundations of the piers as firm and solid as if they were built upon dry ground, they will always be in danger of the water gulling underneath and carrying away the ground from under the planked gratings on which the piers stand."

Answer.—He enters into an explanation of the effect of running water on the beds of rivers, and into calculations respecting the consequences in case London Bridge should be removed, and concludes with, "I rather suspect (with regard to the river Thames and Westminster Bridge) the reverse of the objection will happen; viz., that the piers will in time be more and more buried in the ground by the silting of the river which must accumulate in a long course of years, for in all tide rivers (at least in those that have no extraordinary declivity towards the sea), we find their beds continually rising, and in the Thames in particular, it is well known that the bed of the river (especially above London Bridge) is several inches higher than it was one hundred years ago, which I conceive to be occasioned by the tide of ebb having so long a time to deposit its settlement, and every tide of flood preventing in a great measure part of that settlement from being carried down to the sea."

It is needless to offer any remarks on these opinions of Mr. Labelye. He appears to have acted with the greatest consideration while engaged in this arduous undertaking, and if we bear in mind that an engineer at that time had very little from the experience of others to guide him, and that this was unquestionably the greatest and most difficult work that had ever been attempted in this country, we must feel more inclined to admit the genius of its author and to give him praise for the amazing skill and ingenuity displayed in its construction, than to cavil at any errors he may have committed.

We now pass over a period of seventy years, during which there is nothing worthy of notice. The proposed removal of one of the piers of old London Bridge appears to have been the first thing to call the attention of the Commissioners of Westminster Bridge to the security of its foundations, for we find that in May, 1823, the late Mr. Telford was called on by them for his opinion as to the probable effect which might be occasioned by such removal. In his report, he mentions that the platforms upon which the piers rest, which were described by Mr. Labelye to have been placed none less than five feet nor more than fourteen below the bed of the river, are now found to range between three and seven; and if London Bridge be wholly removed, the consequences will most likely be fatal to Westminster Bridge; he then recommends certain works to be done for its safety. These works proceeded under his direction during the remainder of his life; they consisted of piling round some of the piers and protecting them with masonry by means of a diving-bell, rebuilding some of the cutwaters and octagons, &c.

In August, 1835, notwithstanding what had been done by Mr. Telford, we find, when Mr. Cubitt was called on to report how far the proposed embankment for the New Houses of Parliament would affect the stability of the foundations of the bridge, he states that the foundations were still far from being in a secure state—and in June, 1836, he reports "on the present state and best manner of rendering secure the foundations of this bridge."

He points out three modes of securing them:—

1st. Depositing heavy rubble stone round them.

2d. Surrounding each of the piers with sheet piling of oak or cast-iron, coming up above low water, securing them to the piers and filling the space with stones and cement.

3d. Paving the whole space under the arches, and driving sheet piling on each side of the bridge the whole way across the river.

This last plan he estimates at not less than 120,000*l.* and not more than 150,000*l.*, and to completely restore the superstructure besides, in all from 150,000*l.* to 200,000*l.*

In February, 1837, Mr. Walker reported on the same subject. His instructions with reference to the present bridge, he states, were—

"That I survey Westminster Bridge, and report my opinion on the state of its foundations, and what I deem necessary to be done to put the existing bridge in a state of permanent security, with an estimate of such repair."

His opinion is—

1st. That the best mode of securing the piers of Westminster Bridge is by *coffer-dams*, then pumping out the water, and piling round the piers.

2d. That the expense of this for all the piers will be . .	£70,000
3d. That renewing the ends and spandrils of all the piers in the way already begun, will cost	21,000
4th. That the present parapet ought to be taken off, and a lower one substituted, and that the inclination of the road may and ought to be improved; the cost of these will be	12,000
Total cost	£103,000

Shortly after this Messrs. Walker and Burges prepared plans and a specification for the repairs of the bridge, and the Commissioners accepted Mr. William Cubitt's tender in May, 1838.

The specification is formed into two divisions:—

The first contains the coffer dams and securing the foundations of eleven piers, deepening the bed of the river, at the bridge, after the piers are secured; putting in a new cornice and a new parapet for its whole extent, lowering the carriage road and footpath upon the bridge, raising the appreaches at each end, and repairing the footpaths with new stone.

The second embraces the repairs to the masonry of the superstructure; such as restoring the injured faces of the stones of the arches and piers, rebuilding such of the cutwaters and octagon piers as may be ordered, and also repairing and rebuilding the spandril walls of the arches.

Mr. Cubitt immediately commenced operations, and in eight months completed the coffer dam round the 13 and 14 feet piers on the Westminster side; and notwithstanding all that had been said about the impossibility of keeping the water out, and that it would require 150 men to pump constantly in a dam round *one* pier only, it appears that *one* man, working two or three hours during the day, is sufficient in this dam round *two* piers.

When the mud which had accumulated during the execution of the dam, and the coverings of gravel were removed, the caissons were found in a perfect state, the wood (fir) even retaining its resinous smell: their construction agrees very nearly with the description given by Mr. Labelye. The sill is formed of whole timbers extending longitudinally under the pier, and framed at each end, so as to run parallel with the cutwaters. Upon this the grating is placed; it is composed of timbers 10in. × 10in.; its outer frame is of the same shape as the sill, but seven inches less in width all round, thus forming an offset or footing; the transverse timbers upon which the pier rests are one foot apart, and firmly morticed and trenailed into the frame, and trenailed into the sill. Round the pier a curb of planking 6in. thick and 2 feet 8 broad, was fastened to the grating—this has since been removed, to make way for the stone-work.

The accompanying plan and section to an enlarged scale will explain the method pursued in securing the foundations (the dotted line on the section shows the fall of low water since the removal of old London Bridge). The sheet piling which surrounds the caisson is, beech 12in. thick and 15 feet long; the waling is 8in. thick by 12in.; every third pile is bolted to the wale with a $1\frac{1}{4}$ inch screw-bolt, the head countersunk into a cast-iron washer; the wale is bolted to the caisson by $1\frac{1}{4}$ inch tiebolts, 6 feet long, let into the timber; the inner end has a cast-iron carriage, bedded as shown in the section; the angles of the waling are secured with wrought-iron straps. The space between the sheet-piling and the caisson, and also between the timbers of the grating is filled in with brickwork, thus forming a solid bed for the pavement, which is of roche Portland stone, six feet in depth of bed, and 18 inches height next the pier, bevelled off to 12 inches next the piles.

We intend to continue our notice of the works as they proceed.

CANDIDUS'S NOTE-BOOK.

FASCICULUS V.

———"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is perfectly inexplicable to me, that notwithstanding the excessive admiration professed for Palladio, no views are ever taken of his buildings—models, we are assured, of refined taste, and every kind of architectural elegance and grace, and replete with, that captivating *non so che* which defies both definition and description. I am not acquainted with a single instance in which any building by him has been given in such works as those of Clochar, Schuelt, Ruhl, which profess to select what is most worthy of study in Italian architecture. We have of late had a tolerably smart shower of Italian views of one sort or another, both in Annuals and elsewhere, yet none of them have cared to show us the glories of Vicenza; while the Piazzetta at Venice has been represented over and over again, till it has become absolutely stale. Yet, if poor Vicenza is very scurvily treated, Sienna does not fare much better being quite *shyed at* by all our travelling and view-taking folks. Even Woods bestows only a couple of pages upon it, in which he confines himself almost entirely to the cathedral, bating what he says of the pronunciation of the people, which we could very well spare for something more akin to the information the title of his book promises. Poor Woods! not only did he somehow or other "miss seeing" one of the greatest lions of its kind at Genoa, the Saloon of the Serra Palace, but, *horresco referens!* neither did he see even the façade of the Piccolomini Palace at Sienna, a most majestic piece of architecture—one incomparably finer than anything Palladio ever designed. This façade and the picturesque cortile would alone suffice for the fame of any architect; yet the name of Francesco di Georgio, to whom it is attributed, though Rumohr claims it for Bernardo Rossellini, is scarcely ever heard of among us; yet whether by Di Giorgio or Rossellini, the design is one of first-rate excellence.

II. Whatever study an architect may bestow upon the design of a mansion, a very great deal is, after all, left to be done entirely *à discretion*, as the French say, that is, to the risk of the most flagrant indiscretion. Beyond cornices round the ceilings, doors and chimney pieces, and perhaps a few columns, an architect considers that he has nothing further to do with the interior, after the building is once erected. The chief thing to be said in excuse of this disregard of character and effect on his part, is, that at least it is attended with no danger of any kind of effect being put out, or character destroyed, for the simple reason, that his uniformly plain four-sided rooms have nothing whatever of the kind; indeed, it is but reasonable that all matters of mere taste should be left entirely to those who have to pay for it, and who, it may be presumed, know far better than any one else their own particular likings and dislikings, and who can at all events buy fashion—a most delightful thing, although not exactly an article that "will wear well for ever, and afterwards be better than at first." Wherefore should a man, because you have employed him as your architect for the walls of your house, be allowed impertinently to dictate to your taste, and tell you there must be this and there must not be that; to tell you that such or such a thing will quite cut up and kill something else? Officious jackanapes!—he deserves to be killed himself and cut up afterwards, *in terrorem*, to the whole profession. It is some consolation to know that in this country the profession are generally persons of far more discretion than to behave themselves after such very unseemly manner. They leave you to have it all your own way; you may paint, paper, carpet, and do every thing else *à discretion*, without giving themselves any concern about it. Perhaps they are rather too *pococuranti*, but then they save themselves a vast deal of trouble, and other persons an infinity of vexation and annoyance. In fact, it is little short of a downright insult to tell people, even by implication, that you consider your taste greatly better than theirs, or rather that they have no taste at all; almost would it be a lesser affront to tell them they have not common sense, nor common understanding. *Ne sutor ultra crepidam:* let the architect stick to his concrete, his brick and mortar, his columns and proportions, and all the cabalistic words of his vocabulary; perfect ignorance of all such vulgar matters may be confessed not only without shame but with perfect self-complacency, and with a glow of conscious superiority. But to suffer yourself to be dictated to or even guided in matters of taste, is a thing not to be thought of. What, are you such an absolute Goth in your ideas, such a vulgar plebeian in your notions, as not to know, without being told, what is quite *comme il faut*, and TASTY or not?

III. It is very extraordinary—I mean it appears unaccountable, for the thing itself is a matter of course—that notwithstanding the vast number of designs for buildings, or of views of them, scarcely one in five hundred shows any part of the interior of a building; so that, did we not know to the contrary, we might suppose that the mansions of our nobility, and all our other edifices both public and private, were merely outside show, whereas many a one which is as plain and uninteresting as can possibly be externally, contains some apartment or other within it worthy of being made known. I question whether there is any ugly house of any size, or one that has acquired a vulgar sentimental notoriety as that in which some poetical luminary was first fed on pap, that has not had its likeness taken, to edify and delight the fanciers of such mawkish rubbish? Besides being a very preposterous superstition, I am afraid that it is one which leads to a very great deal of mystification on the part of those who provide the public with such highly interesting mementos, and who not being always so scrupulous as their customers are curious, manufacture a view of the "House in which the celebrated So-and-so was born," or "died," and pass it off as genuine. Perhaps the house that Jack built, could any one but find out where it stood, would be a greater curiosity of the kind than all the others put together.

IV. Whether it be the intention or not of the Gresham Committee to act with perfect fairness in the competition for the new Royal Exchange, certain it is that they hold out very little encouragement for any one to engage in it. There is not the slightest manifestation of any anxiety to obtain a design of superior merit—no pledge given that the decision will be according to unbiassed judgment, that that judgement will be not only impartial but most deliberate, and committed to, at least assisted by, those whose opinion will have weight with the public, and who are willing to be responsible for the selection they shall make. Further, instead of anything like readiness being shown in furnishing as explicit instructions as possible—notwithstanding that a positive charge is made for a plan of the site, the information supplied is so vague as to leave entirely out of view nearly all the most important points that require to be clearly understood; at the same time, there is a most extraordinary precision indeed as to others, although they must be entirely dependent on circumstances of plan, for some of the rooms are limited to the exact dimensions of 13 feet by 13 and 6 inches! Does not this look very much as if a plan had been made by some one, and that the sizes of the rooms which happen to be in it, are expected to be adhered to most punctually, no matter whether any other design can be so adjusted as to bring them in without taking away or adding a single inch? To be sure, tolerable latitude is allowed the competitors in another respect, because the principal area may be about 20,000 square feet, which about seems to imply that one or two thousand more or less will not be regarded.

V. Sufficient distinction is not made between the æsthetic value of a particular style, and the historical interest which may be attached to it; and yet there may be much of the latter where there is very little of any of the former. Such is the case with Elizabethean architecture; for though the extant examples of it deserve notice, and are not altogether without attraction in themselves, very seldom indeed do they offer anything worthy to serve as a model; while modern imitations of them merely give us the uncouthness of taste they display, without any of the counterbalancing recommendation they possess. By no possibility can any reminiscences of other days be made to attach to a "spick-and-span" new edifice, any more than a lineage from the conquest can be bestowed upon a new-made city knight, who perhaps does not know, or does not care to know, who was his grandfather. What may be venerable in an old country church either for the historical evidence it affords, or as belonging to the most ancient part of the structure, may possibly become barbarously mean when copied in a modern one. Few things are more disgusting in architecture than the affectation of simplicity,—than a spruce, pert-looking edifice, impertinently aping the unassuming modesty and humility of a primitive place of devotion.

ON CHALK EXCAVATIONS.

BY SAMUEL HUGHES, C.E.

Fig. 1. Elevation of Bridge—Section of Bridge.

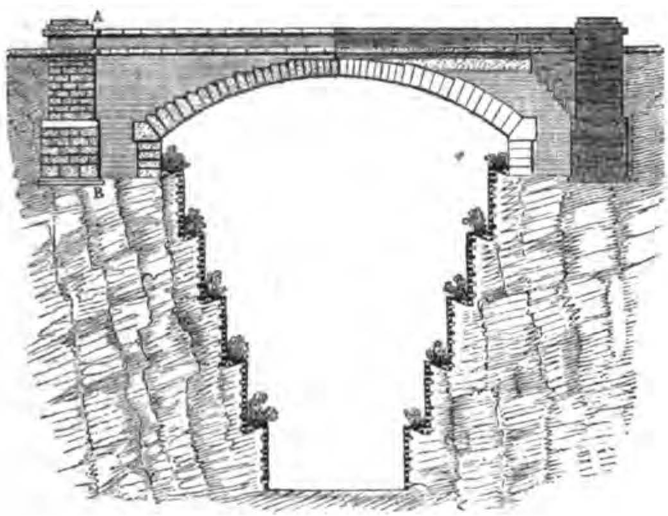


Fig. 2. Plan of Abutment.

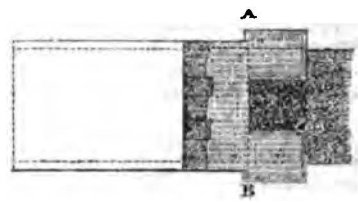


Fig 3. Section of Abutment through A to B.

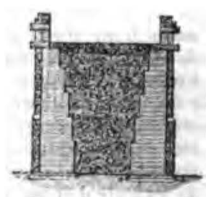
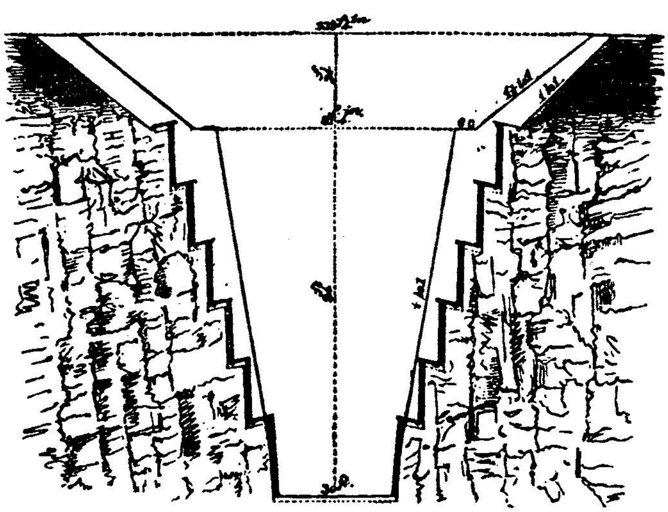
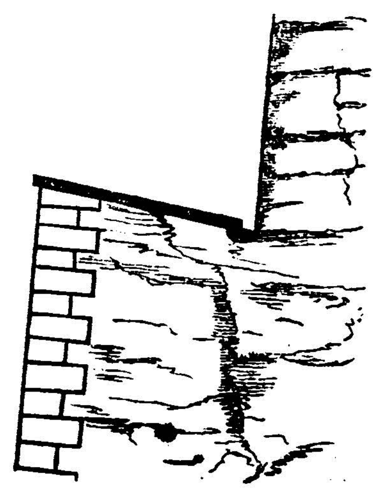


Fig. 4. Section of Cutting.



[The interior lines show the system proposed by Mr. Rastrick, and the exterior shows the system of cutting and benching proposed by Mr Gibbs.]

Fig 5. Enlarged Section of Coping Top of the Benches.



ON CHALK EXCAVATIONS.

BY SAMUEL HUGHES, C. E.

On Chalk Excavations, and the means adopted under different circumstances of intersecting the Great Chalk Ridges of England, for the purposes of Railway and Canal communication.

The extent and position of the chalk formation in this country are so well known as scarcely to require description. The ridge of chalk surrounding the London clay, and forming the basin in which this latter has been deposited, extends through the counties of Norfolk, Suffolk, Cambridge, Hertford, Bedford, Buckingham, Oxford, Wiltshire, Hampshire, Surrey, and Kent. The entire length of the outer boundary of this ridge from Hunstanton, in Norfolk, to Folkstone, in Kent, is about 350 miles.

At Salisbury two branches diverge from the main formation, the one extending in a south-easterly direction by Winchester, Chichester, Brighton, and Newhaven, as far as Beachy-head, a length of about 92 miles; and the other extending in a south westerly direction to a short distance beyond Dorchester, a length of about 50 miles.

The chalk of Lincolnshire and Yorkshire commences on the north side of the Wash, opposite to Hunstanton, and extends by Scamblesby and Caistor across the Humber, by Market Weighton and North Grimston, to the sea at Hamboro' Head, a length of about 100 miles.

Around the outer side of the London Basin, the chalk, except where broken through by the passage of water, is elevated with a bold precipitous escarpment, whilst from the summit of the range towards the centre of the basin the dip is more gradual. In the county of Norfolk, however, the range is so much depressed that no escarpment is observable.

Without entering into any geological theory to explain the original deposit and formation of the calcareous substance so universally known under the name of chalk, it can hardly fail to attract the observation of the most superficial, that the escarpment of the whole chalk range has formed at some time the margin of an immense lake. It would seem that the water thus bounded has overflowed its banks, carrying with it vast quantities of the material composing the upper part of the range. Thus we find the flint gravel which has been washed from the top of the chalk hills distributed entirely over the London Clay Basin, and along the southern side of the South Downs throughout their whole extent.

The chalk formation is divided by geologists into two groups, the upper chalk with flints, and the lower or grey chalk, which contains no flints. The firestone, although appearing from its position immediately under the lower chalk, to form a part of the same group, is ranked by geologists as the upper bed of the *green sand formation*, and the propriety of this arrangement will be evident on examining the structure of the firestone: it is evidently composed of an arenaceous grit, and appears not unlike some varieties of the Oolite or Bath stone.

The principal railways which intersect the chalk range of the London Basin, are the Northern and Eastern, the London and Birmingham, the Great Western, the London and Southampton, the London and Brighton, and the South Eastern. Amongst these various lines, my attention has been more particularly directed to those laid out into the south of England, on which a greater extent of chalk country is passed through than on any of the lines in the direction of north or west. The lines to the south enter the chalk at the distance of about 10 miles from London, and continue in this stratification as far as the escarpment of the Surrey Chalk Downs. The line of this escarpment may be accurately traced by the towns of Farnham, Guildford, Dorking, Reigate, Westerham, &c., the lowest passes in the range between these points being at Dorking, the Valley of the Mole, otherwise known as the Vale of Mickleham; at Merstham, in the line of one of the present coach roads to Brighton; and at Oxted, where the road from London to Lewes crosses the chalk.

In addition to passing over from eight to ten miles of the chalk district, composing the Surrey chalk range, each of the lines of railway proposed between London and Brighton, intersected the South Down range, in which the lowest passes near Brighton, are at Shoreham, through the Valley of the Adur; at Saddlescombe, a little east of the Devil's Dyke; and at Clayton, where the present mail road from London crosses the chalk. The lines of Brighton railway intersecting in their course of about 50 miles the two most important chalk districts in the country, and passing over not less than 18 or 20 miles of this stratification, will naturally furnish some important information as to the facilities of overcoming, for the purposes of internal communication, the great natural barrier presented by the chalk ridges of Surrey and Sussex.

Commencing at the northern end of these lines, it has been already stated that the principal passes in Surrey are at Dorking, Merstham and Oxted. These three passes, with the particular comparative merits of each, have been very prominently brought before the notice of Parliament in the Session of 1837.

The Dorking pass was the one adopted for Mr. Stephenson's Brighton line, in its course from the Southampton Railway by Epsom and Leatherhead to the Holmwood Common, beyond Dorking.

The Merstham pass was fixed on by three engineers, each engaged for a separate line, as the most eligible for the required objects. Thus the several lines proposed by Mr. Vignoles, by Sir John Rennie, and Mr. Rastrick, and by Mr. Gibbs, all passed through Merstham, with very trifling deviation from each other in any part of their course, through the chalk district.

The Oxted pass was adopted for the South Eastern Railway, but this part of their line has been abandoned, and this railway is now to commence by a junction with the London and Brighton at a point between Merstham and Redhill.

It may now be advisable to view separately each of these passes, the first in order being the Dorking. At this place the river Mole forms a complete outlet through the chalk; and as the river rises on the south side of Dorking, and flows over the chalk as far as Leatherhead in a northerly direction, it would seem natural that a line adopting the valley of this stream through the chalk range should encounter no considerable summit in its passage through the chalk. Accordingly we find that Mr. Stephenson's line passed over the London clay as far as the south side of Epsom Common, and then entirely over the chalk to Dorking, without rising more than 160 feet above high-water* mark; this summit occurs at about 15½ miles from the commencement at Vauxhall-bridge. The works through the chalk are very inconsiderable, with the exception of the cutting on Leatherhead Common; the chalk passed through by this line is remarkably dry, and the firestone and gault brickearth are entirely wanting as they have been broken through by the river Mole, or rather by those waters which on bursting through the chalk originally formed the Vale of Mickleham. The greatest height to which the chalk rises on this line is 230 feet above high-water; namely, in the cutting through Norbury park, where the surface of the ground rises from the river Mole to the height of about 120 feet above the same, with a slope of not less than 2 to 1.

Of the three lines proposed through the Merstham pass, Mr. Vignoles' rises to a summit of 304 feet above high-water; the summit on Sir John Rennie's was 324 feet, and on Mr. Gibbs' 281 feet. The highest summit of chalk on Mr. Vignoles' line was 464 feet, on Sir John Rennie's 435 feet, and on Mr. Gibbs' 522 feet. The greater height of the summit on Mr. Gibbs' line was occasioned by the direction taken in order to preserve a straight line through the tunnel. The line of Sir John Rennie and Mr. Rastrick, commonly called the direct line, and which, as well known, is now in course of execution under the direction of Mr. Rastrick, was laid out through the lowest ground that could be followed consistently with the nature of the curves, which were limited to a radius of not less than one mile, the intention at the time the bill was before Parliament being to open cut entirely through the chalk district. On Mr. Gibbs' line, however, a tunnel three-quarters of a mile long was proposed, and it being obviously of little consequence how high the summit might be above the tunnel, it happened that the ground through which this was carried rose to a height of nearly ninety feet above the highest point on the direct line.

The Merstham pass has been very minutely investigated, in order to discover the nature of the chalk, and the subordinate beds of firestone and gault. The greatest height to which the gault rises in the neighbourhood of Merstham is 290 feet above high water mark, and the firestone which rests upon it is about seventy feet higher.

The following are selected from a variety of borings and shafts which have been sunk immediately upon the chalk:—

Shafts sunk close to the Turnpike-road at the Joliffe Arms Inn, Merstham, commenced at surface 364 feet above high water mark—

ft.	in.	
7	0	Chalkwash and loam.
2	6	Stiff chalkmarl.
5	6	Stiffer do.
9	0	Chalk marl, a little shattered.
16	6	Very fine firm rock chalk.
40	6	

The rock chalk continues—

* The expression "high-water," wherever used in this paper, refers to the Trinity high-water mark in London.

Shaft sunk by the side of an old chalk pit, in a field opposite the Star Inn, Merstham, 374 feet above high water.

ft.	in.	
15	0	Strong lumpy chalk much shaken by vertical fissures.
4	0	Fine strong chalk.
0	2	Layer of plate flint.
7	0	Firm rock chalk.
26	2	

Rock chalk continues—

Shaft sunk at the end of a plantation in the parish of Chipstead on the road from London to Brighton, 320 feet above high water.

ft.	in.	
8	0	Loam and flint gravel.
6	0	Clean clayey loam.
3	0	Loam and flints.
23	0	Solid chalk.
40	0	

Rock chalk continues:—

Boring at Dean's Farm commenced at surface 402 feet above high water:—

ft.	in.	
10	0	Loan and gravel.
21	0	Chalk much shaken.
31	0	

Solid chalk below this depth.

Boring in Coulsdon Parish commenced 292 feet above high water:—

ft.	in.	
6	0	Chalk marl.
20	6	Chalk much shaken.
26	6	

Solid chalk below this.

Boring in a field belonging to Sir William Joliffe in the parish of Merstham, commenced at 375 feet above high water:—

ft.	in.	
11	0	Flint and gravel.
2	0	Loose sand.
15	0	Chalk, with flints.
47	0	Hard chalk.
75	0	

Boring at a spot 400 feet above high-water mark:—

ft.	in.	
16	0	Flints and gravel.
42	0	Hard chalk.
58	0	

From the above it will be seen that the chalk of Merstham consists mainly of the inferior beds of rock chalk. One of the borings indicates a layer of flint, and this is, probably, the lowest of those layers which are exposed in the quarries of Smitham Bottom, near Croydon. It is true that flints are abundant in the upper part of the chalk, even at Merstham, but they are in a loose, unstratified state, and have evidently been washed from their natural position, which is considerably higher than where found at present. Below the chalk marl in which the loose flints are imbedded, the rock chalk is at first considerably shattered, but at a greater depth is extremely firm, and might be used for building where it can be protected from the action of air and water.

Numerous quarries are worked in the neighbourhood of Merstham, and the excellent quality of the lime burnt from this chalk is well known. In the quarries south of Merstham the chalk is much shattered by vertical fissures, which appear to separate the whole face into rectangles of about six inches wide. Considerable quantities of debris have fallen from the face of the chalk which rarely stands upright for any length of time. In one quarry which I have visited the depth of chalk is about 50 feet, and the slope nearly one-third to one, and in another, rather nearer to Merstham, but still on the south side, the chalk face which here also is about 50 feet in height, stands upright from the bottom to within 20 feet of the top. The fire-stone is obtained at Merstham from galleries worked under the chalk, and extending a considerable distance under ground. A large shaft has also been sunk down to the firestone, and considerable quantities have been brought to the surface, and used for the ornamental work of Lord Monson's house at Gatton, from which estate the firestone is principally obtained.

A great deal of discussion arose during the struggle between the various Brighton lines in the session of 1837, as to the best method of forming the chalk excavations. It was argued by one party that a slope of from ½ to 1, to 1 to 1 should be adopted for the cuttings, while another proposed to make the sides nearly vertical, contending that a slope of one-sixth to 1 was sufficient. A third party proposed a system of benching at about every 15 feet in height, the successive steps to be vertical, and to be faced with rock-chalk. The accompanying drawing (fig. 4) exhibits the two designs proposed respectively by Mr. Rastrick and by Mr. Gibbs.

Of the Oxted Pass, which was selected for the south-eastern line, I am not able to say much. The Oxted chalk, on the south side of the summit, is of a brittle, friable nature, and does not appear to stand well in the quarries at a less slope than about 1 to 1. This may be observed in the great Oxted quarries, and in a small pit about 40 yards from the line. The gault lies up very high beyond the chalk at this place, and several springs may be observed at the junction of the gault and the firestone. Close to the road leading over the chalk hills at Oxted is the celebrated Riddlesdown quarry, the property of Mr. Atkins. The deepest face of chalk in this quarry is, standing at a slope, something steeper than ½ to 1. The chalk here is in very large blocks, and contains no flints. The frost occasionally brings down masses of this chalk, the face of which, after a fall, presents a rugged irregular appearance, in consequence of the falling out of occasional loose blocks, while others have been too firmly wedged in to be thrown down. In addition to the preceding principal passes, a number of others have been tried, mainly with the object of discovering a spot where the chalk, although rising to a considerable altitude, should yet be narrow in the direction of the line intersecting it. Thus, admitting that a tunnel were necessary, it will obviously be possible that the very highest summit of the chalk may be found most eligible, because the ridge at this summit may be narrower and more compressed, thereby occasioning, at the ends of the tunnel, less work than on a line which penetrates a much more depressed part of the range. Although certainly not justified in saying that this condition was answered by any of the trial-lines through the more elevated parts of the Surrey hills, it may nevertheless be useful to record the result of these trials, one of which—the Oxted—has been already mentioned, the others being at Betchworth, and at Bletchingly. The Betchworth line was intended to cross over a corner of Epsom race-course, touching the park of Baron de Tessier, and thence passing between the villages of Betchworth and Buckland, The summit of the railway in the chalk was 300 feet above high water. The chalk of Betchworth is remarkably dry, and appears to be firmer, and not so much shaken as that of Merstham. With respect to the line by Bletchingly, I am unable to give anything more than the height of the summit which was tried, and which, in connexion with the approach on each side, was found so comparatively ineligible, that all idea of carrying a line in that direction was immediately abandoned. This summit is at the south-east corner of Platt Green, on the road leading thence to Tupwood Common; height above high water mark, 730 feet.

The first pass in the South Down range which I propose to notice, is that through which the River Adur flows to its *embouchure* at Shoreham. The lines through the Adur valley entered the chalk at Beeding, about 5 miles from Shoreham, and, as the tide flows in the Adur as far as Bine's Bridge, which is seven miles higher than Beeding, it may readily be supposed that the chalk in this valley is depressed to a very uncommon extent. Accordingly we find that the four lines severally laid out by Mr. Vignoles, Mr. Stephenson, Mr. Gibbs, and Mr. Cundy, nowhere rose more than 25 feet above high water mark in their course through this valley. The general features of a section through this pass, taken in a straight line or a line whose curves are not incompatible with railway travelling, consist of low ground forming the marshes on the sides of the river, alternating with steep banks of chalk which flank the marshes, and which, it may be presumed, presented a greater resistance to the original force of water than the adjoining parts of the chalk which have been swept away towards the sea.

The valley of the Adur affords the engineer many instructive opportunities of observing the conditions under which slopes of chalk may be expected to stand, and it may not here be out of place to record the result of some observations made to ascertain the practicability of inducing vegetation on steep slopes of this material. In favour of the practice of constructing chalk excavations with slopes approaching to vertical, it has been urged that the danger of slips would be very much lessened, if not entirely removed, were it possible to cover them with any kind of grass, which would have the effect of holding and tying together the minute fractured parts occupying the face of the slope. This notion is plausible, but would scarcely seem to be supported by the state of natural slopes now existing, and which, therefore, present an unexceptionable ground work for judging on the subject. The following are the observations before alluded to. :—

The old Shoreham windmill stands on a summit abont 180 feet above the road to Brighton. The face of the chalk at this place is very steep and the vegetation is partial; grass, however, was growing undisturbed at an inclination of $1\frac{4}{10}$ horizontal to 1 perpendicular. On a slope of 1½ to 1, vegetation is partial, and in many places the soil has been carried down by the rain, which has formed small gulleys or ravines down the slope. The summit at this part of the chalk district is not more than 150 yards from the base of the hill, consequently neither the removal of the soil from the face of the slope, the formation of the small gulleys, nor the consequent barrenness exhibited at this place, can be attributed to an extraordinary extent of surface drainage washing over the slope. On an inclination of $1\frac{4}{10}$ to 1, slight patches of vegetation appear, but the grass is very stunted and thinly scattered; while on a slope of 1 to 1, no trace of vegetable growth could be found. The soil covering the chalk is of a light clayey nature, and varies from 5 to 8 inches in depth.

Higher up the Valley of the Adur, and nearer to Beeding, the face of the hills rising from the valley at a slope of three to one is extensively covered with timber. Ash and elms thrive well here, and the underwood is strong and healthy, consisting chiefly of white and black thorn, brambles, elder, and ivy, accompanied by nettles, thistles, and strong coarse grass. The chalk in this district is of a rubbly description, full of veins, cracks, and fissures; it is, however, strong and heavy, stands well in an upright face, and contains numerous flints.

As an example of the natural slope of loose chalk in embankments I may mention that, at a considerable excavation near Beeding the rubbish or refuse chalk wheeled into spoil, and teamed over head to a depth of fifteen or eighteen feet assumes an inclination of $1\frac{4}{10}$ horizontal to 1 perpendicular. On this slope, which has no covering of soil, and contains no mixture of mould, there are slight traces of vegetation; it is, however, very coarse and unhealthy in its growth, consisting of a dry brown coloured description of grass, very short and mixed with moss. The chalk of the excavation, from which this spoil bank was made, has been worked to a great extent for the purpose of being burnt into lime, the quality of which is excellent. The greatest depth of this excavation is not less tnan 160 feet, with a face which is nearly upright, and which stands well, although the chalk is by no means so firm and compact as in some other parts of the range. The fissures are numerous in this pit, and parallel veins of flint traverse it nearly horizontally at unequal distances from each other, varying from 3 to 7 feet. The upper part of the quarry, consisting of chalk marl and chalk much broken and very tender, stands well at 6 inches horizontal to 1 foot perpendicular.

The Saddlescombe gap is the next in order proceeding eastward; and in this place, following the lowest ground in the valley, the chalk summit does not exceed 380 feet above high water mark. It was found, however, from levels taken through this gap, that a line entering the chalk range boldly at one of the highest points of the range, namely, at the Devil's Dyke, a little west of Saddlescombe, encountered less of difficulty and heavy work than a line through the gap. This result became evident on discovering that in either case a tunnel would be necessary, and that the ground beyond Saddlescombe gap is not so much depressed as two valleys or bottoms leading from the south side of the Dyke. It was therefore decided by Mr. Gibbs, who surveyed the country in this direction, to adopt the Dyke line passing on to Brighton, to the east of Hangleton, through Goldstone Bottom. The summit of the chalk range at the Dyke is 640 feet above high water, and the summit at the railway was to be 141 feet, at a point about a mile beyond, or south of, the highest ground intersected by the line. The gault brick earth at this place extends as far south as the village of Folking, rising to a height of 190 feet above high water mark, and the fire-stone resting on the gault is 216 feet above the same level.

The next pass in the chalk range, namely the Clayton, is of considerable importance, as the line of Brighton railway sanctioned by Parliament intersects the South Downs at this place. The summit of Clayton Hill, under which the line passes, is 460 feet above high water mark, and the summit of the railway itself in the chalk district is 212 feet above the same level. The fire-stone is either very inconsiderable in depth or is entirely absent at Clayton, and the junction of the gault with the chalk takes place at a point opposite Clayton church, about 245 feet above high-water mark. A boring made in the parish of Piecombe, on the north side of the chalk summit, entered the chalk at two feet below the surface, and passed through solid chalk for 55 feet when it was discontinued. Also a boring on the south side and in the same parish, entered the chalk after passing through 9 feet of chalk wash, and was continued through 20 feet of chalk, the same stratification existing for a considerable depth below. In the chalk quarry at Clayton Hill, there is a considerable quantity of débris at the bottom, and the average slope of the face is ½ to 1, although it presents surfaces varying from the perpendicular to a slope of 1 to 1. The chalk cutting on the turnpike-road over Clayton Hill is 45 feet deep, with slopes of 1 to 1. A chalk pit close to the road, and opposite Pangdean farm, is from 35 to 40 feet deep, and the chalk here, although it does not stand well, preserves a steeper slope than the Clayton quarry already mentioned.

The chalk of Clayton and the neighbourhood is exceedingly dry and hard, but much shattered. The fissures seem to have rent the face of the chalk into a series of long-shaped pyramids, with the apex uppermost, and would appear to have been caused by the same upheaving force which has so extensively operated on the whole chalk stratification of this country.

As connected with the subject of the South Down chalk range, I may briefly notice the pass of the proposed south-eastern Brighton Railway. This line was intended to enter the chalk range at a point called Mount Harry, and to proceed by Falmer to Brighton, with a summit of 192 feet above high water. Not having seen this part of the range, I am unable to say anything from personal observation as to the nature of the chalk. It appears, however, from the evidence of the witnesses called in support of the line, to be not unlike that of Clayton.

Having now exhausted my stock of information relative to the South Downs, I purpose to make a few remarks on the chalk of Kent, which may be said to comprise the south-eastern arm of the London chalk formation. An extensive chalk cliff is exposed along the coast from Folkstone away to Dover and the south Foreland, in the course of which are many interesting and well-known points. The celebrated Shakspere's cliff, from which a very extensive fall has lately taken place, was a very bold projection with a face nearly vertical to a height of about 60 feet above the beach. While beyond this height, the slope was nearly ¾ to 1. The flints are almost entirely wanting in the chalk of Shakspere's cliff, the upper mass of the cliff appearing to be composed of hard nodules of chalk, imbedded in a matrix of finer and whiter chalk, which serves to cement them together, thus forming a very close and compact substance. In the upper part of this chalk there is little or no stratification visible, there being no partings, as in the grey chalk. The lower stratum of the cliff consists of grey rock chalk. Where fissures appear on the face of the cliff, they are almost invariably in the pyramidal form, already mentioned in describing the chalk of Clayton.

It is well known that the South Eastern Railway passes along the edge of the cliffs, from Folkstone to Dover, by means of galleries and archways; a mode of execution which seems to be unrivalled for cheapness and facility of execution. The works on this part of the line have been so well described in some periodicals of the day, that it will be unnecessary for me to do more than allude to them.

Numerous excavations in the chalk may be seen around Dover, a few of which it may be interesting to notice. A little above Archcliff Fort there are 5 caves dug into the chalk, the roofs and sides of which appear to stand well without steining, except that the roofs have slightly scaled away up to the first course of flints. These caves are about 18 feet high by 20 feet wide. An open cutting in this place, about 45 feet in depth, stands nearly vertical and presents numerous layers or bands of flint running parallel to each other about 4 feet apart. Under the castle cliffs on the east side of the town is a well, sunk by a builder, where it was necessary to stein the sides, as the chalk was too faulty to stand without this protection; and I believe I am right in saying that the chalk is nowhere standing in any of the military works around the town, without a facing of brickwork or of turf strongly picketed. Some very large falls of chalk, probably not less than a 100,000 tons, have at various times come down on the east side of Dover.

The South Foreland is a very remarkable face of chalk, which appears at a distance to be nearly vertical, but on approaching more closely is found to slope about ½ to 1. The height is about 350 feet, and a considerable quantity of *débris* has fallen to the base of the cliff.

In the neighbourhood of Chatham are several chalk excavations, but none so extensive as those at Dover. East of the town on the road to Maidstone, a cutting of about 30 feet in depth stands nearly vertical. In the fortifications of Chatham, most of the chalk, as at Dover, is faced with brickwork. One excavation, however, forming a gorge from the river to the crest of the works, has been cut for some distance without facing, with a slope of ½ to 1, in depth about 40 feet; another part of this gorge is faced with brick, the same slope being preserved.

The principal canal with which I am acquainted passing to any extent in the chalk formation, is the Thames and Medway, which is formed from the village of Higham, to its termination at the Medway, a distance of 2¾ miles, by means of a tunnel almost entirely through chalk. In the open passing place on this canal, an excellent example is seen of a chalk cutting, executed with a steep slope. A good deal of peeling off has taken place here, and as this assertion has been disputed, I beg to state a fact coroborating its accuracy. A small piece of brickwork, perhaps about 10 feet square, has been built on one part of the face, and when I visited the place on two occasions about two years ago, the brickwork projected at least 6 inches from the face of the cutting, although when first built it had no doubt been flush with this face. Hence a very clear proof was obtained that the chalk here had scaled off at least to the width of 6 inches. I may add, that I have been informed by a gentleman who has seen the place within the last four months that the brickwork had then fallen down, and that the chalk had very visibly wasted since our first examination two years ago. Extensive chalk-cuttings are exposed at each end of the tunnel, namely, at the Friendsbury entrance, where the cutting is nearly upright, and at Higham, where the cutting is also nearly vertical, but more detritus is seen at the base here than at Frindsbury. All these cuttings are in the upper chalk, in which plates of flint occur at short intervals.

The famous quarries of Northfleet and Greenhithe are well known; in the former of these I witnessed the only instance that ever came under my observation, of chalk standing perfectly upright without any appearance of scaling on the face, or of detritus at the base. This, however, may certainly be seen on each side of a short road leading from the London road into the Northfleet quarry, which stretches down to the river. The depth is 30 feet, and the sides are quite upright, with a greenish timeworn appearance. One place in the quarry is 90 feet in depth; the chalk has scaled and formed débris at the base. This chalk has few fissures, and contains many flints in the upper part, the lower being very hard and fine. The average depth of the Northfleet quarry is about 70 feet, standing nearly upright, and upon the whole with little débris at the base, considering its great depth.

The Eastern quarry at Greenhithe is 87 feet deep, nearly upright, with rather more débris than at Northfleet. In some places round the sides of this quarry, where ancient fissures have been filled in with gravel, considerable falls have been brought down, probably by the well-known action of frost behind the mass.

The Western quarry has a face of 80 feet, standing upright, but much débris occasionally falls. It is difficult in these quarries to estimate the annual wasting of chalk by scaling or peeling off, because in many cases it is frequently removed, and it becomes quite uncertain whether the observer is witnessing the accumulation of only a few weeks or that of as many months. The top of this quarry at Greenhithe is covered with a bed of loamy gravel, which has filled up occasional cylindrical wells in the chalk of small bore to the depth sometimes of 40 feet.

The nature of the decomposition which operates so extensively on many kinds of chalk, has been the subject of great variety of opinion, and, as bearing on this question, I take the liberty of pausing here to draw an important inference from the observations above described on the chalk of this district. Excavations partly composed of the upper chalk with flints, and, towards their base, of the lower or gray chalk, will best illustrate the position I am about to advance, namely, that the decomposition almost entirely takes place in the lower chalk, and not in the upper chalk, with flints. It will be remembered that the only instance I have described of an upright cutting, without detritus at the base, was at Northfleet, where the depth was only 30 feet, while at other spots close by, where the depth was 80 or 90 feet; considerable quantities of debris have fallen down all along the face. From almost every instance I have been able to observe, I think it clear that the upper chalk with flints, where not much shaken, really will stand upright without scaling. At the same time, it is no less certain that, below a particular depth, the chalk undergoes a very apparent and extensive decom position, and, in many cases, presents a base visibly hollowed out.

It may be difficult to fix, in every chalk excavation, the [illegible] neath which the decomposition is so evident; but, in the N[illegible] quarries, the line appears well defined by a curious and re[illegible] regular plate of flint, which extends all round the faces [illegible] quarry, and which is considered identical with a similar pl[illegible] layer, seen at both ends of the Thames and Medway Canal T[illegible], and in the open cutting for the passing place.

It is hardly in accordance with hitherto received opinions on the subject of chalk cuttings, to say that these will stand better in their upper than their lower beds, and yet the result of every observation made on the chalk of Kent, leads positively to the conclusion that the superior beds of chalk are less subject to decomposition than the lower. Instances in proof of this may be seen at Dover, particularly on the eastern side of the town; at Chatham, in the military works; at Rochester, and the other entrance of the Thames and Medway Tunnel; and at the quarries of Northfleet and Greenhithe.

In considering the nature of chalk decomposition, it is necessary to distinguish this from the falling of chalk which is shattered by vertical fissures. In the latter case, large masses fall down, when loosened by high winds, or slightly burst by frost; but the regular decay of solid chalk arises from the peeling off or scaling which takes place on the face. This is almost invariably observed below the flints, and is evident when very white spots are seen on the face: from these spots large flakes or cakes of chalk have fallen down to the base, and although these are inconsiderable in thickness, sometimes not more than an inch, yet the frequency with which they fall renders this a source of very extensive decay.

Having mentioned the various railways intersecting the chalk in other directions, as well as those in the south of England, I must now explain that, with the former, my acquaintance is very limited; and I consider it more respectful at once to confess my inability to say anything useful of them, than to attempt any review from such imperfect means as those in my power. A few remarks, however, on the chalk-cuttings of the London and Birmingham Railway, the only other line of which I can speak from personal observation, may not be entirely uninteresting.

The Chalk of Watford Tunnel is very soft and white, with numerous layers of flint, and much saturated with water, in which respect it differs from all the former kinds of chalk I have described—these being all remarkably dry, at least as deep as they have hitherto been explored. At the northern end of Watford Tunnel is the same soft, white chalk with flints. The slope from the base is ¾ to 1, until within 15 feet of the surface, when the slope is increased to 1½ to 1.

The cutting near Cow Roost consists also of very white chalk, much saturated, and the slopes are 1½ to 1, in 25 feet cutting. Further on the line, in a cutting near the road from Tring, the lower gray chalk occurs in moderately sized blocks. The cutting at the north end of the short Tring tunnel, consists of chalk, chalk marl, and a little gravel. The slope, which is ¾ to 1 in 35 feet cutting, stands well, and the chalk appears drier than in some of the cuttings nearer London.

The saturation of the chalk on this line is occasioned by the altitude of the gault brick earth, which lies up very high in the neighbourhood of Ivinghoe, and dams back the water, which cannot escape from the chalk at a lower level than the top of the gault. The Birmingham Railway, it is well known, passes through the chalk in the same valley as the Grand Junction Canal.

Having already submitted an opinion relative to the position of the chalk which is most calculated to stand with an upright face, I would, however, in this respect, make a great distinction between the chalk of different places. The inferior beds of chalk are much more shaken in some districts than in others, and even in composition the gray chalk comprises several varieties, as will readily be seen on comparing the chalk of Shakespere's Cliff, at Dover, with the chalk (of corresponding depth in the group) at Merstham, and elsewhere. When the lower chalk is much shattered, the face is only prevented from giving way by the system of mutual dovetailing, occasioned by the pyramidal form of the fractured blocks. The angles of one block abut upon the angles of another, and, provided the base be firm, the whole will stand for some time. But it will be evident that this support must fail when the angles become worn down, as they constantly do become, by the process of real decomposition. Large falls may now be expected, and I believe that these are the circumstances under which the lower chalk, when much shaken, invariably gives way.

It seems very reasonable, therefore, that the system of facing the chalk with a thin wall of brick, or of any kind of building or rubble stone, should afford protection against this danger. At present, I believe there are no examples of chalk-cutting with the sides upright and faced in this way, but it will be highly useful, at some future period, to know the result of some trials of this kind, which will certainly be made on the chalk of Merstham and other places. With respect to the lower chalk which is not shattered, there can be no doubt that the form of decay here presented, and which consists of the scaling off on the face, would be prevented by the facing already alluded to.

In concluding this paper, I trust it will not be considered that I am departing from the object I commenced with, in submitting the accompanying design (fig. 1), for a bridge across a chalk-cutting, in which is shown the method of facing the sides of the excavation, and forming a succession of retreating benches as proposed for one of the Brighton lines of railway.

I would submit, that the arch of this bridge may be turned without centreing, and the bridge entirely built, before the ground below is excavated. The foundations must of course be first cut out, and the abutments carried up to springing height; the ground must then be cut, levelled, and made smooth to the required curvature determined on for the arch, and deal battens laid down as on an ordinary centre. On these the arch may be turned; and it is evident that much expense would be avoided, both in the saving of centres and scaffolding, and in the superior facilities of carrying up the whole building on solid ground.

London, March, 1839. SAMUEL HUGHES.

PUBLIC COMPETITION.

As public competitions for architectural designs are now becoming more noticed than they have hitherto been, and the public appears to have awoke from the slumber so long quietly enjoyed, I send you some observations on the manner usually resorted to by the committees, who have the management of these subjects. First, we will premise that in some town, no matter where, a few individuals, frequently a solicitor or proprietor of land, (for almost all great projects originate in the first instance from interested motives in the projectors,) conceive the idea of erecting a magnificent building, a Town-hall, a Theatre, an Exchange, a Church or other edifice. Over a glass of wine, or in this Teetotal age perhaps a cup of tea, the first formation of the project is concocted; each individual present canvasses his friends, to form a committee, and not the least important, to elect certain officers for the management of the establishment; this done, a spirit of disinterestedness immediately pervades the whole assembly, and it is unanimously resolved that after certain funds are collected, the committee shall advertise for plans for the intended building. So far it is well enough, and no blame can be attached to any of the members as far as this commendable self-interest goes; up to this time no deep science, except that of arithmetic, is called into operation—but here terminates generally the power to do justly, even upon the principle of self interest. Well, a large sum is proposed to be laid out, the time is stipulated for sending in the designs, and, as a bait to the unwary, premiums are offered for some *few, very few*, of the best productions—that is the best productions, in the eyes of the committee: this appears fair enough so far. But when we ask, who the committee are composed of, we obtain such an answer as I received from Liverpool when I put that query to the committee for St. George's Hall; a few words from that letter will serve as a general precedent to committees in answer to too inquisitive architects;—but before I give this extract I will just state the manner of proceeding of the St. George's Hall committee; at the same time let me be distinctly understood, that I do not mean in the least to imply that that committee mean to act unjustly, or that they are not qualified for their office, I merely take it as an example of the doubtful appearance they voluntarily throw over their own proceedings, arising from the want of openness and candour in not publishing the names of the committee, so that architects may have an opportunity of forming an opinion how far—not from their situation in life or respectability alone, but from their education and information—such individuals are duly qualified to set in judgment on an art which requires the closest application and deepest study for years on the part of its professors.

The first intimation which I had of the proposed erection of St. George's Hall was a plan (with printed resolutions and instructions to architects) from a committee, which was sent to me by post, but without any name to it, except that of the printer. The printed plan and instructions are very well as far as they go, except as to the time specified for sending in the designs, which is so very limited that, unless competitors neglect a certain business for an uncertain one, the drawings cannot be prepared with that attention which a building of this extent demands. Immediately after the receipt of the printed instructions, I wrote to the Chairman of the committee—for I did not then, nor do I now know his name—to request he would give me further information on the subject. In this letter I referred him to the report of the Royal Institute of British Architects, and quoted the queries therein named, together with some others I thought necessary. The queries are as follows:—

1. By whom are the designs to be examined and selected?
2. Have any designs been laid before the parties previously to the competition being proposed?
3. Have the parties any architect, or person professing to be an architect, in their employ?
4. Will any means be adopted to ascertain that the designs can be executed for the sums estimated?
5. Will the parties undertake to lay aside all designs, which cannot be executed for the sum estimated?
6. Is it the intention of the parties at once to exclude from the competition all designs not in strict conformity with their instructions in every respect?
7. Will the architect whose design is selected be employed to execute the work, provided his character and standing in the profession is such as to render him unexceptionable?

To which letter I received the following reply:—

Liverpool, 14th March, 1839.

Sir,—Our answers to the queries of your letter are as follow:—

1. By the committee; a body of gentlemen of the first respectability in Liverpool.
2. No.
3. No.
4. See ninth paragraph of the printed particular.
5. See ditto ditto.
6. It is.
7. Most probably.
8. First part—No. Second part—Yes.
9. Two premiums—250 guineas and 150 guineas. (See advertisement in London papers.)
10. Good; no unusual expenditure.

I am, Sir, your very obedient servant,

E. G. Deane, } Sec.
Thos. Harvey, }

E. B. Lamb, Esq., Architect, 25, Henrietta-street, Brunswick-square, London.

It is evident enough how very unsatisfactory the first answer is. Respectability is certainly an important part of the qualifications of a committee-man, but that it implies intuitive knowledge in architecture I think may be doubted. It would be a novel mode of proceeding if a lawyer were applied to to sit in judgment in a surgical case, and it would be equally novel for a surgeon to usurp the powdered wig and gown of an advocate; yet in neither case is it necessary to have a knowledge of the principles of taste as well as practice. Yet in architecture a committee is formed of respectable persons, without any previous acquaintance—the subject to sit in judgment upon probably 80 or 100 different designs, comprising perhaps nearly 1,400 drawings. If they are not in the first instance bewildered by the confusion of subjects before them, and at once get out of their difficulty by applying to a well-known architect for a design, instances of which have more than once occurred, they perhaps form their opinions from a showy design, without taking into consideration the correctness or incorrectness of the architecture, the practicability of its execution, the convenience of accommodation, or the likelihood of its being erected for the sum specified.

I will now only call your attention to the 7th query, and answer. The query is sufficiently explicit to expect an unqualified reply, yet we have one, considering the want of candour apparent in the committee, of a very suspicious nature. I do not for a moment doubt the respectability of the committee; but they appear determined that no influence of any kind shall bias them, not even that of an inquiry i they are acquainted, as amateurs, with architecture.

The remaining answers relate merely to unimportant questions. I may just state that the advertisements did not appear in the papers until some days after I had received the printed instructions; at least I did not see them.

After a lapse of some time I found that other business prevented me from time to time giving that consideration to the subject, which its importance required, and upon calculating the time it would take to prepare the necessary drawings to my own satisfaction, and without great inconvenience and loss to myself, I determined to write again to the committee for an extension of time, and also to recommend a public exhibition of the designs previously to any decision being formed by the committee; a copy of this letter is subjoined:—

9th April, 1839.

Gentlemen,—I beg to thank you for your reply to my letter of inquiries relative to the St. George's Hall, Liverpool, and I trust you will accept my apology for again troubling you; but I am now about to ask a greater favour, and one that, if granted, will be a boon to the profession, who are about entering this competition—namely, for an extension of time for sending in the designs. And when I point out to you this necessity for doing so, together with the benefit which must be the result to the committee, I hope it will not be considered an idle request.

From the printed particulars furnished to architects by the committee, it is evident that the designs cannot be completed with fewer than from twelve to fifteen drawings, nearly all of which will require to be drawn on double elephant paper (3 ft. 4 × 2.2), since the requisite subjects will probably be as follows:—Ground plan, one pair plan, two pair plan, at least three or four elevations, three or four sections, and one or two perspective views. This is the smallest number of drawings which will be necessary, in order fully to explain each design. Now the actual time for the mere labour of making such a series would be at least from thirty to forty days; while to prepare an estimate and description would occupy at least five or six days more—so that from five to six whole days would be required for this purpose alone. The most important part of the task, which I have not yet mentioned, is that of preparing the design itself, preparatory to making fair transcripts of the several parts of it, the time requisite for which it is utterly impossible to state, since it must depend entirely upon the study bestowed by each individual in maturing his first ideas. In some cases, therefore, this preparatory labour may be very considerable—in others, exceedingly little: almost the very first ideas that happen to present themselves being adopted and proceeded upon at once, however stale and common-place they may be in themselves. Consequently, if inadequate time be allowed for duly considering the subject, little more perhaps than could, without inconvenience, be spared for merely making out fair copies of the original sketches, many architects will, on that account alone, be deterred from entering into the competition, feeling that unless they should happen to succeed entirely to their own satisfaction in the very first instance, they would have no time for reconsidering or correcting any of their sketches—probably be compelled to let pass many imperfections they would afterwards detect. It is hardly to be supposed that any member of the profession, who has any practice at all, can devote the whole of his time to works where the chances are a hundred to one against his success; therefore, if the committee require designs from men of experience as well as from the juniors, they will at once see the necessity of an extension of time.

I am aware that a single application of this nature will have but little weight; but from the conversations I have had with several members of the profession, I am induced to think that the majority, if not all, would feel benefited by being allowed more time for preparing their designs. Yet if none applied, there would be but little hope of obtaining this boon. I need hardly state, that the committee would also be gainers in the like proportion; as a work of such magnitude requires the greatest deliberation, not only on the part of the architect who produces the design, but also on that of the judges who have to determine upon its merits.

I therefore beg to suggest, and I do so with the greatest deference, that immediately upon the receipt of all the drawings by the committee, they should be thrown open to the public for exhibition, for at least one month previously to any decision being formed by the committee. This is a request (and I put it most respectfully) the profession have some right to expect would be acceded to, as they could then look with the greatest confidence to the ultimate decision of the committee, and it would be an evidence to the public of their disinterested motives; it would be also an honourable precedent for all future competitions in the kingdom: and, by the confidence which it would be sure to establish, be the means of calling together a greater number of the profession than any public competition hitherto known. What has lately taken place with regard to the Nelson Monument, is an example that ought not to be thrown away; and indeed the eyes of the public are now beginning to be so opened by it, that, sooner or later, I am convinced, not only a public exhibition of all the designs, but one previous to any premiums being adjudged or selection made, will be established as a matter of course in all architectural competitions of any importance. The opportunity now presents itself to you of letting the town of Liverpool be the first to originate so exceedingly salutary a system,—one fraught with numerous benefits to all parties concerned, but to none more so than those whose interest it may be presumed it is to obtain a design which shall have stood the test of such public ordeal, and obtained the greater number of suffrages from persons of experience and taste, and uninfluenced by other bias than the desire of obtaining such a structure as shall reflect credit on their townsmen. Among the minor advantages which would in this case attend such exhibition, would be, that it would attract numerous members of the profession, both from the metropolis and from other parts of the kingdom.

May I beg the favour of your laying this letter before the committee as early as possible, and trusting they will give some consideration to the observations which it contains, and waiting their decision,

I am, Gentlemen, &c.

Messrs. Deane and Harvey.

I again wrote the following:—

May 3, 1839.

Gentlemen,—A short time back I wrote to you respecting the public competition for the erection of St. George's Hall, Liverpool, and not having received any reply to that letter, I am again obliged to trouble you with a request that you will be kind enough to state whether the committee have deemed it of sufficient importance to take into consideration the subjects therein contained. I shall feel obliged by your reply within next week, as I am about publishing some observations of public competitions, and wish to name this amongst others in the course of those observations. I feel that it is necessary to apologize for giving you so much trouble, but on a subject of so much interest to the profession, and to the public at large, I am sure you will readily grant me an excuse.

I am, gentlemen, &c.

Messrs. Deane and Harvey.

And, after waiting without any reply, received the following:—

Liverpool, May 4, 1839.

Sir,—In reply to yours of the 3d, we beg to state that we answered yours of the 9th of March on the 14th of the same month, and have not received any communication from you since, excepting your letter of yesterday.

If you will refer to our letter to you, dated 14th March, we think you will find that we there answered all your inquiries; but if you wish any other information which it is in our power to give, we shall be most happy to afford it you.

We remain, Sir, your very obedient servant,

E. G. Deane, }
Thos. Harvey, } Sec.

E. B. Lamb, Esq., Henrietta-street, Brunswick-square.

I insert this letter as a link in the chain, and to show the remarkable circumstance of mine not reaching its destination. The little hopes I had entertained of having my request acceded to, were now fled; but as I still felt interested in the subject, I determined to write again, and send a copy of my letter of the 9th April. The letter accompanying that, is as follows:—

7th May, 1839.

Gentlemen,—I received your letter of the 4th inst., and am greatly surprised to find that you have not received mine of the 10th of April. As this appears to be caused by the neglect of the postman, or other person concerned in the delivery of letters, I purpose making inquiries at the General Post-Office on the subject, particularly as the letter has not been returned to me—the course usually adopted when letters have not been delivered as directed. I send you a copy of the letter,

And am, Gentlemen, &c.

Messrs. Deane and Harvey.

This letter produced the following reply:—

Liverpool, 8th May, 1839.

Sir,—In reply to your letter of yesterday, we beg to inform you that, upon further search, we find your letter of the 9th of April was duly received, and laid before the committee, who came to a resolution, after much deliberation, that it was inexpedient to grant any extension of time. The other subject mentioned in your letter (the public exhibition of plans) is a matter for the future consideration of the committee.

We beg that you will accept our apology for the unintentional neglect of which we were guilty in not answering your letter of the 9th April, and also for the equally unintentional error which we committed in stating that it had not been received. It reached us by the same post as one upon the same subject from Mr. Donaldson, the Secretary to the Royal Institute of British Architects, and they were both laid before the committee without delay. Their determination was communicated by us to Mr. Donaldson, and we were under the impression that it had been communicated to you also; but it seems we were in error.

We trust you have had no further trouble about it; and remain, Sir, respectfully, your most obedient servants,

Edw. G. Deane, }
Thos. Harvey, } Sec.

E. B. Lamb, Esq., 25, Henrietta-street, Brunswick-square.

It is certainly a singular coincidence that a letter which could scarcely be forgotten on an occasion of this nature, should happen to be so misplaced as to prevent its being answered, but I beg most distinctly to state that I perfectly agree with the writers, that the neglect is unintentional; at the same time, I may with justice add, that this sort of neglect is not an unfrequent occurrence with committees and their officers. Other instances might be named where plans have been laid aside and entirely *forgotten* by the committee.

I have now laid before you the usual kind of correspondence which takes place between architects and committees, and I think, upon the slightest consideration, it will appear who are the most benefited parties. I do not mean to impugn the Liverpool committee, I merely take them as a sample of the apparent openness and disinterestedness of such bodies. Can persons so constituted reasonably expect architects to enter into a competition, when they withhold that evidence of their fair intention, which ought to appear, by not publishing their names to their papers, so that architects should be as able to form an opinion of their being fully qualified for their duties, as it should be evident to them that architects are qualified for theirs. In the present state of competition committees, it is of small importance whether the architect wastes his time in bestowing deep study on his design, or merely commits to paper the most commonplace ideas; for the little knowledge of the subject usually shown by the *judges*, is insufficient to discriminate between genius and mediocrity. If any one will take the trouble to inquire, he will find this opinion fully borne out, without depreciating the talents of the committee. An instance of this nature occurred some time ago in the parish of Holloway: two churches were to be built, and were duly advertised in the usual way for competitions; mottoes, not names, were to appear, and every appearance of fairness was shown by the committee. At that time I happened to be transacting business with one of the committee, a clergyman of perfectly unimpeachable character, and in the course of one of our business meetings, I asked him who the committee for the erecting the churches were; he mentioned several names of the highest respectability in the parish, but when I asked him by what qualification they acted, he admitted that not one of them was acquainted with the subject; and the result of their deliberations is the production of the two new churches, one near King's Cross, called Gothic, and the other near the North-road, called Grecian. I admit that the limited funds would not allow of much display; but although a man may wear a shabby coat, it would be in better taste to put it on the right way. This is only a trifling one, among innumerable instances of this nature.

I will now turn from this subject to another of more importance, but with less promise, namely, the Royal Exchange. A copy of the advertisement of the Joint Gresham Committee I see is placed in your last number, with some observations, to which I beg to add some others.

It will be needless to comment upon the shabby commencement of this committee, by requiring a fee for the necessary instructions, as every architect who enters this competition must lay out a sum of money that one pound would be but a trifle to complain of. I pass over the resolutions, till I come to No. 10, which awards three premiums;—300*l.* for the best design, 200*l.* for the second, and 100*l.* for the third. Then comes a sly kick at the competitors. "The successful competitor to whom the first premium is awarded, shall not be considered as having necessarily a claim to be entrusted with the execution of the work; but if not so employed, and his designs are carried into execution, a further sum of 500*l.* shall be paid to him, the committee retaining possession of all the drawings for which the premiums have been given." So if they, in their mature judgment, fail in discovering a single design with merit enough for execution, they consign the three successful designs to some successful operator, to be compounded according to receipt—at least, this is the inference any impartial person would put upon this clause At the end of the 13th clause comes a list of rooms with their dimensions, but what these rooms (41 in number) are for, the architects are to guess; three, I have understood, are for three companies, but what companies we are not informed; and as the other rooms are without names, they may be fitted up as barns or drawing-rooms, at the discretion of the architects, for the Gresham Committee appear to have very little discretion upon the subject. Who are the Joint Gresham Committee? Echo answers "Who?" At the head of a public charity or city feast, men do not appear to be ashamed of their names; because, in the latter instance at least, they are fully qualified to discuss the merits of the subjects before them. But where architects only are to be dished up, and where the mind is to form a judgment of a liberal profession, they shrink from publicity. Can it be that they are aware of their own inability? Can any man in his senses be induced to join a committee, and vote for what he is totally unacquainted with? Who are the Joint Gresham Committee? I ask again. If they are acquainted with the subject, surely they ought to be the first to show that confidence can be placed in their judgment; for who but those engaged in the study, though only as a recreation, can have the least idea of the intricacy and difficulties of forming a just decision? If men of this standing were some of the judges, and the profession were aware of it, immediate confidence would be placed in them; for what honest man would decide against his own character?

I make no comment on the last paragraph of the instructions—it is sufficient in itself to awaken suspicion in the breast of the least sceptical.

What is to be done in this case? asks almost every architect. Agitate, agitate, agitate, say the reformers of a system notoriously bad—so bad, indeed, that the committees themselves would be glad to get out of the dilemma. But how? First, you acknowledge yourselves incompetent, being unacquainted with architecture.

"But we know no amateurs to help us." Then apply to known professional men who are not competitors, and who have no more interest in the matter than the fees which you give them for an opinion, a report, in fact, in writing. But this report should not be entered into until a public exhibition of all the designs had taken place, and sufficient time allowed for the public to form an opinion; and if, during that exhibition, a time was set apart for the judges to frame their report and have it published, the exhibition still being open, the competitors would have an opportunity of refuting the opinions of the judges, if necessary; the public would be called to the subject, and would get better initiated into the art; the profession would be great gainers, but the result would be most in favour of the public. Every other profession is judged by a professor, or at least by one acquainted with the subject: few men buy pictures without the advice of a connoisseur; few, indeed, go to law without a lawyer; some, but very few, take medicine without a doctor's opinion; but as to architectural knowledge, it is innate with every one, and thousands upon thousands are squandered away, more to the satisfaction of the builder than the employer.

Another thing I would strongly urge, and for which a competent committee would see the necessity, is, that ample time should be allowed for preparing the designs. We might almost suppose that architects, like outfitters, kept a stock of designs on band, ready for any emergency, if we may judge by the time in which they are expected to be done. Some good regulations have lately crept into the instructions given to architects; for instance, the scale has been determined, the style of architecture in some instances, the manner of finishing, and the number of perspective views have been limited. These are good regulations, but of little avail if the judges are unacquainted with the subject. There are a few things in addition to full instructions required to constitute a fair competition satisfactory to all parties.

1. Competent judges.
2. Ample time for preparing the design.
3. An exhibition, previously to any examination, by the judges.
4. A published report, with time for refutation, if necessary.

These it is within the power of every committee to grant, and they cannot be considered unreasonable for architects to demand; and when it is considered that every architect devotes great time and study to the subject, and has spent the greatest and best portion of his life in acquiring the knowledge he possesses, if he feels a little irritated by the way in which his labours are sometimes treated, it may more frequently be laid to injustice (unintentional perhaps) than disappointment.

It is granted that no measure of efficient reform in the present system of competition—a system which leaves open the door to all kind of unfairness and intrigue, can be devised that will not at first be attended with some difficulty, and require some energy; yet that is no reason wherefore no remedy should be attempted to be applied; on the contrary, the strongest reason for our setting about doing it at once, instead of procrastinating, and thereby suffering the evil to become more and more inveterate. In fact, if the opportunity which now presents itself for bringing about such very necessary reform be suffered to pass by when so much has been said upon the subject, and after some little beginning towards it has been made, as far as regards the public exhibition of the designs for the Houses of Parliament and the Nelson Monument (though not in that stage of the proceedings where such publicity would have been most serviceable), the chance of any reform at all will become hopeless, and matters will be allowed to fall back into their old course; for it is not very likely that either in the present or the next generation, will the profession be called upon to compete for a work of similar magnitude and importance to that of the Royal Exchange.

It is hoped, therefore, that the Gresham Committee will pay some attention to the remonstrances which have already been made by individuals, and that the profession may receive satisfactory pledges that the strictest impartiality shall be accompanied by the most deliberate judgement. Of course a public PRE-EXHIBITION should be granted as a *sine qua non*; since that withheld, the main security for the rest is taken away; while that granted, it will almost of itself insure impartiality and mature consideration. Another and not the least advantage would be, that while an additional stimulus to exertion would be afforded to the competitors many would be deterred from entering into the lists, well aware that whatever chance there might be for them, where secrecy in the proceedings gives a vantage ground to personal interest and intrigue, their pretensions would not endure the scrutiny of a public gaze.

That competition in architecture is beneficial to the public at large, and certainly to the profession, there can be little doubt; and, when conducted upon just principles, it is the only means of setting aside monopoly and stimulating the rising members of the profession to exertion; indeed, this opinion is so general, that I feel the greater surprise that Mr. Bartholomew, in his recently published "Hints," could assert one of a contrary nature, unsupported as it is by any argument by which I can coincide with him. But I have already trespassed too much upon your columns, and shall therefore now dismiss the subject; and am, Sir,

Yours most obediently,

25, Henrietta-street, Brunswick-square, E. B. LAMB.
10th May, 1839.

ON SCULPTURE AND ARCHITECTURE.

He would confer a large benefit on art, who, in a philosophical spirit, should betake himself to the detecting of its great principles; and, shaking from his mind the load of professional clogs, pry freely and boldly into the beautiful treausure of nature, to draw thence the secret of her workmanship for the guidance of her imitators; and if the book that recorded his labours should do little itself towards its object, yet it might give birth to another, or a series of labours and books which should effect a thorough investigation, ending in the satisfactory ascertaining and fixing of the universal and inevitable in art. If his labours should not produce, and his book publish, a code, yet so might a foundation be laid for the erecting of a code; and if not even that, yet it might stir up some sleeping philosopher or philosophers to do the work he has failed to do,—at least, to make a solid basement on which (now or at any time) the perfect building could be raised, story by story, to its completest form. The importance of a system, immediately or gradually, perfected; an undisputed, indisputable code of laws, universally applicable—to which the artist might go for guidance, and the critic for authority, and the importance of even a single caput in the code—should make the smallest attempt welcome, and entitle it to tender usage. But attempts are more to be desired than hoped for; the labourer's reward is of fame only, whose wreaths are not golden wreaths, and who coquettishly distributes them such as they are.

In a lower degree, still, attempts towards the detection of some one or two principles, in limited portions of art, claim a diminished consideration. They may be of advantage; truths (of less value, indeed, because limited in application, yet of some value) may be, though not perhaps discovered, at least promulgated; and, at the worst, if the attempts be full of error—yet if of sufficient importance to excite attention—they lead to their own refutation, and to the clearing away of just so much rubbish that might, perhaps, at some time or other impede the workman. And in the course of the investigation trains of thought may be suggested, pursuing which (for of a spark comes the fire) the artist may escape out of the labyrinth of tangled technicalities and perplexity of indifferent details which now smother many a large genius in infancy, that, but for them, had betaken itself to the great schoolmaster in art, Nature, and had educated and unfolded itself to the strength of a full man. It is impossible to avoid acknowledging that neither in the works of modern artists nor the opinions of modern critics generally, is there any evidence that much thought has been expended on their labours, or that any considerable knowledge has been acquired by either of the great foundations of their craft. They are practical wailings over the absence of the philosophical director, and even no acquaintance can be discovered in them with these generalities, which belong to their own particular province.

Thus much, for warding off the strokes of censure from the following comparison of the two arts, sculpture and architecture, as they are concerned in the embodying of the beautiful. It must be observed that the useful is set aside as not concerned with the work (the Nelson memorial) which suggests these remarks; and that by beauty is always intended the abstract, most exalted, and purest: it is not used in that unlimited manner by which, in common speech, it represents every quality, from deformity upwards.

Beauty, then, in art cannot exist, independently of imitation. The object of imitation is Nature—1st, in order animate; 2nd, inanimate: considering art as merely imitative; the most excellent imitation of the highest class constitutes the most perfect work. Thus the perfect imitation of a man is a superior work to the perfect imitation of a tree.

Sculpture imitates the first and most excellent class, and is therefore superior to that which imitates the second—viz., inanimate nature; but where is this last to be found? Has any artist copied a tree, or a mountain (unless the pyramids be feeble copies), or the sea (unless the molten sea of Solomon, which we may imagine was no very wonderful work)? Imitation, then, would seem to be confined to sculpture; and if beauty cannot exist independent of imitation, beauty must be allowed to be confined to sculpture. Architecture, then, is not an imitative art, but ranks lower; and, adhering to the first concession, beauty is wanting to architecture. And so long as the beautiful is regarded as the end of art, architecture is a much inferier art to sculpture. Buildings are chiefly for habitation, either of gods or men; they are temples or houses. The Druidical gods inhabited—that is, their temples were sometimes—trees; and could man roost on branches, as fowl do, his wrought house might be the imitation of a tree, if real trees should fail, or be inconvenient. Then architecture would be lifted up into the ranks of the imitative arts, and would be inferior to sculpture only as its model would be of a lower class. As it is, man's house is a protection from weather and assault; and these are the prior objects in its construction. The best adapted form to secure these objects being determined, it remains to bring into the work as much beauty as can be admitted, without prejudice to the objects. Here, then, the architect flies to nature for a model; and in proportion to the amount of perfect imitation brought into his work, would be the amount of beauty. But again nature fails him; as he finds no model for his whole work, so neither can he for its parts. Unless we allow that columns are imitations of human form, and certain parts of Gothic architecture imitations of groves of trees—which, the resemblance being so slight, it would be hard to do. Not allowing these, and setting aside those ornaments, borrowed from sculpture, which are inartificial additions to the architectural design, do not assist, even feignedly, in the carrying out of the design, and which, therefore, do not belong properly to architecture, there is, neither in the whole work of the architect, nor in its parts, imitation; and therefore the beautiful does not at all enter into it, either as a whole or in detail; and the workman would seem to have nothing for it but to fall back upon utility and perfect his work to that end. Something, however, may be attempted beyond; a compromise may be made between utility and beauty—beauty conceding a great deal, and utility a little. A certain sort of imitation there may be, not of actual models, but of the principles discoverable in them. The ingredients and sources of beauty in nature's models may be searehed for, and if any can be found that are independent of adaptation, these may be breught into architecture, and the artist may endeavour to develop them in his work. Thus the proportions of height to breadth, found in the most perfect models furnished by nature to the imitative arts, might be, and most probably were, applied by the earlier architects to those parts of their work which admitted of it. Thus they may have applied to the Doric column the general proportions found in men, animals, or tree-trunks remarkable for strength, as that order is intended to express strength. The thinness of the doric may have been founded on the slighter form of woman, that order expressing grace; sublimity is connected with size, chiefly height; breadth adds more to strength. With these faint conceptions and imperfectly settled principles the architect goes to his work, without a model, and therefore without a test—the uncertain workman of his own uncertain speculations. Hence the variety of opinions among the best instructed and most capable artists, the changing nature of the standard; viz., the succeeding orders.

So much for sculpture and architecture; art being regarded as merely imitative. But there is yet something beyond, which raises art to a higher rank than imitation alone ever could; that is, to the creative; to the proper regions of poetry: for true poetry, whether it has its expression in language or form, or whatsoever, is the conceiving, and making of a work superior to its model, and is not the creating of a work after no model. Imitation is the basis, and is never in the most exalted works of poetry dispensed with. Genius is of an higher order, as it carries out its model nearer to a perfect ideal excellence. Thus, in men, may be detected the initiative of moral perfection: the imitation that expresses this, is an inferior work of art—poetry will conceive and express moral qualities of an higher order than those that are found in any model; and will be more exalted as it climbs higher towards their perfection. Sculpture and architecture deal with form, and form is either the subject or the means; it is either final or medial, When final—when form is regarded for itself alone—the question arises, Can there be any thing beyond imitation? Can forms be created like those to which the sense has been accustomed, yet yielding a superior satisfaction to the sense? If the sense be thus capable, we see not why new forms without model should not also satisfy it, and then architecture would stand on the same level with sculpture. The examination of this question would lead to others; such as, whether there be in the organs of man an inherent adaptiveness to beauty, or only an acquired? whether beauty is self-existent or dependent? and so forth: to which, perhaps, there never eould be certain satisfactory answers. It will be more safe to assume that form cannot be created nor amended, but imitated, when it is regarded as an end; but when as a means, when it is the expression of faculties, as the instinctive and the reasoning, then art uses it, and, using it, thereby enables itself to advance beyond imitation, and becomes creative; for all faculties are imperfect, in the best models. These can be conceived the perfection of the faculties—and it is possible to express, by form, that perfection, which, yet not being expressed in any known form, the artist cannot express by imitating, but may by creating. Here then sculpture surpasses itself and architecture. Granting to the latter every thing; that, up to this point it has gone hand in hand with sculpture, that there is in it an equal capacity to satisfy the sense; yet, at least, now, it halts and drops behind. Sculpture is at work with the highest possible subjects; form is no longer presented to the eye, but the soul to the soul; and now also it becomes important as an instrument in the hands of the state, with which the state may work powerfully; for the whole mass of sympathies, good and bad, are within its influence. Mental and moral excellence or depravity are ever-present models or beacons for good, or for ill.

The conclusion to which we have come then, is—That sculpture makes its highest effort when it strives to express moral or mental perfection; and then is in the highest regions of poetry: that therefrom it falls gradually, and through many stages, down to mere imitation; and thence still continues to fall from excellent to the most worthless objects. That probably in its lowest, certainly in its highest, exertion, it is superior to architecture; and both as a poetical and political servant much more worthy.

But utility backs architecture. Now utility is imperial, and must first be consulted: however, there is a limit to her territory; stepping beyond which, she becomes an aggressor, and should be strenuously driven back. In no matter whatsoever connected with art, should utility be allowed to interfere, if she have no just claim to concern herself with it. She should never be permitted to approach beauty, for she is the natural enemy of beauty, and has such spite against her, as that, whenever she can get near enough she scratches, and pinches, and bruises her, till she is next to death; and if thenceforth beauty live at all, she is so distorted and deformed as that one can scarcely recognise her. A limb here gone, and a feature there, or the back entirely broken. When architecture, therefore, who is the servant of utility, can make good her claim to meddle, there is no help for it, but to let her meddle, and to curse her for a busy-body; but if she can support no claim, she should be carefully put out of the way.

The application of these remarks to the Nelson memorial is easy. The first thing to be desired, is perfect imitation; after that, excellence of model; and if the poetical step can be taken beyond, so much the better. Then follows the question—What claim can architecture put in to meddle? Can it be useful in any way? It will deform the work much: can it do any great service in compensation? The only one that suggests itself, is this—that it will protect the delicate material, the only material fit for sculpture to make its highest attempts upon, from the hard usage of our climate. If that service be allowed as necessary, architecture may be permitted to render it; but then in the least officious, and most unpretending manner. A plain, though as fair-proportioned as possible, temple may cover the marble piece of sculpture; such as shall not draw attention from, but rather lead it to, the figure or group within, and as may harmonise with its meaning. But if the accepting of this service at the hands of architecture be reluctant, how shall its interference be endured, when it is in no way useful; a building answering no useful purpose, is a sort of deformity without deformity's excuse And can such be a fit work for a testimonial to Nelson? And if not a whole building, how infinitely less a part?—a column for instance. What can be more absurd, if there be any truth in what has been herein before said, than the selecting of a fragment. One, well in its place, unmeaning and absurd out of it; which is shaped to fit to its place, and is therein perhaps ornamental, but is unshapely anywhere else; which moreover, either really or feignedly, answers a purpose in its place, none out of its place. A column apart from its pediment is like a leg apart from its body; and is as ridiculous standing alone as a leg would appear, which should run about by itself.

As an excuse for appending the column to a building, the pediment is thrown out; which overhanging seems to require support. For the purpose of support it is well, and the proportions of the column may be as perfect, in the different orders, as it is possible for them to be; but they have been fixed with a reference to the building the column is attached to, the pediment it supports, and perhaps to the grouping of several. But is it not absurd to take it away from its pediment, and set it up solitary, naked, its proportions undeveloped by any attendant thing: an imitation of nothing, therefore not beautiful in itself; connected with nothing, therefore contributing nothing to the ornament of anything;—properly a support, yet bearing nothing, except, in some instances, a piece of sculpture—that is, the imitation of man's form; an imitation addressing itself to the eye, yet perched far beyond the eye's reach, where a chimney-pot would almost serve as well. As an apparent remedy for the inappropriateness of a single column, some have carved bas-reliefs, winding their weary way gradually up to it top, as if in contemplation of that advance of science, which should furnish man with wings, and enable him to flutter in air and whirl about the sculpture for examining it. Till that shall happen, all the bas-reliefs are effectually thrown away, that are placed beyond the first row or two. Who but a crow can see them? Why not just chip the stone, in the way the street pavement is chipped? That would answer quite as well as the bas-reliefs, and the spectator would not be vexed with the never-to-be-gratified desire of seeing what all the carving is about up in the air. There has been one step further in absurdity—the casting of the column and reliefs in bronze, making that, which in stone is obscure enough, ten times more obscure; as in that wretched thing in the Place Vendome. Why, when form (sculptured form) is at any distance from the eye, it loses distinction (*i. e.* in the case of bas-reliefs); the forms are confounded with the back-ground; therefore the figures in the metopes of the Parthenon were distinguished by painting the back-ground blue: and the Athenians in that, showed that they knew what they were about. They never placed the forms they had sculptured out of sight, or even so placed them that they should be in the least indistinct. The worst instructed among them would have cracked his sides with laughter to have seen the Duke of York perched up in the clouds. Had the Duke been a bird, his position there would not have been ridiculous, but only useless—useless because we should desire to examine him, his shape, feathers, and so forth; but up there, tail, claws, beak, would have been all alike, and no one would be able to say, if he was looking at a bird or a tortoise. Perhaps the artist was enamoured of the Duke's title of Highness, and would in his work symbolise it; or that he desired to panegyrise the Duke, and signify the mounting of his soul to Heaven: so that, with the contrary purpose, with a wish to satirise and condemn, he would have set his sculpture at the bottom of a hole as deep as the present column is high, whereby the descent of the soul should be designed.

The column, and the piece of sculpture together, as a work, is ridiculous—it is contended. The column, as the principal (having the sculpture as a mere appendage), is equally ridiculous; and its selection betrays ignorance of the great purposes of art. The sculpture, as the principal, were well; the column, as an appendage to it, ornamental or useful, still more ridiculous than when a principal. And the sculpture being raised by it far beyond the reach of examination, the whole work is both beneath and beyond observation. W.

ON THE PUBLIC BUILDINGS OF THE ANCIENTS.

By J. Fleming Tait.

The use of immense blocks of stone for the formation of public buildings, temples, and monuments, has from the times of remote antiquity been ever considered as an honourable testimonial of the perseverance and labour of those who erected them, and as a proof that they not only built for the purposes of present use, and ornament, but also for the benefit and instruction of posterity. Had the Egyptians, the Greeks, or the Romans even, constructed their great public works with blocks of stone of no larger size than those which we are in the habit of employing for ours, it would inevitably have followed, that in the many irruptions of barbarian nations, which desolated those countries in their decline, and whose principal object, next to the all-predominant one of plunder, was to destroy and efface to the utermost of their power every work of art, and evidence that a people wiser and more celebrated than themselves had existed, those splendid remains, which defied their utmost efforts, and are still the glory of their respective places, and the admiration of all who behold them, would have been swept away from the face of the earth and their very names have perished with their existence—and the traveller and scholar of the present day would have found as much classic pleasure in wandering over the steppes of Tartary, or the vast wilds of Siberia, as he would in visiting the spots where Athens, Thebes, and Palmyra stood—besides a host of other names equally celebrated in history, and have gazed upon the place where the Eternal City stood, with no greater degree of interest than he now does upon the site of Babylon.

And yet that vast mis-shapen heap was once the mightiest and proudest city the world ever saw, and the boast of all antiquity. Her walls, which were three days' journey in circumference, and whereon six chariots could drive abreast! So colossal are her temples and palaces stated to have been by the ancient historians, that they are considered by many as utterly unworthy of belief; and thus likewise would the accounts of the great temples of Carnac and Luxor have been received, did they not remain to this day in an almost perfect state, to attest their own magnificent and gigantic proportions. These edifices are coeval with Babylon; so are the Pyramids of Cairo and the walls of Balbec; on the *summit* of the former of which are stones eighteen feet square, and in the latter of sixty feet in length; upon which, as the wild and simple Arab pauses in his rapid career to look on these enormous masses, he exclaims with wonder, that he beholds the works of the giants of old times!

And why have these buildings survived a city whose structures excelled theirs? Because she, like a selfish spendthrift, thought only of present show, and constructed her edifices of materials which would not stand the wrecks of time and barbarians wrath—while they, built of materials which needed not the aid of cement, which scorned even fire itself; they built for posterity—and it has done them justice. The efforts of the Saracens to destroy one of the Pyramids were tremendous, and incessant, until their engineers were forced to give up the attempt as impracticable, and retire in disgrace from the unworthy attempt to mar what they could not make.

The Greeks, who stand unrivalled for grace and beauty of design, did not let this important principle of the durability of their structures escape them, as may be seen by the size of the stones used in all their public buildings, and particularly at the Acropolis and at Pæstum, although they fall far short of those used by their predecessors the Egyptians; while the Romans, who followed up the principle, but (unlike their usual custom) in a lesser degree, are still very far our superiors; and we find by examining the remains which these nations and others have left us, that according as the component stones are large or small so are the buildings in a greater or a lesser state of preservation.

The Romans, however, showed the high estimation in which they held the principle, by the transportation to their own capital, of some of the gigantic Egyptian Obelisks and Sphynxes; a work of itself of great labour, and almost equalling that of the original erections.

But the transporting and using of immense masses is not confined solely to the ancients, for we find that most of the modern European nations have to boast of at least one proof of their endeavours in this respect. The small Italian states are, perhaps, the most fertile in these; in many instances, however, they have trenched a little on the property of their forefathers. The statue of the Apostles, on St. Peter's, are, it is well known, eighteen feet high. The Russians have the famous rock for the equestrian statue of the Czar, Peter the Great, brought there with enormous labour by command of the Empress Catherine, and which was very injudiciously curtailed of its dimensions after its removal by the sculptor, much to her annoyance. The French have been improving in this respect lately, and have also transported one of the celebrated obelisks, presented to them by the Pacha, and which at present adorns the Place de la Concorde, at Paris. That which is said to have been given to us at the same time, lies neglected. Even the little Corsican town of Ajaccio can now boast of one of its own erection, whose weight exceeds 1,200,000 lbs., or 535 tons, in honour of Napoleon, who was born there.

But we! In two thousand years the question may be iterated. "The Greeks we know, and the Egyptians we know—but who are ye? Where are your monuments?" It will avail our descendants but little to point at the unhewn stones on Salisbury Plain, and cry, "these are our fathers' works!" Let us redeem our character. Some great national buildings and monuments are now about to be commenced, and it will be strange if, with the very superior mechanical advantages we possess in the powers of steam and facilities of transportation, we do not at least rival, or approach, some of the great works which other nations have to point as the labour of themselves or their ancestors. The principal expense of conveying blocks of stone from the north of England to the capital would be that of removing them from the quarry to the nearest railway station. Why, for instance, might not the pedestal for the equestrian statue of the Duke of Wellington in the city be composed of one block, and brought in this way?

There are three other great works about to be commenced, and it is earnestly to be hoped that the nature, size, and durability of the material to be used in their construction will not be unworthy of buildings to decorate the capital city of so great an empire as this. Of the evil of not paying proper attention to this, sufficient evidence may be had by witnessing the great and expensive repairs which have been called for of late years at Oxford, on their colleges, where, in many instances, they had been almost on the verge of ruins; and this may be mainly attributable to the smallness of the stones used in their construction, inasmuch as they leave the weather to act on so many interstices, and thereby increasing the decomposition in a tenfold degree. Few are hardy enough to imagine that the monument at London-bridge will last half the time the Trajan column has—and yet it is the work of perhaps a greater architect—but must perish for want of this important point not having been attended to. And thus it is with all our buildings—they are for the present ornament, and the future is left unheeded. Almost the only attempt at durability appears to be that nondescript affair which has been erected on the Calton-hill, at Edinburgh, and which is called the National Monument.

Before leaving the subject I may remark as an extraordinary circumstance, that in no case do the Egyptian delineations represent their monuments or the erection of them;—we have them in war, in triumph, at feasts, at their trades, at their agricultural pursuits, and at their burial processions, but no where in this branch; thereby leaving us quite uninformed as to the manner in which a people, apparently with so few mechanical powers, have yet been able to surpass all who have succeeded them.

ARCHITECTURE, ROYAL ACADEMY.

The contents of the architectural room this year certainly does not indicate much enterprise with respect to new buildings, nor much diligence on the part of the profession; so far from it, that, taking the exhibition as a sort of thermometer, activity and energy scarcely rise to lukewarm. The absence of many who have been in the habit of exhibiting, may in some degree be accounted for by the competition for the Nelson monument, and the approaching one for the Royal Exchange; yet, although that circumstance may be so explained, we are still at a loss to understand wherefore so large a proportion of the drawings that have been sent should be so very mediocre in quality—some so disreputable to our architectural taste, supposing that the annual exhibitions afford any standard by which to judge it—as they certainly ought to do. When we look at some of the things here hung up, we cannot but feel curious to ascertain, were it possible, what degree of demerit, we might say of actual vileness, is requisite in order to exclude a design. On no account ought there to be such facility of admission; for although it may look, at the first glance, very much like extreme liberality and good nature, it argues not only indifference but almost contempt for architecture, on the part of the Academy. It seems (provided it can but keep up the average respectability in the department of painting, and secure one or two stars among the pictures,) the Academy care not one straw how bad the architectural part of their exhibition may be. It would be infinitely more generous in them, were the R.A.s to exclude architectural drawings altogether. It does not, however, exactly follow that the architects are much to be pitied, seeing that they tamely suffer matters to take such course, without doing anything to support the credit of their own body. Is it to be supposed that people can be blind to the "damning fact," that, so far from the exhibitions having displayed any advancement in architectural taste, since the profession has acquired for itself a certain position and authority by the establishment of the Royal Institute, it retrogrades rapidly, if we are to judge by what we are allowed to behold at the Academy. It is possible that its exhibitions may be no criterion at all; yet, unless some other be afforded them, the public can hardly help taking them to be such. Why, we ask, do not the profession bodily set their shoulders to the wheel at once, and extricate themselves from "the slough of despond," in which they are now sticking, on the north side of Trafalgar-square? They may be assured that the painters will not oppose their withdrawing from their premises, and establishing an annual exhibition of their own; which, it is scarcely necessary to observe, ought to be very differently managed. Instead of glaringly, not to say preposterously, coloured drawings—frequently, too, of subjects quite insignificant or worse than insignificant in point of design—we might then hope to behold exhibitions in which every branch of architectural design would be brought forward in such manner as would tend to promote it. If architects cannot see all this, they are greatly to be pitied; but if seeing it they do not care to make any exertion to vindicate themselves in the eyes of the public, we may spare our pity, for it would be only thrown away upon them.

These are confoundedly splenetic remarks!—Very true; we therefore regret that circumstances should justify them. At the same time, the great inferiority of the present exhibition of architecture as a whole, does not at all affect the merit of those drawings which form an exception. It is possible, too, that several which we should have placed among these latter, have escaped our notice; because, as every one well knows, a great many are so hung, that they cannot be perceived at all, unless diligently sought out for by the catalogue, and when found out may scarcely be discernible. In fact, if worth looking at at all, architectural drawings require to be submitted to close inspection, for without that, little more than the general forms and character can be understood; and if good designs are put where they cannot be seen without a ladder or pair of steps to get up to them, so much the worse, for there are plenty which can be seen that might possibly be fancied to be interesting had we not seen them at all. And it may be observed, that there is a difference between merely hanging up and exhibiting, although, in the vocabulary of the Royal Academy, they have precisely the same meaning.

But *commençons*; and we will therefore turn at once to No. 1238, "The Staircase of Goldsmiths' Hall," P. Hardwick, an ably-executed drawing, and architectural subject of considerable merit, yet rather indifferently hung, being too low, though not a small drawing, to be viewed properly. This is one of the very few interiors exhibited this year, and on any other occasion would probably have been the first both as a picture and a design, although now reduced to a secondary rank by Owen Jones' "View of the Alcove at the upper end of the Hall of the Two Sisters in the Alhambra." Well does this performance deserve the epithet splendid, for architecture has scarcely ever achieved anything more elaborate and gorgeous than the interior of the edifice of which we are here presented with a specimen. Yet, gorgeous as are the elements of this style of decoration, it is so far from being deficient in harmony that even its multiple variety resolves itself into a unity of expression. Prodigious must have been the labour of such performance—scarcely less prodigious must be the enthusiasm which prompted its author to engage in it. Still, though thus far disposed to award him unqualified commendation for his exertions, we must remark that we should have been better pleased with his work upon the whole, had the general effect been less hard. Besides which, the merit of the drawing as a work of art, is greatly impaired by gold itself being made use of instead of the effect of gilding being produced by colour. Hence, although there can be no mistake as to what is intended for gilding, the brilliancy and sparkle of it are quite lost, the metallic lustre showing itself only as the eye happens to catch the surface in a particular direction. Actual gilding is allowable enough in mere patterns of detail, because there it cannot possibly be expressed by colour alone; for instance, such a subject as No. 1131 (the "North side of the Gilt Room Holland House," by J. C. Richardson), which is a mere elevation; but when applied to what pretend to be pictures, it becomes quite contradictory to artist-like treatment. That all the effect of gilding is attainable even in water-colour drawings, would be sufficiently proved by Zanth's interior of the Chapel Royal at Palermo, the Cathedral of Monreale, &c., exhibited last year at the institute; and which, though possessing greater breadth of effect, were still more highly finished than this drawing by Mr. Jones.

There are one or two other interiors, yet so utterly insignificant and devoid of merit as drawings, as to be rather injurious than not to the exhibition, since the titles of them in the catalogue serve only to excite expectations that are miserably disappointed by the things themselves. Wretched as is the taste shown in the "Library at Strawberry Hill," which forms the subject of No. 1156, still an artist might have conferred on it some pictorial value; instead of which its want of beauty is here rendered positive ugliness. Again, when we look at No. 1193, "Interno della Basilica di S. Pietro," we are almost bewildered, and ask ourselves how it is possible that such trumpery and paltriness, such utter insignificance as are there manifested, can be received as a representation of the Roman Basilica, which with all its gross vices and defects, is at least magnificent. This drawing has, moreover, not the slightest pretension to novelty of subject, the only thing that could have excused its utter want of merit in all other respects. Such excuse, however, does exist for No. 1211, "Perspective of the Interior of the Church of the Madeleine at Paris, from actual measurement," by C. J. Pierce. We cannot contradict this drawing's being made from actual measurement; but we may be allowed to question the utility of actual measurement, if it is to give us such perspective as here makes the skylight of the central dome in a plane inclined to that of the picture? Either measurement or perspective, perhaps both, are notoriously at fault here. In other respects, too, the drawing evidently does not do justice to the subject; therefore the most that can be said in its favour, is that it serves to convey some idea of the design and style of decoration of the building itself, which is not without richness in its general character.

Other interiors there are none; not a single original design of the kind—for that from Goldsmiths' Hall hardly answers to such character, being a view of an executed design, not an idea that remains to be embodied. How it happens that there are invariably so exceedingly few subjects of this class, either designs or views, we are so far from being able to explain that we cannot even conjecture; for when we consider the vast scope they afford, the variety and novelty of which they admit, the abstinence manifested with regard to them becomes only all the more unaccountable. We may, indeed, guess at one or two reasons—one of which is that they require something more than that kind of putting parts together by which an elevation may be concocted out of architectural points. Some may perhaps think that if subjects of this class are so rare, it is because there are very few opportunities for interior display, either on a superior scale, or demanding superior quality. It may be so; but then how are we to account for the exceeding strange, out-of-the-way, and impracticable designs, of which there are not a few in almost every exhibition—senate houses, palaces, mausoleums, and other things of that sort; and which are besides seldom better than architectural bombast—the most common-place ideas wrapped up in extravagant pretension?

No. 1170, "Elevation of the principal Front of a design for a College," by W. Nield, is an affair of the sort; and No. 1205, termed (we do not understand why), "A *horizontal* Section of a design for a Museum," is another;—a museum with the dome of St. Paul's raised upon it! The more lavish exaggeration than real grandeur and richness manifested in designs of this class, becomes quite preposterous when compared with the parsimony which marks those intended for actual execution Hardly can they be said to have any value even as mere studies, because they evidently set at defiance all idea of practicability; whereas the object of studies ought to be to show how charater and effect may be infused into the simplest elements. The juxtaposition of the drawings, No. 1169 and 1170, is no doubt entirely accidental, but it serves to convince us of the prodigious difference between the *romance* and the *reality* of architecture; for while Mr. Nield's is one mass of carving and sculpture, Mr. Railton's "Residence now erecting at Ripon for the Bishop of the Diocese," is so very homely and unpretending a building, that, unless informed by the catalogue, no one would suspect it to be intended for an episcopal palace. Yet, though its extreme plainness might be exacted by rigorous economy, it was not economy that prevented the architect from imparting to it more nobleness and more character—it excluded neither variety of outline nor piquancy of expression; whereas there is nothing whatever either in the conception or treatment that indicates any ability on the part of the architect. On the contrary, even as a mere house—one that might have served well enough in the days of Gothic Wyattism, it looks as if merely set down in a field.

Angels and ministers of grace defend us! Oh Royal Academy! Oh poor architecture! to what pass must you both become, when we are permitted to behold such an enormity as No. 1179. "The Ship, Torbay Tavern," (situate at the corner of the new street, and the Greenwich Pier, as erected from the design of Mr. Thomas Finden, by G. Mayhew! Besides Mr. G. Mayhew, no one would have set down to make the likeness of such a design.

After that drawing it is absolutely refreshing to look at No. 1213 "Eagle Tavern, City-road," by P. S. Paunet; which independently of such comparison, is really not without considerable merit; in fact in much better taste than many things, on the side of which the superiority ought to lie; but if we mistake not, there are one or two minor differences between this drawing and the building itself. Well, at length we are come to a turning, and have lighted upon something we are disposed to commend. We cannot bestow any compliment on No. 1089, "Design the Entrance Front to the St. Ethelburga Society Charity Schools," by W. Grellier, but willingly admit that he has shown some ability in No. 1091, "The North Wing of the Tilers' and Bricklayers' Company's Almhouses, Ball's Pond," which as here represented, although very plain and humble as to style, possesses much propriety of character, and picturesqueness of effect; at the same time we question whether the building itself will produce anything like the effect given to it in this richly coloured drawing; it being not at all unlikely that what is here rendered attractive, may in reality have a poor appearance in the building itself. Nos. 1106 and 7, "The West of London and West minster Cemetry, Earl's Court," by B. Baud, is more striking at the first view than it is satisfactory when it comes to be inspected. The general arrangement and plan, which bear some similarity to an ancient hippodrome, are well calculated for architectural effect, but the style itself, and the design of the elevation, are poor. We may here notice Allom's model of a design for the same purpose in the Italian style, consisting of three chapels placed upon a terrace, and connected by open arcades, enclosing three sides of a court, at the inner angles of which, are towers rising above the other buildings. The whole is well combined, and forms a rich architectural group, the picturesqueness of which is considerably enhanced by the porticoes of the two lesser chapels being turned towards the court, so as to face each other, and show themselves in flank, while the larger one of the central chapel is seen in front. This design we should conceive, would be more economic than the one which it seems has been adopted; because although the buildings themselves are more rich, they do not extend over so much space. We perceive by the catalogue there is a third design for the same purpose, No. 1134, by H. Case; but having overlooked it can say nothing at present as to its merits. Another subject of the same kind, and very similar in style, though different in composition, is No. 1261, "Intended Chapels at the Rochester and Chatham General Cemetery," H. E. Kendall. This has a lofty Italian tower in the centre, with an arcade extending on either hand from it to one of the chapels. No. 1186, "Peasmorsh, Sussex, now erecting for Dr. Buckland," W. S. Donthorn, is one of the best designs of its class in the room. The next No. 1187, "Design for the façade of a Chapel in the style practised by the scholars of Giotto, in Upper Italy; intended to illustrate the polychromatic, decoration of the end of the 14th century," W. Dyce, is carefully executed, and owing to the singularity of its subject, a rather striking drawing, but being merely an elevation without background, it does not enable us to judge of the actual effect attending such mode of decoration.

No. 1210, "Design for a public building at Rugby," T. L. Donaldson, is clever both as a drawing, and as a specimen of the style adopted, namely the Tudor. No. 1250, "The office of the Monmouthshire Merlin, now erecting at Newport, Monmouthshire," E. B. Lamb, is a design of more than ordinary merit—a very happy and tasteful application of the better Italian style; and although sober in point of decoration, piquant and rich in effect, the style being treated with great ability and feeling. It is indeed very much superior to any thing of the kind, or we may say to any thing on the same scale in the metropolis. Nearly the same may be said of No. 1122, "Design for a Chapel proposed [to be erected at Buxton," by the same architect, which although very different in style, the façade consisting of a Grecian Ionic portico, is stamped by considerable originality, and by a freedom and spirit both in the general ideas and details, which our builders of porticoes would do well to endeavour to emulate, instead of hashing up the prints of Stuart's Athens till we absolutely nauseate them. Instead of the usual string of columns before a wall, we have here depth of portico and inner columns, which occasion a variety in the perspective appearance of the most delightful kind. This and the other design are two of the redeeming points in the exhibition; nor is it the least of their merit that they prove how much may be accomplished within a very moderate compass.

Donaldson, Lamb, Fowler, and Kendall, are the only members of the Institute, we believe, who have contributed towards the present exhibition. The Professor of Architecture himself has not sent a single drawing. Of the other two architect-academicians, Sir R. Smirke takes care to keep safe out of the way of criticism by never sending any thing, and had Sir J. Wyatville this year followed his example, neither he nor any one else would have been very great losers, for his three drawings of parts of Windsor Castle, do not excite any great expectations with regard to the publication, for which we are informed they are intended. By Gandy there is not even a single drawing, though he has almost invariably exhibited one or more every season until now. We hope that 1840 will, if it should not prove more prolific than poor 1839 has done, for in regard to number there are enough or more than enough of things hung upon the walls—produce more that is of higher quality. We hope to see the same proportion of good and bad, only quite reversed, the bad bearing the same ratio to the good, that the good now does to the bad; and with this wish for its better success, we take our leave of the exhibition.

THE ROYAL EXCHANGE.

SIR,—As there is no reason to suppose that the dispute between the Government and the Gresham Committee arose from a desire in either party to secure the patronage for another job, it is fair to conclude that both parties were desirous that the New Royal Exchange should be built in a style worthy of the object, particularly as the Gresham Committee are merely trustees, and the public are to be taxed to the amount of £150,000 for the approaches.

It seems that the committee of the House of Commons either omitted to make their intentions clear, or the Act of Parliament was not quite so intelligible as an Act of Parliament ought to be. But there is an end to the dispute, and the Gresham Committee have invited architects who wish to compete for the design to pay them one pound for their instructions. The sum is paltry, and no reasonable excuse can be made for the exaction. It has been the practice with auctioneers, when about to sell property which has excited public curiosity, to sell their catalogues, as a tax on the curiosity of those who had no intention of purchasing. But no such restriction could be required in this case, because they might have required the name and address of the parties applying for the instructions; and it would be but an act of justice to return the pound to the unsuccessful competitors. As I have borne my share in competitions, and do not mean to compete again, I trust I shall be excused for inviting those who may, to take the proper precautions, before it is too late, to secure them a fair and competent tribunal. Conditions were sold by the Government, and broke, which I have proved in my letter to Lord Duncannon; designs for the Post-office have been selected for premiums, and afterwards rejected, and another design adopted, bearing a strong resemblance to one of the designs to which no premium was awarded, which I have made known in my letter to Lord Melbourne; and the transactions relative to the Nelson Testimonial have placed three talented artists in the disagreeable position of receiving premiums out of a subscription for designs which have been pronounced useless.

Of what use, then, would the most explicit instructions be, or the most peremptory conditions as to modes of drawing—points of perspective and uniformity of scale, if they should be disregarded by the judges. To prevent this evil, I would respectfully suggest that the competitors appoint by ballot one judge, the Gresham Committee another, and the city of London a third. The designs should all be exhibited to public view; the three judges should afterwards select three designs, to be referred to a person appointed by the Crown, whose opinion should be final.

A more public exhibition would not protect the competitors against favouritism and partiality. As it is possible that the public press might be misled by the opinions of those to whom their architectural department may be confided, of whose names we should be ignorant, and consequently incapable of knowing the degree of credit to which their opinions are entitled.

Dr. Johnson, in exposing the Blackfriars Bridge job, which had, under the pretence of a preference to an elliptic arch, been made the means of introducing a favourite, makes the following observations:—

"Those who are acquainted with the mathematical principles of architecture are not many, and yet fewer are they who will upon any single occasion endure any laborious stretch of thought, or harrass their minds with unaccustomed investigations. * * If in opposition to the arguments, and in defiance at once of right reason and general authority, a design should at last be chosen, what will the world believe than that some other motive than reason influenced the determination. * * He that in the list of the committee chosen reads many of the most illustrious names of this great city, will hope that the greater number will have more reverence for the opinion of posterity than to disgrace themselves and the metropolis of the kingdom in compliance with any man, who aspires to dictate, perhaps without any claim to such superiority, either by greatness of birth, dignity of employment, extent of knowledge, or largeness of fortune. In questions of general concern there is no law of government or rule of decency that forbids open examination and public discussion."

This was Johnson's opinion, drawn from facts; may not the Gresham Committee fall into the error which he exposed?

THOMAS HOPPER,

40, Connaught Terrace.

PUBLIC STATUES IN THE METROPOLIS.

Nothing perhaps can be a greater ornament to a city, or a higher proof of the glory of a country, than to see in its streets testimonials of the great men who have immortalised their own genius and shed a lustre on their native land. Like benevolence, the performance of this noble duty brings its own pleasure along with it, and we can never regret the expense of what is an object of beauty in our eyes and a source of gratification to our minds. The weak may feel a consolation for their inactivity when they see that Sparta has so many better men than they, and those of exalted genius, although they want not this excitement, may see that they will not fail in their reward. The placing of these memorials in localities with which the living heroes have been connected gives a greater interest to the work, and invests the scene with a visible classicality. No place than London has been more negligent of this, and there are none which has possessed more men known to fame, more time-hallowed sites, or more native genius.

Just to give an idea of what might be done in this way, I will imagine the grand line of road from London to Westminster Bridges, the *via sacra* of London, laid out in this way. On approaching the foot of London Bridge, the foreigner, entering London by that grand entrance, should be reminded that he stood on sacred ground. Near the Dover-road should be a group of Beaumont and Fletcher, with their arms interlaced, and an inscription "To the Twins of Elizabethan Dramatic Literature, which flourished near this site. Francis Beaumont, born —, died 1615, and buried in Westminster Abbey, and John Fletcher, born in London, 1576, died 1625, and buried in St. Saviour's." Passing near the site of the Globe and Bankside Theatres, and of St. Saviour's, where Gower, Massinger, and Fletcher lie interred, the spectator would be on the spot where (according to tradition) the bard held horses, a statue of Shakspere near the scene of his greatest triumphs, with the inscription "To William Shakspere, the Prince of Dramatic Poets, born at Stratford-on-Avon, died 1616." On crossing the bridge, at the junction of Gracechurch-street with King William-street (although it should have been where the proposed statue of the Duke of Wellington is to stand), near Lombard-street, the place of his birth, Pope, with the inscription, "To Alexander Pope, the Prince of Translators; born in London, 1688, and died there, 1744." At St. Martin's-le-Grand, near Bread-street, the place of his birth, and leading to Bartholomew-close and Cripplegate, where much of his life was passed, Milton: "To John Milton, the Prince of the Modern Epic Poets; born 1608, in London, and died there 1674, and buried in St. Giles, Cripplegate." At the Ludgate-hill end of St. Paul's, "To Sir Christopher Wren; he found London in ashes, and raised it to immortal fame. Spectator, look about and see his glory and his tomb; born 1632, died 1723." At the bottom of Ludgate-hill, "To John Dryden; he gave Virgil a new country; born at Aldwincle, 1631, died 1700, and buried in Westminster Abbey." At Chatham-place, "To Edmund Spenser, Prince of the English Pastoral Poets; born 1553, in London, and died there, 1593, buried in Westminster Abbey." At Holborn-hill, on the other side, "To Abraham Cowley, the chief of the Metaphysical Poets; born in 1618, in London, and died 1667, buried in Westminster Abbey." At St. Clement's Church, Strand, near the Temple, of which he was member, "To Geoffrey Chaucer, Father of the Poets and Friend of Petrarch; born 1328, in London, and died there, 1400, buried in Westminster Abbey." On the other side of St. Clement's, "To John Locke, Prince of Mental Philosophers; born at Wrington, 1632, died 1704. 'Know thyself.'" At St. Mary-le-Strand, near which he was born, "To Francis Bacon, Prince of the Modern Philosophers; he found the sciences infants, and made them men; born in 1561, in London, he died and was buried at St. Albans, 1626." At West Strand, with Chandos-street, leading to Covent Garden, where he was born, "To Thomas Augustine Arne; he taught the English muse to sing; born in London, 1710, died 1778." In Trafalgar-place, looking towards Leicester-square, where he lived, "To William Hogarth, Painter of Morals and Man; born in London 1698, and died at Chiswick, 1762." also in Trafalgar-place, looking towards his residence in St. Martin's-street, "To Isaac Newton; he spanned the heavens and weighed the earth; born at Woolstrop, 1642, died 1726, and buried in Westminster Abbey." At Westminster-bridge, in the neighbourhood where he was born, "O rare Ben Johnson; born in Westminster, 1574, and buried in the Abbey, 1637." On the other side of the bridge, "To Thomas Banks; he maintained the glory of English Art in Russia; born at Lambeth, 1738, died 1805."

These are not solitary examples, but numbers more might be adduced. In the City-road, at the end of Fore-street, near his birthplace and his tomb, "To Daniel De Foe, known in all climes as the Author of Robinson Crusoe; born in Cripplegate, and buried there in St. Giles' Church." At the ends of the Hammersmith and Battersea-bridges, the natives of the southern suburbs, "To Henry St. John, Viscount Bolingbroke, unfortunate as he was talented; born and died at Battersea." "To Edward Gibbon, who in illustrating the glory of Rome ensured his own; born at Putney." Near Gracechurch-street the scene of many events of his life, "To William Penn, the Founder of Pennsylvania and Teacher of Benevolence to the Human Race; born in London." On the Hackney Road, "To John Howard, the Friend of the Captive; born at Hackney, died at Chertson in Russia." Also to Hampden, the great patriot; Camden, the antiquary; Byron, the poet; natives of London.

Appropriate localities might be found for all the great men, and to some, memorials already exist, Pitt, Fox, Canning, Nelson, and Wellington. Among those to be commemorated, it may be sufficient to mention, Cabot, who gave to us North America, and thus secured the perpetual glory of the English race; Drake, the circumnavigator and founder of our naval power; Blake, one of our greatest seamen; Cook, who gave us a new world and another empire in Australia; Marlborough, our greatest general and the ablest of his day; Clive, the founder of our power in India; Halley, the great discoverer of comets; Roger Bacon, the greatest philosopher of the middle ages; Bradley, who discovered the rotation of the earth's axis and the aberration of light; Harvey, the discoverer of the circulation of the blood; Hunter, the best of our anatomists; Jenner, who stayed the arm of death; Ray, the greatest naturalist of his day; Napier, the author of logarithms; Dalton, who numbered atoms, and gave invisible objects laws; Davy, who united electricity to chemistry; Young, who proved that light moved as water; Savery, who made steam the slave of man; Brindley, who made roads upon the waters; Hargreaves, who taught senseless powers to weave garments for the human race; Smeaton, the author of the Eddystone; Watt, who gave arms to the steam engine; Trevithick, the master of the steam engine, who taught it to fly upon the roads, resist the current of the waters, and drain the bowels of the Andean mountains; Reynolds, the prince of English artists; Flaxman, who gave our sculpture a European reputation. To these might be added some of our writers who possess an European reputation: Addison and Steele, the twin essayists; Young, the writer of the Night Thoughts; Sterne, the sentimentalist; Fielding, the prince of novelists; Smollett, the novelist; Johnson, the custodiem of our language; Goldsmith, the most harmonious of our writers; Hume, the first of our historians; Garrick, the prince of our actors; and two distinguished Irishmen, Burke and Sheridan; but out of compliment to the many eminent foreigners who have dwelt among us, we might commemorate Erasmus, the restorer of letters; Holbien, who died here; Rubens and Vandyke, who have left with us many of the finest of their works; Handel, who united his own glory with ours; Voltaire, who here first brought his Henriade to light; Franklin, the man who snatched lightning from heaven and the sceptre from tyrants; and Herschel, who for us extended the bounds of the planetary system.

That executing such a design would prove highly ornamental to the metropolis it is quite unnecessary to demonstrate; and it is equally evident that it would tend to the promotion of the arts and the diffusion of taste. Considerable variety might be introduced into the form of the monuments, as Gothic crosses, Greek votive temples, fountains, and the employment of bas-reliefs and accessory emblems. The expense of fifty such statues might very easily be defrayed for 100,000*l.*, and it is unnecessary to say that larger sums have been lavished on jobs pernicious in their results, and futile as to their expected benefits. Were such a grant made, considerable sums might be raised by public subscription, and the Corporation of London and public companies would make donations, the theatres might give benefits for the dramatic heroes, and the concerts for the musicians; and we are sure that the object is such as not to be of mere local importance, but to have a claim on the revenue of the empire. The government likewise, by making the grant in annual portions, would prevent it from making any great figure in the budgets of timorous Chancellors of the Exchequer, while its execution would give an impulse to art, and stamp at once a character on the Victorian era.

A. R.

PAMBOUR ON THE STEAM ENGINE.

Sir,—As you have often, at different times, noticed M. Pambour's works on the steam engine, allow me to direct your attention to his table referred to in page 92, vol. 2, of your journal. In most cases therein the practical results differ very widely from the theoretical. Now may not this be explained partly by taking into account the gradient immediately before the place of trial, or, in other words, the accelerating or retarding force with which it enters it? For instance, in the case of the Fury, August 4, 1834, (page 229 of Pambour,) it drew 50 tons at 24 miles per hour. Now the theory gives 29 miles; but immediately before the trial plane comes a descending one of . This is omitted in the table.

In example, page 228, the Fury drew 244 tons at six miles per hour. By the theory it could not have moved the load. May this result be attributed to the accelerating force of the plane it had just left, or altogether to the incorrectness of the theory?

I am Sir,
A constant reader,
London, April 12, 1839. H.

IMPROVEMENT OF THE RIVER DEE AND PORT AND HARBOUR OF CHESTER.

We have read with some attention Sir John Rennie's interesting report upon the river Dee, and did our space allow should examine it at some length. After minutely entering into the views detailed both for and against the improvement of the river by dredging, Sir John recommends the construction of a ship canal, with docks, from Chester to Heswell. At this latter place he proposes to make an entrance harbour in fifteen feet at low water spring tides, being five miles shorter than the present course of the river, and enabling vessels drawing twenty feet water to come up to Chester at neap tides. His estimate for this plan is £560,000, a sum, considering the magnitude of the undertaking, extremely moderate. There is never less, it must be remembered, than twelve feet at low water spring tides over the bar of the Dee, while the Mersey is not only very defective, but difficult of access; Chester, also, is sixteen miles nearer to London than Liverpool, and would only require an extension of about twelve miles to Preston Brook to open the communication with Manchester and the inland towns; while it would be backed by the extensive mineral and manufacturing districts of Wales and Cheshire. Considerable discussion has been maintained in the Chester papers, whether the canal plan should be odopted, or whether it is preferable that the river should be improved; but when it is stated that in order to obtain the same depth by the river as by the canal, that from sixteen to eighteen feet must be dredged out at Chester, and an average of ten feet for a distance of fifteen miles below in the open tideway, that the present river-bottom is composed of loose sand, which would run in as fast as taken out, having a fall of only seven inches per mile, we confess that we should have considerable doubts as to the propriety of pursuing such a questionable course. We have heard the Clyde quoted as a successful example, but if, as is stated, above £800,000 has been expended there in obtaining twelve feet water, for a distance of twelve miles, that it has required above half a century to effect this,

and that the bed of the Clyde was better adapted for such an operation, it does not appear to us to strengthen the arguments in favour of dredging the Dee, in comparison with the more certain and less expensive plan of the canal.

The subject of dredging the old channel of a river, or substituting a canal, is replete with interest, and demands the greatest skill and discrimination of the engineers; we shall take an early opportunity of again referring to the report and papers connected with the controversy between the parties.

POLYCHROMY OF THE ANCIENT GREEKS.

Traces may be found on the marbles of Campide and of the British Museum. The Parthenon, the Propylein, the Thesciam, the Erechtheium, and Pinacotheca, have all remains of paint 2,000 years old. Many writers in the German periodicals have treated on this subject, but somewhat in a vague and cursory manner. The Institute of British Architects has given some detailed collections of notes and illustrations. A French architect of eminence has published some elaborate restorations of polychromy. Col. Leake has these words (in his "Athens," p. 399), to the exact truth of which every accurate observer can bear witness: "All the sculptures of the Thescium, with those of the metopes and those of the friezes of the vestibules, preserve the remains of colours with which they were painted. Vestiges of bronze and gold-coloured arms, of a blue sky, of blue, green, and red drapery, are still very apparent. A painted foliage and meander is seen in the interior cornice of the peristyle, and a painted star in the lacunaria." To this I may add, a bright red, blue, and yellow pattern, in the newly cleared part of the Pinacotheca, the egg shape moulding on fragments of cornices lying beneath the Propyleia, the same near the Erechtheium, a yellow coloured pattern in parallel lines in the roof of the Caryatid portico of the same, besides an *à la Grecque* pattern and star in fragments of the same building, and evident traces in the upper part of flutings and the capitals; the outlines of these and most other patterns are scratched on the marble with some sharp tool. In the Museum of the Acropolis are fragments supposed to belong to the Hecatompedon, which retain very bright colours, red and blue, particularly some triglyphs; a head of which the hair appears to have been gilt. Some of these fragments, retaining bright colours, are now in London; and the colours themselves, from analysis, appear to have been mixed with honey and wax. In short, the buildings of the age of Pericles were painted. Whether the custom was derived from Egypt or not, it would be absurd to say that the Greeks showed exquisite skill in architecture, and a barbarous taste in painting. Those who cry out most loudly, forget that time has now re-painted the Parthenon, &c. for them, with a great variety of the richest browns and grey tints, otherwise it could not have been seen when the sun shone on the fresh cut marble. This is illustrated by the poor effect of the columns of the re-erected Temple of Victory, which are white from having been buried for two or three centuries in the earth. The secret of taste seems to have been, that the backgrounds, and plafonds, and the triglyphs (as representing the stone cut through), were painted deep blue, to assimilate with the sky they represented, and which appeared above them; that the flutings of columns and other large members were coloured with neutral tints, while the minute ornaments were marked by the brightest reds, yellows, greens, and blues,—highly contrasted indeed, but each so small in breadth, that they produced no gaudy effect at the height to which they were elevated, being chiefly on cornices, friezes, capitals, &c. When the eye was directed to any one spot of the building, the contrasted hues produced a high relief and variety; but when it was removed, so as to take in a view of a large part of the structure, the colours by no means destroyed its unity, since they then became mingled like the vanishing rainbow. Such an effect any one may see from approaching or withdrawing from a card coloured with prismatic colours. Von Klenze has given a pretty, but not entirely happy illustration of this in his circular temple at Munich. An interesting discovery in polychromy has just been made in a statue in alto-relievo, discovered between the south-eastern promontory of Mount Hymettus and Sunium; it is six feet high, and generally (except in one arm) of good proportions. The subject is a warrior, armed with helm, breastplate, greaves, and spear, standing erect, in profile. The beard and countenance remind one much of the Egina marbles, but the style is superior; beneath the breastplate a leather jerkin seems to have been worn, and the fustinella descends below this half way down the thighs, like a highlander's tartan. The background has been coloured vermillion; the tints on the flesh are nearly gone, but the elaborate patterns on the armour are clearly visible; among these are borders in a variety of forms in bright colours, besides stars, and some other figures not easily deciphered. Blue, red, and yellow, are the recurring colours; and the whole effect is exceedingly good, and indeed imposing, for the countenance (the beard being trimmed and pointed) is earnest and intelligent. The pedestal bears the words εργον Αριστολεους, a sculptor, who, it appears, was one of the founders of the school of Sicyon, long before the rise of that of Athens. Here, then, is a painted statue still in existence, as decidedly painted as was that of Shakspere in Stratford Church; it was the production of a famous school, the taste of which seems to have been followed by Phidias himself, in the great cryselephantine statue of the goddess in the Parthenon, since this latter had coloured garments, for the golden peplos descended to the feet. **If Phidias then condemned not Aristocles, what may we dare to say in this degenerate age of art?**

While I am writing, some beautiful reliefs have been discovered near the temple of Victory similar to the two admirable specimens already found there; a series of winged Victories seem to have formed a prolonged decoration, of a unique kind, round the front of the base, for they could not have belonged to the temple itself. Mr. Pittachi has also discovered some vases on the spot where the work of the sculptor of Sicyon was found; and could this active officer be supplied with means, no doubt many rich remains would reward his labours, but the government can only allow him a very small annual sum for the excavations of the Acropolis, and, unfortunately, a jealous and ill-judged law has the effect of stopping all enterprise on the part of foreigners.—*Athenæum*.

ST. BRIDE'S, FLEET-STREET.

(From the *Churches of London*. By G. Godwin, Jun., F.S.A.)

The present edifice was not constructed until 1680. Sir Christopher Wren was the architect; Mr. William Dickenson the superintending surveyor. The cost was £11,430. The steeple was not commenced until some time afterwards; for, according to an entry in the parish books, the first stone was laid October 4th, 1701. It was completed in 1703.

The steeple, as left by Wren, was 234 feet in height from the ground, in consequence of which great elevation, and from the want of proper precautions, it was twice seriously injured by lightning. On the first of these occurrences, namely in June 1764, so much damage was done, that it was found requisite to take down 85 feet of the spire. The metal vane, the cramps with which the masonry was secured, and the other iron work employed in the construction, led the electric fluid down the steeple, in the absence of any continued or better conductor; and as at each point where the connection was broken off, a violent disruption necessarily ensued, the stone-work was rent in all parts, and projected from its situation. One stone, weighing nearly 80 pounds, was thrown over the east end of the church, and fell on the roof of a house in Bride Lane, while another was forced from the bottom of the spire through the roof of the church into the north gallery. Mr. afterwards Sir William Staines, was employed to repair the damage; and in doing so he lowered the spire eight feet, either by direction of the parish authorities, or on his own responsibility, without, as it would appear, any sufficient reason for this mutilation. The whole cost of the injury caused by the lightning at this time, was estimated at £3000. On the recurrence of this accident, which took place in 1803, the damage was much less considerable.

St. Bride's steeple is, unquestionably, a most successful and beautiful design, as well as a fine specimen of Wren's skill in construction. Each of the four octagon stories pierced with openings, and which compose the lower part of the spire, is beautifully proportioned, and together, in their mutual relations, they are most harmonious. The parts are simple, almost severe; the effect of the whole agreeable and good. Every succeeding writer who has described this church, has lauded the steeple without reserve, pronouncing it second in beauty only to that of Bow church, Wren's masterpiece in this class of design. On the first consideration of it, an examiner may not be disposed implicitly to assent to this opinion, feeling that the mere repetition of the same forms, although in the end productive of good effect, as it does not call for the exercise of much inventive power, is not entitled to the highest degree of admiration; and that as this steeple displays less variety than many others by the same master, it has less claim to praise. Further consideration, we think, may lead to a different opinion in this case. To pile story upon story without good result, is not difficult and requires little genius. To do so and produce the effect here attained, is quite the reverse, and needs the soundest judgment, and much taste; and we are disposed therefore to believe, that St. Bride's steeple may be confidently appealed to by Wren's admirers, as one of the best of his numerous works. In height it approaches nearer to the exquisite spires which belong to, and characterize the pointed style of architecture, than any other example, as it does to, in lightness of effect, and in gracefulness. It is still very far from possessing the same degree of beauty which belongs to some of those matchless productions of human skill; but then, on the other hand, it has a charm in common with other spires designed by Wren, peculiarly its own; namely, as a record of a difficulty overcome. A spire does not belong to Italian architecture, it may in fact be regarded as a violation of a great principle of the style, which is horizontality; and it therefore required no ordinary effort of genius so to introduce and fashion it, as to render it homogeneous with a building so designed. This effort Wren successfully made, and it has been justly said to be nearly equal in degree to what would be necessary to invent an entirely new species of building.

The two lower stories of the spire are Tuscan, the third is Ionic, and the fourth Composite. At the angles of the parapet crowning the tower, from which the steeple rises, vases are introduced, as they are also at the base of the obelisk which terminates the spire, by which means all harsh transitions of form are avoided, and the outline of the whole, from the tower to the fane, is rendered pyramidal.

The upper story of the tower, with its circular-headed pediments, presents the somewhat singular feature of an attached Corinthian column at each angle, which in this case is not altogether productive of good effect. The *entasis* of the column being strongly marked, gives to the outline a crippled appearance, inducing at first sight the idea, that the superincumbent weight has caused the walls to bulge at the centre of the story.

The exterior of the east end of the building is neat, and the dressings of the great window are boldly designed.

CALEDONIAN CANAL.

(Copy of Mr. Walker's Report, continued from page 177.)

Detailed Estimate referred to in Report.

Beginning at the West end—	£.
Five or six permanent guide buoys, with anchors, are required between Fort William and the entrance at Corpach, for which say	300
For Corpach Entrance Lock, which is in good repair generally, but allow for stoppage of small leaks and some pointing	100
A great part of the masonry of the two Corpach Locks is bad, and in bad repair; this requires to be taken down and rebuilt, which, with other works, will amount to	6,000
The reach between Corpach and Bannavie, one mile and a quarter long, requires only the repairing and gravelling of the road, which forms part of the general head of roads taken afterwards	
The eight Bannavie Locks require repairs of the masonry, gates, &c., amounting to	6,500
Strengthening banks at a few places above Bannavie, on south side, amounts to	150
In the five culverts before referred to in Bannavie Reach, pointing and partial repairs with puddling are required, say	1,000
For the Strom off-let Sluices in this reach, stopping leakage, pointing, &c. take	100
A weir in Moy Burn is wanted to stop the gravel before entering Canal; this, and removing present accumulation of mud brought down the burn and lodged in the Canal, will amount to	300
Gairlochy Regulating lock, in masonry, platforms, sluices, &c., requires an outlay of	2,000
A dam above Gairlochy Lock to shut off water of Loch Lochy while the lock, &c. are under repair, will be	330
For deepening the channel from the lock into Loch Lochy, and warping buoy near the entrance, say	700
Deepening the entrance to Laggon Lock, east end of Loch Lochy and forming causeways to facilitate the approach of vessels, is	900
The two Laggon Locks between Loch Lochy and the summit, or Loch Oich Level, are in good repair.	
To give 17 feet depth for navigation, the Canal between the Laggon Locks and Loch Oich must be excavated, by dredging through the deep cutting; this amounts to	6,000
A track-path to be formed upon the slope of the deep cutting at Laggon, the present banks being high and very inconvenient, amounts to	600
For planting spoil banks along Laggon, cutting with larches or firs, allow	200
Loch Oich; for shallow portions to be deepened by dredging, amounts to	1,200
Guide-posts in Loch Oich, &c., and deepening the cut between Loch Oich and Aberchalder Lock will cost	550
Facing with stones the slopes of the Canal banks in the western district, not yet stoned, and gravelling and repairing track-paths, are	3,700
The works proposed for increasing the quantity of water in the Loch Oich, or summit, for the supply of the Canal in dry seasons	2,000
A new course for Aberchalder Burn, to prevent gravel running into and impeding the navigation, is	1,500
Aberchalder Lock; repairs of masonry, lock-gates and machinery, estimated at	600
Dam above lock, to support the waters of Loch Oich, is	210
Aberchalder to Kytra, reach of two miles and a quarter, deepening Canal to 17 feet (the top level here to be as originally proposed), amounts to	1,750
Kytra Lock, for repairs of masonry, lock-gates and machinery, say	600
Deeping for some distance below Kytra Lock, and removing sand from north slope, is	200
Reach between Kytra and Fort Augustus Locks, two miles and a half, new off-set sluices to empty Canal when required, similar to the stone sluices, will cost	2,000
The puddle linings required in this reach, to stop present leakage through the banks, are	8,000
Stoning slopes and gravelling track-path from Loch Oich to Fort Augustus, &c,	1,800
Fort Augustus Locks, taking down and rebuilding masonry, repairs of gates, machinery, &c., extra of 6,900*l.* already taken under first division, and buoy at entrance into Loch Ness, amount to	10,500
Widening entrance, by rounding off angle from Loch Ness at Bona Ferry, say	800
Forming track-paths across swash-ways in Loch Dochfour, is	1,150
Widening entrance at lower end of Loch Dochfour, is	250
A waste weir at the outlet of Loch Dochfour, which discharges the waters of Loch Ness	3,450
For guide-posts in Loch Dochfour, say	20
Dochfour Burn, forming a new course to prevent gravel from being carried into and impeding the navigation	830
Doch-garrock Regulating Lock is in good repair.	
Reach from Doch-garrock to Muirtown, five miles excavating soil, replacing with puddle, part of the line being so very leaky as to require the constant feed of ten sluices at the Doch-garrock Lock, each sluice six superficial feet, with an average head of one foot, to supply the waste through the banks, come to	11,000
Torvean Hill, removing gravel and supporting slope with rough wall	270
Off-let sluices for emptying the reach when required, same as for reach above Fort Augustus	2,000
Strengthening south bank of Canal above Muirtown Locks	150
Muirtown Locks generally in good order; for pointing and repairing gates, &c. say	200
The bridge over the Laggon Locks being stronger, with little trade, than the bridge upon the turnpike road at Muirtown, say for changing the situation of the two bridges	100
For lengthening wharf wall at Muirtown for trade of Inverness and surrounding country, say	1,500
Gravelling track-paths and stoning slopes of eastern district of Canal, amount to	6,200
Sundry repairs of lock-gates, machinery, foot-bridges, &c. in east district (inclusive of Fort Augustus)	150
The Clachnaharry Locks at east end of Canal are both in good repair, although the entrance lock has sunk down 18 inches from time of finishing.	
Jetty at Clachnaharry Sea Lock, for repairing it, and three new dolphin piles, allow	300
Four buoys between Kessock Ferry and Entrance Lock	200
Twenty-five milestones	50
Substituting some stone in place of wood mooring-posts or bollards upon banks	100
Small lighthouses, one at each entrance, one at each end of Loch Lochy and one at each end of Loch Ness, say six	300
	£88,810
Add 10 per cent. for contingencies	8,880
	£97,690

In addition to the above, some machinery and utensils will be requsite for the execution of the works and for the proper establishment of the Canal, which are estimated as under:	
A new steam-dredger	2,500
Four mud barges with false bottoms	1,200
Three common barges	600
Ten houses for lock and bridge keepers	600
A diving-bell and vessel, &c.	750
A diving helmet	100
A crane at the Corpach Basin	100
A crane at Muirtown Wharf	250
A small crane and shed, warehouse and steam-boat wharf above Muirtown Locks	200
Add sundry smaller utensils, &c.	500
	£104,490

CRINAN CANAL.

It was not, as I have already stated, until my return from the survey, that I received any instructions respecting the Crinan Canal. My attention to it was therefore more general than otherwise it would have been; but, considering it was a feeder to the Caledonian Canal, and having Mr. Gibb along with me, having remained for a night at Ardrisshaig, and passed the morning of the 4th in the examination of the works at that place, and at the east end of the canal generally, and having, through the accident already referred to, been delayed the whole of the day upon the line, I noticed the general state of the works, and made some inquiries. Mr. Gibb has also since kindly supplied me with details and information, which his long and intimate acquaintance with the subject enabled him to do, and I have been furnished by Mr. Smith with a copy of the reports on the Caledonian Canal, which contain the particulars of all the expenditure and proceedings since the Crinan Canal came under the management of the Caledonian Canal commissioners, and also a statement from Mr. Gibb, relating to the repairs and works done since the Crinan Canal was opened. Lord Breadalbane, Mr. Caldwell a shareholder, and Mr. James Thomson, have also waited upon me, and given me their opinions.

The object of the Crinan Canal is, as you are no doubt aware, by a cut of nine miles in length from Loch Fine, or rather Loch Gilp, to Loch Crinan, which communicates with Loch Eil, to save the more exposed passage round the Mull, of Cantire, and a circuit of seventy miles, a saving which is still important, though rendered less so by the introduction of steam.

The first act for making the Crinan Canal, was passed in the 33 Geo. III., and I am informed that the sums raised by subscription amounted to about £100,000; this being insufficient to complete the work and execute certain repairs, £25,000 was advanced by the barons of the exchequer of Scotland from the forfeited estates fund, and £30,000 by the lords of the treasury to effect the above objects. Both these sums were to be repaid, with interest, from the canal revenues. The canal was then opened, but the works were imperfect, added to which, a breach in one of the embankments obliged the navigation to be stopped, and a further advance of £19,400 was authorized to be made in 1817, by the barons of the exchequer, to the commissioners of the Caledonian Canal, under whose management the canal was then placed, and still remains.

The repairs above referred to were executed by Mr. Gibb, under Mr. Telford, in 1817, and from that time the canal remained open, the current repairs being done by the company's workmen until 1835, when some of the gates were renewed, other important repairs done, and an addition of five feet made to the depth of the reservoir, by Messrs. Gibb and Son as contractors, the amount of which was about £2,800. In 1836 also a landing-place or pier, convenient for the passengers by steam-packets, and for the herring fishery, was built by the same contractors at Ardrisshaig.

There are upon the canal eight locks ascending from Loch Gilp or Ardrisshaig, at the west end, and seven locks descending to Crinan at the east end; these locks are 96 feet long by 24 feet wide, and 12 feet deep, except the two at Crinan end, which are 108 feet long by 27 feet wide; the canal is therefore fitted for merchant vessels of 200 tons burthen, and the steamers which ply between Glasgow and Inverness are made inconveniently narrow to pass through it. To avoid this, a larger steamer started last year, which makes the passage round the Mull of Cantire, occupying from six to eight hours additional time, although the loss is probably more than compensated by the greater width of the vessel in the other part of the journey, independently of the general convenience and security against stoppages upon the Crinan Canal, which are not unfrequent, and upon which there is at present no passage during the night.

The importance of the Crinan Canal to the Caledonian Canal is greatest in reference to the trade of the Clyde; and, for the reason I have stated, its importance for steam communication is much less than for sailing vessels, unless the locks and canal were enlarged to the size of the Caledonian Canal, or, which has been proposed and would probably be a better plan, by cutting down the summit by which eight locks would be saved. The expense of either would be very great, and certainly in my opinion much beyond what it would be prudent to undertake under present circumstances, and until the superiority of the Canal to the mor circuitous route is more fully established.

Without, however, contemplating such an outlay, much good might be done, and at a comparatively small expense, to add to the efficient working and managing of the canal.

The breakwater which shelters the entrance at Ardrisshaig should be carried out (Mr. Gibb and Mr. Thomson, senior, thought 80 feet would be sufficient) to cover a projecting rock, which is partly dry at low water, and is dangerous for vessels approaching, particularly at night, with rough weather, and more so since the beacon which marked it was carried away, and had not been replaced. Upon this proposed extension the entrance light might be conveniently placed, the present light, from having been allowed to get out of repair, being now a very imperfect guide. From the importance to life and property, lights and beacons when once established should never be neglected.

East Entrance.—The entrance to the canal at the east end requires to be deepened at least five feet, to allow vessels to enter the lock, the sill of which is laid eight feet under low water. The expense of this, compared with the advantage, would be but small. Mr. James Thomson informs me that a good deal has been done towards the removal of this shoal, which was at one time seven feet and a half, but is now only four feet above the sill. If completely removed, the steamers could enter at all times of tide, which would be a most important improvement, particularly at night; the accommodation at Ardrisshaig does not seem the best, and as there is nothing interesting in the line of the canal, to get through it in place of being obliged to search for nights' lodgings would generally be preferred by passengers, even those on pleasure. At present there is no night passage for any vessel, whether with goods or passengers, through the canal.

Locks.—The masonry of the locks, from the eastern entrance to Cairnbean, a distance of four miles, appeared good, and the canal of proportionate width.

From Cairnbean to the summit, and thence to the Crinan Lock, No. 14, the lock walls are built of the whinstone found in the district, and are generally rough. The quoins, copings and aprons are of better stone. Some repairs in the gates are required, only part of these having been renewed in 1817; and I was informed that some of the lower platforms are defective from the puddle having wasted.

The shortness of the summit is an original defect in the canal, which would be effectually remedied by cutting down and taking out a lock at each end of the summit, by which considerable time and future expense of repair would be saved; but even this would, I fear, be attended with too large an outlay to be undertaken at present.

Between Dimandry Lower Tower and Belanoch Bay, and thence to the Upper Crinan Lock, part of the canal is through rock, and is in places so narrow, that two vessels cannot pass. This is inconvenient, and the wear and tear to steam-packets, which require some speed for steering, is stated to be considerable, through their coming in contact with the sharp, rocky sides. The expense of making the canal the full width through this rock would be considerable, but the worst parts might be remedied.

Crinan End.—It was night before I reached the Crinan end. Mr. Gibb informed me that the sea lock here is good freestone, but that the lower or sea gates are attacked by the worm, and are at present very defective. This should have immediate attention; to sheath them with copper below low water would probably be the best preventive, and in the end the cheapest, as they are stated to want frequent repairs from the above cause.

At the Crinan as at the Ardrisshaig end, there is a bank between the entrance lock and the lake, which is considerably higher than the lock sill; it was described to me as of clay and mud, and that the length was small; surely this ought to be removed.

The revenue of this canal during the last year is stated in a letter from Mr. Thomson, the engineer and superintendent, to have been 1,903*l.*, the expenditure 1,671*l.*, leaving a surplus of 232*l.*; as respects balance, this is a favourable statement compared with former years, in which, on an average, the expenditure and receipts were nearly equal. The trade during the last fifteen years has increased, but not above 200*l.* or 300*l.* on an average of several years, so that in a financial view the Crinan and Caledonian Canal are much upon a par.

Mr. Thomson's attention was so much taken up by the repair of the damaged gate, and of a leak in the bank, that I had but little opportunity of conversation with him; but it appeared to me that the machinery of the locks and bridges was not sufficiently attended to, and that more attention to cleaning, oiling and preserving, was wanted generally; this might arise from a desire to save every expense, but it is surely bad economy, and perhaps the same desire extending to the commissioners, prevents their having an out-door superintendent or clerk who can afford to give his undivided attention to the state and interests of the canal. Upon a work of this magnitude, and now depending for its success upon despatch, such a person would appear to me indispensable, even if I had not had the opportunity (though certainly short) of witnessing it. I should likewise recommend regular returns to be made, not only of the number and description of vessels that pass the canal, but of the time taken from their approaching the entrance to entering the lake at the other end, and if any delay, the cause of it; also of all accidents, and the cause of them.

The accounts of receipts and disbursements appear to have been returned more regularly within the last three years. If there is any regular audit of accounts, I have not been informed of it; altogether the Crinan Canal does appear to have been treated as if it were a favourite concern.

Although regularity and despatch will do great things, I have a worse opinion of the Crinan Canal, taken by itself, than of the Caledonian Canal, as an ultimate measure; but, if kept in an efficient state, it must be beneficial as a public navigation, and an important arm of the Caledonian Canal.

As I did not expect to be called upon for any opinion respecting it, this meagre account must be excused, and I have no documents to enable me to estimate the expense of the works which I have recommended.

The idea of a railway by the side of the canal has been suggested; by this (even if worked by horses) passengers might be conveyed in an hour with greater certainty than they now are in four. A steamer of proper dimensions for passengers would work from Glasgow, &c., to Ardrisshaig, and from Crinan to Inverness. For cheap passengers and heavy goods, the present steam-boats going less frequently than at present would suffice. That this would increase the despatch and character, and therefore the extent of communication, cannot be doubted; but the increase must be great to warrant such an establishment of steam-packets, which would of course be a private concern. I do not think the cost of laying a railway upon the banks would be heavy. My opinion on the whole is, that the necessary repairs to the Crinan Canal, the deepening of the entrances, and other things I have recommended, should be done forthwith, and a vigilant superintendence established; but I do not see my way in this so clearly as to advise more to be done at present.

BIRMINGHAM RAILWAY SIGNALS.

Every station is furnished with an alarum, to give notice of the approach of each train, and to summon the whole of the men to their appointed places. These alarums are so constructed, that a weight is wound up after they have performed their office which prepares them to perform it again. On seeing the forthcoming train has reached the proper spot, the policeman stationed at them pulls a trigger, and the weight begins to descend, ringing a loud gong-shaped bell by means of internal machinery. Bells are also hung so as, in a few seconds, to collect together the whole of the men belonging to the station for any required purpose. * * * *

The police are placed along the line at distances varying from one to three miles, according as local circumstances rendered it necessary. Each man has his beat and duties defined, and is provided with two signal flags, one of which is red and the other white: the white flag is held out when no obstruction exists; and, on the contrary, the red flag indicates that there is danger, and that the train must not pass the signal till it is ascertained that the cause of danger is removed.

Each policeman, also, is furnished with a revolving signal lamp, to be used after dark; which shows, at the will of the holder, a white light when the line is clear; a green one when it is necessary to use caution, and the speed of the train be diminished; and a red light, to intimate the necessity of immediately stopping.—*Roscoe's London and Birmingham Railway.*

The Luxor Obelisk.—The faces of the pedestal of the obelisk in the Place de la Concorde, which look towards the Chamber of Deputies and the Church of the Madelene, are to be engraved with representations of the apparatus used in taking it down at Luxor, and in raising it where it now stands. The designs are taken from a work published by M. Lebas, the engineer, who brought the monument from Egypt and erected it. The other two faces are to bear the following inscriptions:—"Lodovicus Philippus I., Francorum Rex, ut antiquissimum artis Egyptiacæ opus, idemque recentis gloriæ ad Nilum armis partæ insigne monumentum, Franciæ ab ipsa Ægypto donatum, posteritati prorogaret, obeliscum die XXV Aug. a. MDCCCXXXII. Thebis Hecatompylis avectum naviq. ad id. constructa, intra menses XIII in Gallium perductum, erigendum curavit d. XXV Octob. a. MDCCCXXXVI, anno regni Septimo." "En presence du Roi Louis-Philippe ser, cet obelisque, transporté de Lougsor en France, a été dressé sur ce piédestal par M. Lebas, ingénieur, aux applaudissemens d'un peuple immense, le XXV Octobre, MDCCCXXXVI."

OPENING OF THE EXHIBITION OF THE PRODUCTIONS OF INDUSTRY AND THE ARTS AT PARIS.

The exhibition of productions of industry was opened on Wednesday, the 1st ult., to the public.

The buildings constructed in the Champs Elysées have a front of 185 metres in length and 82 metres in depth; the façade is composed of a gallery parallel with the grand avenues of the Champs Elysées. Five rooms detach themselves perpendicularly from this gallery; these are contiguous, and separated from the others by courts. The rooms and galleries are 10 metres high, and covered with zinc. Notwithstanding the extent of these buildings, they were far from being sufficient for the numerous productions which were admitted.

The number of exhibitors is incessantly increasing. In 1834 it amounted to one-third more than in 1827—namely, 2,437. The present number is 3,348, and will probably increase in the course of a few days. In 1827, 20 departments sent nothing to the exhibition; in 1834 this negative number was reduced to 11; and in 1839, to 6. Those six departments are those of the Lower Alps, Cantal, Cher, Gers, Lot, and Lozère. The department which reckons the greatest numbers of exhibitors is that of the Seine; out of 3,348 exposers, 2,047 belong to that one, or nearly two-thirds of the whole. That is a large number indeed, even admitting that encouragement should be shown to those manufactures based upon the application of the fine arts. The following departments furnish the greatest number of exhibitors after that of the Seine:—The Seine Inferieure, 96; the Rhone, 73; the Gard, 58; the Nord, 56; the Upper Rhine, 55; the Loire, 43, &c.

Among the small quantity of tissues which we were able to see, we must mention some rich silks, worked with gold, from Lyons. Some satins and woollen damasks, some fine muslins of Tarare and St. Quentin, lace of Mirecour, and blondes from Caen. The exhibition of Mulhausen sent some prints and mousselines de laines as remarkable for their taste as for the brilliancy of the colours. Muslin is a fashionable stuff, and should occupy a distinguished place in the exhibition. The shawl manufacturers Denclrouse, Gaussen, &c., have also sent their contributions.

Amongst the other objects, the most striking are the bronze statues of Quesnel, the gilt bronzes of Thomire and Denière, which are placed in front of each other, the plated goods of Balaine and Veyrat, the lustres and coloured crystals of St. Louis and Baccarat, and the colossal glasses of St. Gobin and St. Quirin. There were numerous excellent specimens of porcelain, *particularly those copied from the English*, with flowers in relief.

The department of the Alier exhibited some models which rival those of Paris. The Parisian jewellery had some splendid specimens, among which was a panel of silver cloth, by a new proceeding, for which M. Moreau Christophle has taken out a patent. There are as yet only a few billiard-tables, which are not all in very good taste, but one deserves mention; it is made of ebony inlaid with coloured wood. Musical instruments were abundant; several organs were placed at the bottom of the room.

Comfortable, and even luxurious arts, seem to prevail over what M. C Dupin styles domestic arts. Magnificent carpets of the Pompadour school showed the flexibility of the manufactories of Aubusson, but we should prefer to see the common carpets descend to so low a price as to render them more general in France. The walls were ornamented with stained paper, the predominating patterns of which consisted of panels or arabesques, with vases of flowers or Gothic medallions in the centre.

The blinds suspended at different windows showed the progress of this branch of manufacture. The glass manufactory of Choisy exposed some bouquets of glass and paintings of the same materials, which appeared to us perfect as regards the brilliancy of the colours.—*Le Commerce.*

The articles of Parisian manufacture occupy a conspicuous place in the exhibition. They consist principally of ornamental objects, upholstery, furniture, mirrors, stained paper-hangings, carpets, &c. Among the latter we noticed in particular those embroidered with the needle, which passed almost unperceived at the exposition of 1834, but have since that period made a truly astonishing progress. Eight or ten Parisian houses exposed their work this year, the most remarkable of which for their good taste and execution are those proceeding from the establishment of Charles Hautrive and Sisters, of No. 24, Rue du Caire, who have exposed an arm-chair entirely embroidered *au petit point*, and two magnificent screens. One of these, embroidered *en chenille*, on silk canvass, exhibits a choice of the most beautiful flowers, which rival nature in freshness and colouring. The second of these screens contains an exact copy of an exquisite painting, much admired at one of the last expositions of the Louvre, and, from the finish of the execution of the tapestry, it would be difficult to decide which, the embroiderer or painter, displayed most talent. It is done in imitation of the last works of the Gobelins. The picture is enclosed in a rich and elegant frame, and, as a piece of ornament, it would not be misplaced in the very first *salons* of London or Paris.—*Times.*

Age of the Globe.—In a conversation with Dr. Lardner, stating how much we were indebted to the discoveries in geology, demonstrating the antiquity of the earth, he replied, that we need not resort to geology to prove the fact; for, as it regards the creation of the heavenly bodies, it could be proved that the fixed stars are at such an immense distance, that, notwithstanding light moves at the rate of a hundred thousand miles per second, it would take three hundred thousand years for a ray of it to travel through space ere it reached the earth; so that the stars we now see must have been created more than three hundred thousand years ago.—*From a new work, "Pleasant Recollections of a Dilettante, by William Gardiner."*

LIGHTING OF THE HOUSE OF COMMONS.

The experiments of the Bude lights for lighting the House of Commons were repeated last night, chiefly with the view of ascertaining the effect of the new plan upon the reporters' gallery. As far as that part of the house was concerned, we can say the trial was altogether successful. Though the apparatus for conveying the light to that as well as to other parts of the house is not yet complete, yet enough of its operation was seen to show that when complete its superiority over the wax lights will be past all question. We were not present at the first trial of the Bude light, but we understand that on that occasion the complaint was general that the glare thrown into the body of the house was greatly offensive to the eye, while the seats under the gallery were in comparative obscurity. This was explained last night by the fact that the order to light up the house on the new plan came before the preparations were in a sufficiently forward state. Be that as it may, the grounds of objection have been wholly removed. The light is now made to descend from the roof through ground glass plates, over which the apparatus is so contrived that the light can with ease be varied from the colour of a pale moonlight to a bright sunlight, or be mellowed down into a rich autumnal glow; still giving sufficient light, without any unpleasant glare, to every part of the house. The glass through which the light is sent down is fitted air-tight into the bottom of the chandelier, so that no heat can be generated by it in the house, save the slight radiation from the surface of the chandelier itself, but compared with the heat and the consumption of atmospheric air by the combustion (or rather the very imperfect combustion) of 240 wax candles, the heat and atmospheric combustion of the new plan are not (as far as the body of the house is concerned) as 1 to 100. Whatever heat may be generated by the new process will be carried off through the roof, and never affect the body of the house. To those of our readers who may not be acquainted with the nature of what is called the "Bude" light, it will suffice to say that in Mr. Gurney's plan it consists in a number of burners (in each chandelier) supplied with wick and oil, somewhat like the Argand lamp, with the improvement that in this there is only one circle or cylinder, while in the common Argand lamp there are two. Lighted in this state, the lamp would send off a very large and offensive mass of unconsumed carbon; but to prevent this, a stream of oxygen gas is made to pass through the centre of each burner, by which the total combustion of the carbon of the oil and wick takes place, and the light is consequently raised to a beautifully brilliant flame, the intensity of which may be increased according to the volume of the stream of oxygen passed through it, and, as we have already said, the light may be mellowed as taste, fancy, or convenience may suggest. From what we saw last night we think the very clever plan of Mr. Gurney a vast improvement on the present system, and, as Joe Hume would say, "it is a great deal cheaper."—*Times,* May 24.

LONDON AND BIRMINGHAM RAILWAY.

We have selected the following extracts from Roscoe and Lecount's interesting description of this Railway, which we have before more than once favourably noticed:—

CONTRACTS, EXTENT, COST, &c.

Contract.	Length	Contractor.	Contract Price.	Revised Estimate
	Miles		£	£
Euston Extension	1	W. and L. Cubitt	76,860	91,528
Primrose Hill	5¼	The Company	119,987	280,014
Harrow	9½	Joseph Nowell and Sons	110,227	144,574
Watford	5	Copeland and Harding	117,000	138,219
King's Langley	2¼	W. and L. Cubitt	38,900	57,386
Berkhampstead	4⅛	W. and L. Cubitt	54,660	65,002
Aldbury	2½	W. and L. Cubitt	16,694	25,134
Tring	3	Assignees of Townshend	104,496	144,657
Leighton Buzzard	7½	James Nowell	38,000	43,162
Stoke Hammond	3⅝	E. W. Morris	39,303	42,345
Bletchly	3⅜	John Burge	54,500	61,071
Wolverton	5	The Company	67,730	107,765
Wolverton Viaduct	⅛	James Nowell	25,226	28,964
Castlethorpe	4½	Craven and Sons	49,735	71,873
Blisworth	5	The Company	112,950	144,301
Bugbrook	5	John Chapman	53,400	65,013
Stowe Hill	1¼	John Chapman	23,050	31,536
Weedon	1⅜	W. and J. Simmons	26,150	31,442
Brockhall	3⅝	J. and G. Thornton	34,150	50,583
Long Buckby	3⅜	J. and G. Thornton	42,587	48,256
Kilsby	1⅝	The Company	98,982	291,030
Rugby	5⅝	The Company	59,283	93,384
Long Lawford	3¼	W. and J. Simmons	20,330	25,893
Brandon	4¼	The Company	40,000	55,090
Avon Viaduct	1-16	S. Hemming	7,979	8,621
Coventry	7¾	Co. & W. & J. Simmons	101,700	150,496
Berkswell	4½	Daniel Pritchard	53,248	62,738
Yardley	7½	Joseph Thornton	68,032	78,131
Saltley	1⅞	James Diggle	32,878	38,707
Rea Viaduct	⅛	James Nowell	13,644	15,505

THE KILSBY TUNNEL.

The Kilsby Tunnel is about 2,423 yards long, and was intended at first to be formed eighteen inches thick in the brickwork; but it was found necessary to increase this, in most cases, to twenty-seven inches. The whole has been built in either Roman or metallic cement.

The works were commenced in June, 1835, by the contractors; but such serious difficulties were met with, at an early stage of the proceedings, that they gave up the contract in March, 1836, and nearly the whole work has been performed by the company. Previous to the commencement of the works, trial-shafts were sunk in several parts of the line of the tunnel, in order that the nature of the ground through which it would have to pass might be ascertained; and it was found to be generally lias shale, with a few beds of rock—in some places dry, in others containing a considerable quantity of water.*

In sinking the second working-shaft, it was found that a bed of sand and gravel, containing a great quantity of water, lay over part of the tunnel; and this was such a perfect quicksand, that it was impossible to sink through it in the ordinary way. By repeated borings, in various directions near this part of the tunnel, the sand was discovered to be very extensive, and to be in shape like a flat-bottomed basin, cropping out on one side of the hill. The trial shafts had accidentally been sunk on each side of this basin, so that it had entirely escaped notice until the sinking of the working shaft.

Mr. Stephenson was led to suppose that the water might be pumped out, and that under the water thus drained the tunnel might be formed with comparative facility; this proved to be the case. Engines for pumping were erected, and shafts sunk a little distance out of the line of the tunnel. The pumping was continued nearly nine months before the sand was sufficiently dry to admit of tunnelling, and during a considerable portion of that time the water pumped out was 2,000 gallons per minute. The quicksand extended over about 450 yards of the length of the tunnel, and its bottom dipped to about six feet below the arch.

In May, 1836, one of the large ventilating shafts was commenced, and completed in about twelve months. This shaft is sixty feet in diameter, and 132 feet deep; the walls are perpendicular and three feet thick throughout, the bricks being laid in Roman cement. The second ventilating shaft is not so deep by thirty feet. These immense shafts were all built from the top downwards, by excavating for small portions of the wall at a time, from six to twelve feet in length and ten feet deep.

In November, 1836, a large quantity of water burst suddenly into the tunnel, in a part where there were no pumps; it rose very rapidly, and in order to prevent the ground being loosened by it at the far end, where it was excavated, a rather novel mode of building the brickwork was resorted to. This was by forming a large raft, and on this the men and their materials were floated into the tunnel, and with considerable difficulty and danger performed their task.

All the difficulties were at last conquered, and the tunnel finished in October, 1838; but, of course, the expenses were increased to a very great extent. The directors felt it to be their duty not to restrict the proper outlay of capital, when satisfied it would secure the convenience of the public, the stability of the works, and the efficient management of the traffic; and they felt persuaded that a perseverance in this course, to the completion of the undertaking, would be found most economical in the end, and best calculated to ensure the permanency of that successful result which is now happily placed beyond the reach of doubt. The contract for making the Kilsby Tunnel was 99,000*l.*, and it has cost more than 300,000*l.*, or upwards of 130*l.* per yard.

To give some idea of the magnitude of this work:—There were thirty millions of bricks used in it, which, at ten hours for a working day, if a man counted fifty in a minute, would take one thousand days to get through them all. There were above a million of bricks employed in the deepest ventilating shaft, and its weight is 4,034 tons. The weight of the whole tunnel is 118,620 tons; or it would freight four hundred ordinary merchant ships, of about three hundred tons each; and if these bricks were laid end to end, they would reach 4,260 miles. The quantity of soil taken from the tunnel was 177,452 cubic yards.

The great ventilating shafts are perfect masterpieces of brickwork, and are found fully to answer the purpose for which they were intended, leaving the tunnel entirely free from any offensive vapour immediately after the transit of each train, and their magnitude can only be estimated by standing in the tunnel and looking upwards.

The passage through this mighty work of engineering skill and ingenuity leaves on the mind, even of those unacquainted with the ordinary difficulties of such an undertaking, a vivid impression of the rare talents of those who designed the work, and superintended its execution. These talents, however, will be more especially appreciated by those who are aware of the many and unforeseen obstacles which arose during its progress. To Mr. Charles Lean, the assistant engineer under whose direction it was completed, great credit is due for his skill and unremitting exertions, and for the great care he bestowed upon the men in the arduous and dangerous duties in which they were constantly engaged. * * * * *

The history of the great railway between London and Birmingham is now finished. A wonderful work it is to look upon, whether it be contemplated in its magnitude and difficulties, its science and capital, or its utility and results. It stands as much the monument of this age as any of the great works of antiquity that have been the subjects of the world's history. There is, however, this difference in its favour, that while they have been raised in the cruel exercise of despotic power, and have mainly subserved the purpose of personal vanity, this has been accomplished by the profitable employment of the redundant capital of a single district, to meet the wants of a vastly-improved people, and is the triumphant invention of science, trained and disciplined under severe study, and gathering accelerated strength from the successful experiments of each succeeding year. The flexible power of steam was, indeed, known to the philosophers of former times; but they used this knowledge only for the fantastic purposes of caprice and amusement. Anthemius, in the age of Justinian, employed his acquaintance with this principle to annoy a troublesome neighbour, and by imitating an earthquake frightened Zeno out of his house; and, at an after-period, Pope Silvester invented an organ, which was set in motion and worked by it. It is the glory of the present era, that science and utility go hand in hand to advance the improvement and happiness of the nation.

Every age of the world has furnished its own peculiar inventions, and these have generally been well adapted to the wants that suggested them, and to the condition in which society was at that time placed. It is a subject more than commonly interesting to contemplate genius toiling amidst so many difficulties, and by patient perseverance overcoming all perplexity and opposition. It is, perhaps, still more interesting to observe it under the trials of its first experiments, amidst the doubts, unbelief, and sometimes jeers, of the multitude, self-possessed in the truth of its principle, yet tremulously fearful while lying at the mercy of the thousand contingencies that might thwart or destroy its hopes and expectations. Such was the case with Telford, on the final erection of the famous hanging bridge over the Menai Straits. It is said that his heart sunk as every successive bolt was struck, till overcome with the agony of his feelings, he retired to his cottage hard by, and awaited on his knees the result. The shouts of the admiring populace, when the wonderful fabric settled into its place across the turbulent waters, and his own almost inarticulate thanksgiving in his secret chamber, arose together in the triumph of that hour.

When poor Henry Bell, after years of thought, labour, and experiment, first pushed his steam vessel on the Clyde, it was done amidst the scoffs and evil surmises of those who assembled to witness the scene. The inventor died in poverty; but an obelisk that rears itself on the banks of that fine river, near Dunglass, attests the tardy, and to him almost useless, gratitude of his countrymen. Fulton embarked on the Hudson with the same contemptuous greetings and prognostications, from the very people who assembled in thousands to hail the arrival of the Great Western and Sirius steamers, across the vast Atlantic, to their own shores. He lived to see, and in some degree to share, the complete success of his genius and mechanical skill.* How deeply we are indebted to these children of science who carried forward their discoveries,—in the benefits of which we so largely participate,—almost broken-hearted, amidst the chilling indifference or the withering contempt of a selfish world!

The work of which we have been treating has involved nearly, if not altogether, a capital of six millions of money in its completion. This enormous amount will require three hundred thousand pound per annum, merely to pay its interest, at five per cent., besides a very considerable sum in addition, to defray the wear and tear, and other expenses of its yearly operations; and yet with all this immense outlay, it is certain, from the host of travellers it will allure into a state of locomotion from pleasure or profit, and the various lines that will eventually flow into it, that it will be one of the most productive railways in the kingdom. We cannot, indeed, clearly foresee the end of such an invention, of which this is one of the greatest experiments, or the condition of society it may ultimately produce; but we are warranted in believing that this onward state of improvement, by facilitating and enlarging the sphere of social communication, will tend greatly to increase the amount of social happiness; and in its combining and assimilating influences over the great human family, will assist in bringing about the benevolent purposes of Him, "who hath made of one blood all nations of men for to dwell on all the face of the earth."

* Organic remains at Kilsby are very numerous. In some parts of the excavation there is hardly a cubic inch without shells and other remains presenting themselves to the eye, and, as the earth taken out has been principally laid into spoil, there will be ample opportunities, for some time yet, for further examination, which would well repay either the scientific inquirer or the cabinet collector.

* The engine used by Fulton, in his first steam-boat on the Hudson river, was made by Messrs. Boulton and Watt, of Soho.

EXCAVATIONS ON THE LONDON AND BIRMINGHAM RAILWAY BETWEEN SHELDON BROOK AND YARDLEY.

A novel and ingenious method of excavating was first tried,† under the skilful direction of the assistant engineer, Mr. R. B. Dockray, a gentleman who now holds the appointment of resident engineer for one half the line, having before superintended the division from Birmingham to Hampton, which is executed in such a superior manner as fully to justify the high opinion formed in every quarter of his engineering abilities. To estimate the plan properly, it will be necessary to describe the old system of operations:—On commencing the work a deep trench or gullet was cut, ten or twelve feet deep, and as many wide, at a suitable inclination for removing the excavated materials. When this gullet was carried quite through the hill, the sides were cut away to the edge of the slopes by "falling"—that is, by undermining at the bottom and driving wedges from the top and a few feet from the face.

† By Mr. Thornton, contractor for the works.

which brought down the earth in large masses; it was then reduced into smaller pieces, and carried away in waggons. In this way the whole of the upper part of the excavation was removed, to the depth of the gullet, by which time a similar gullet was brought up from the commencement of the work, which lowered the excavation twelve feet more; and so on, until the whole was removed; and each of these steps is called a "lift."

The new process is the result of necessity, the parent of many useful inventions. This excavation was the key to the whole contract, and had to be pushed on with the utmost despatch; and as wages were high and the men intractable, it occurred to the contractor that a plough might be effectually used. The material was a hard, dry marl; and after a few trials, and by increasing the strength and altering the form of the plough, the plan was crowned with a success far beyond what was originally contemplated; for in was found that, in addition to dispensing with a number of men, employed it undermining, wedging, and breaking up, it reduced the material to such small pieces, that the labour of several men, who used to break it up at the foot of the embankment, was saved; and many excavations are now entirely worked with the plough.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 23, 1839. *President in the Chair.*

The following were balloted for and elected:—T. J. Maude, W. Pearce, S. B. Worthington, as Graduates; J. C. Prior, Lieut. R. C. Moody, R. E., as Associates.

On Steam Boilers and Steam Engines. By JOSIAH PARKES, M. INST. C. E.*

In a preceding communication† the author had treated of the amount of evaporation in different kinds of boilers in common use; in the present, he treats of their peculiar and relative merits as evaporative vessels; the laws which regulate the amount of evaporation for assigned heated surfaces; and the practical rules whereby the performance of boilers may be tested. The water evaporated and fuel consumed, had been tabulated in the previous communication; the author now gives the dimensions of the several boilers—the area of the grates—the area of heat absorbing surfaces, and the rates of combustion and evaporation. The connexion of the boiler with the engine as regards the proportion of boiler to engine power, is reserved for consideration in a subsequent communication; the attention is now confined to the influence of the proportions of the parts on the performance of boilers for a given weight of coal. Evaporation may be considered as the measure of the useful effect obtained from any weight of fuel, or, together with the duty done by an engine, the measure of the useful effect of a given weight of water, in the shape of steam. The author insists on the importance of ascertaining with accuracy the weight of the water, which in the shape of steam has passed through the cylinder of an engine. The weight of water, or quantity of steam, requisite for producing a given effect or duty, was the subject of continual research by Smeaton; and the basis of Watt's discoveries.

The author being led to make observations on evaporation twenty years ago, soon perceived that the completeness and rate of combustion, the proportion of the grates to the combustion effected upon them and to the whole heat-absorbing surface, were important elements in evaporative economy. These elements, in the author's own experiments at Warwick, where slow combustion was pushed to nearly its furthest limits—in those of Smeaton at Long Benton—of Rennie and Watt at the Albion Mills—of M. de Pambour on the Locomotive Engine, in which intensity of combustion and evaporative power are at their highest limits—of Nicholas Wood on the Killingworth Engine—and of Mr. Henwood, and others, on the Cornish boiler—are the data for the analysis of the evaporative effects; the true causes of which in the several experiments, the author now attempts to develop.‡ The authentic facts here recorded of the working of boilers and engines of established credit and notoriety, will enable the employer of any boiler or engine to compare his practice with specimens of acknowledged and well-attested merit.

The results derived from the above data are arranged in a tabular form, so as to exhibit at once the relation which any one property and the several parts of the boiler bear to any other, and to the effects produced, the amount and activity of the combustion (to which the author assigns the term *calorific forces*), and the modifications it experiences by the structure and disposition of the several parts.

There are also certain quantities and relations which exert a peculiar influence over the results, which, being rightly ascertained, are exponential or indicative of the practice of each particular boiler; these Mr. Parkes calls the *exponents* of that boiler, and are as follow:—

The quantity of coal burnt under a boiler in a given time,—the quantity burnt on each square foot of grate per hour,—the quantity of water evaporated per square foot of heated surface,—and the number of pounds of water evaporated by a given quantity of coal. Besides this, the influence of *time*, that is, the time of duration of any given portion of heat about a boiler, and about equal areas of surface, demands our most attentive consideration, and is specially treated of at the close of the paper. It appears most distinctly, that the boilers tested as to their merit by their respective evaporative economy, arrange themselves in the inverse order of the rate of combustion—the Cornish boiler being greatly superior to all the others when tested in this manner, as well also as in respect if time is selected as the standard of comparison, whereby to mark the scale of descent from the highest point of excellence yet attained in evaporative economy. For this purpose, then, the Cornish results are considered as unity.

The value of the exponents for the Cornish, Wagon and Locomotive Boiler respectively, are collected together in the following table, will serve to show at one glance the respective values of the boilers on this comparison:—

Boiler.	lbs.	
Cornish.........	1·0	of Coal burnt under one boiler in 44·08. seconds.
Wagon*.........	1·0	of ditto ditto in 16·57. ditto
Locomotive	1·0	of Coke ditto in 6·45. ditto.
Cornish	3·4.	of Coal burnt on each square foot of grate per hour.
Wagon	10·7.	ditto ditto
Locomotive	79·3.	of Coke ditto
Cornish.........	1·0.	of water evaporated by 1 square foot of heated surface per hour from 212°.
Wagon	7·1.	ditto ditto
Locomotive	12·0.	ditto ditto
Cornish	11·8.	of Water evaporated by 1 lb. of coal from 212°.
Wagon	8·8.	ditto ditto
Locomotive	7.3.	ditto 1 lb. of Coke, ditto
Locomotive	5·4.	ditto 1 lb. of Coal, ditto.

The Cornish boiler possesses some peculiar advantages, both as regards structure and the practice of slow combination, since, by the former, great strength is attained, and, by the latter, time is given for the complete combination of air with the heated fuel, for the transmission of heat through the metal, and for the escape of the steam through the water. The plates of the Cornish boiler are usually ½ an inch thick; whereas those of a low pressure boiler are usually 1-4th to 5-16ths of an inch thick; thus a much larger extent of surface is necessary to transmit a given quantity of heat in a given time in the former than in the latter case. The Cornish engineers allow seven times as much surface as in the general wagon boiler practice, for the evaporation of equal weights of water in equal times, and twelve times as much as in the locomotive; from which there is a gain of from 30 to 40 per cent. in the former, and of 64 with coke and 100 with coal in the latter case.

The Wagon boiler has great disadvantages of structure, being ill adapted to resist internal pressure, liable to collapse, and greatly affected by incrustation. According to the above table, which exhibits the mean of eight experiments, the combustion is 2½ times more rapid per boiler, and 3 times more rapid per square foot of grate per hour, and the rate of evaporation is 7 times greater than in the Cornish. The loss of heat, the Cornish being unity, is 24½ per cent.

The construction of the locomotive boiler is so very different from that of every other species of evaporative vessel, that no strict analogy can be drawn betwixt it and any other. From the above practical results, it appears that the rate of combustion per boiler is nearly 7 times, and per square foot of grate per hour 23 times more rapid—that the rate of evaporation from equal surfaces 12 times more rapid than the Cornish boiler—the loss of heat, the Cornish being unity, 51 per cent.

The author discusses at length the varying circumstances connected with different boilers, and the corresponding influence on the above results, and particularly the system of management by which he was enabled with a Wagon boiler to approach the Cornish results. The table accompanying this paper will frequently enable the intelligent employer of a boiler to ascertain the best proportion of parts, and the best practice. For, having decided on the quantity of steam required, he knows the quantity of fuel which will generate it if he adopts the measures of surface and proportions of parts, which have given relative effects; or he can ascertain whether his present practice be good or defective. Notwithstanding the great stride which has been made in the economy of fuel by the Cornish engineers, the sources of waste are still great, and we may hope for great advances in evaporative economy, when combustion as a science and practical art has received the attention which it merits.

The effect of a different practice as regards rapidity of combustion and arrangement of parts, entirely disturbs the relation betwixt boilers of equal surfaces; the table shows an almost perfect identity in the total, the radiant, and the communicative areas, between the mean of eight experiments on the wagon and eleven on the locomotive boiler, and the locomotive boiler would present between 3 and 4 times greater surface to absorb the heat generated on the grate than the wagon, if the rate of combustion were the same in both, but the rate of combustion is seven times more rapid in the locomotive, and consequently the locomotive does not offer one-half

* This paper was commenced February 26th, and was continued during four meetings before the Easter recess.

† See Transactions, Vol. 2.

‡ The author has been unable to obtain any similar data for the Marine Boiler.

* The results for the Wagon Boiler are the mean for eight boilers.

the surface of the wagon boiler for the absorption of the heat produced from equal weights of fuel in the same time. The result of this discordant practice is a loss by the locomotive of 1-3rd of the heat which is realized in the Wagon boiler; that the rate of evaporation from equal surfaces is augmented by the locomotive by 65 per cent., so that the increase of evaporative power is attended by a sacrifice of 33 per cent. of fuel.

The locomotive possesses peculiar advantages in the thinness of the metal composing the tubes, and the subdivision of the heat, but these are more than neutralized by the exceedingly short period of duration of the heat, from any given quantity of fuel about the boiler. This most important subject of time is discussed in a series of propositions based on the following principles:—The structure of the boiler and its mode of setting occasion the heat to travel greater or less distances, and over very unequal extents of surface in equal times, and the value of time will be appreciated by referring it to the rate of combustion, to the distance passed over by the products of combustion before they quit the boiler, the time in which the heat traverses the boiler, and to the period of the duration of the heat about equal areas of surface. These remarkable elements give rise to eleven propositions, which are fully discussed and illustrated by tabulated results. The peculiar action which takes place on the metal of the boilers is indicated by the phrase *intensity of the calorific action*, since there are involved many actions which are entirely independent of the temperature of the fire. The relations furnished by some of these propositions are facts as regards the relative action of the fires, and furnish appropriate measures of the effects of different systems of practice on the durability of the boiler.

The preceding abstract having been read, Mr. Parkes remarked there were so many elements to be taken into consideration—the evaporation was affected by so many circumstances—there were so many things left untold—that he hoped some of the many who were capable of experiments would give their assistance. Every day's work was an experiment which ought to be carefully registered. He had great difficulties on many points, particularly with respect to the locomotive boiler and the thinness of the heat-absorbing surface. It had been stated on a preceding evening that Dr. Ure had proved, if two vessels of equal size, the one of thin and the other thick metal, be placed in a sand bath, there will be more water evaporated in a given time by the thicker than by the thinner vessel. This was very extraordinary, since he thought that 25 per cent. would be lost in the locomotive boiler if the tubes were of double the thickness. The effect of thickness of the material was evident in the experiments which every boy has made with the paper boilers over a candle. The real cause of the destruction of boilers is the application of heat to thick surfaces. Another subject of peculiar importance is the temperature at which the heat leaves the boiler and enters the chimney. He had made experiments on this at Warwick, and proved that he could not boil the water in a vessel at the top of a chimney 60 feet high; the temperature never exceeded 180° Fahrt. It was argued that more of this heat could not be used, but the Cornish engineers had shown that to be an error, having surpassed his results.

Another subject is the constant loss of heat by radiation; he had attempted to ascertain this with Mr. Wicksteed; the boilers at Old Ford were covered with cinders, so that but little radiation would take place but from the front or bed; still the quantity of heat which goes off is considerable, and one great source of waste. They had observed with great care the quantity of coal requisite to keep the boiler hot; this would furnish some measure of the loss due to radiation.

Blocks for Railways.

The attention of the meeting having been called to M. D'Harcourt's artificial granite for railways, blocks, and other purposes, Mr. Rastrick remarked that he had about a month ago laid down blocks of the Scotch Asphalte, two feet square, on a portion of the Southampton Railway. The sleeper was put in while the block was formed. It was usual to bore holes and to fix the chairs by bolts; he had wished to ascertain how far the blocks would staud the driving in of the bolts, without any boring; they bore this without any apparent injury, and he thought these blocks, weighing about 3¼ cwt. would answer the purpose better than blocks of other materials.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Report of the Council, presented at the Annual General Meeting, held the 6th of May, 1839.

At the expiration of another year of active exertion, and they trust of usefulness, the Council appear before their professional brethren to render an account of the manner in which they have endeavoured to fulfil the many and important duties which have devolved upon them; and to take a review of those occurrences connected with the Institute and the art, which have marked the past twelve months. They have the satisfaction of stating, that the Institute has proceeded quietly but firmly in their course, drawing the attention of the members to new sources of information; arousing a spirit of investigation; extending the foreign correspondence; and drawing more closely the bonds of mutual intelligence and good-will with their foreign brethren on the continent. Thus, it is to be hoped, entitling themselves to fresh confidence in the public estimation.

Most satisfactory proofs have been received from distant parts of the useful tendency of these exertions and of the propriety of these principles, which have guided the members in their proceedings. The architects in Dublin are now engaged in forming an Institute for the sister kingdom, and have applied to the Council for their advice and co-operation. Upon the suggestion of the Royal Institute of Fine Arts at Naples, the Neapolitan Government have caused to be printed the rules and regulations of this Institute, as well as the proceedings of the opening meeting in 1835, together with the series of questions issued for the guidance of correspondents. These questions have also been printed in the annals of the American Institute of New York, and two editions have appeared in German, published at Hamburgh and in Vienna—those connected with architecture in both hemispheres, will therefore be pursuing their inquiries upon the same uniform system of investigation. In America an attempt was made to emulate the purposes of our society by holding annual meetings of the architects, alternately in the leading cities of the United States. But the remote distances at which the architects live, and their comparatively small number, scattered over that immense territory, presented difficulties, which, in spite of their enthusiasm for the cause, obliged them after two meetings to defer carrying out their object to a more favourable period.

The Council have observed, with considerable interest, that a society has been established at Oxford for promoting the study of Gothic architecture, so as to provide for the cultivation of correct architectural taste, particularly among the clergy, whose influence is naturally and justly so great in the selection of designs for erecting new churches, or in the preservation of old ones. The Council cannot but hope that the time is not far distant when general architecture may form one of the courses in the University education, and be considered as necessary an attainment and accomplishment to the gentleman and scholar, as those branches of literature and abstract science which now occupy the hours of the studious in these seats of classic learning.

Amidst the political difficulties naturally incident to an infant state emerging from the slavery of centuries, and with discordant principles of different habits and distinct interests, it is gratifying to remark that an Archeological Society has been established at Athens under the auspices of the Government. Their purpose is to promote excavations, to preserve the ancient edifices from further degradation, and to pursue those fresh enquiries, to which recent discoveries of monuments, or renewed observations upon those already known, may give rise. That society has forwarded to this Institute a series of their Ephemeris, containing their investigations, copies of the inscriptions, and representations of sculptured fragments recently brought to light. It is satisfactory to observe the accuracy with which these subjects are rendered, and the sound spirit of criticism and investigation with which these erudite researches are pursued. Through the medium of the secretary of the Institute a class of subscribers to that society has been commenced in England; and it is hoped that all who feel an interest in Greek antiquities, will promote by their contributions the investigation of subjects, which Englishmen have already so materially advanced by their learned researches, and rendered familiar by their accurate and superb illustrations.

Shortly after the last annual meeting a proposition was made by the Architectural Society, to consider the expediency and practicability of a union of the two societies. Committees were mutually appointed, who agreed unanimously upon a scheme for the incorporation of the two bodies. This was approved at a general meeting of the Institute, but negatived by the other society—a result much regretted by the Council, as they feel that the interests of the art and of the profession would have been most effectually promoted by amalgamating the whole body of the profession, and concentrating those exertions for the benefit of architecture, which are less efficient when divided. The Council instance with satisfaction a remarkable testimony borne to the soundness of these views taken by the Institute, in the fact, that in consequence of the rejection of the scheme by the Architectural Society, eighteen members of that body withdrew, of whom thirteen have been elected members of the Institute.

The foundation of a students' class formed part of this scheme, and although the proposition for the union proved ineffectual, yet this portion seemed of so valuable a nature, that the Institute resolved to carry it into operation, and eight students have been already admitted.

Within the last twelve months several important competitions for edifices of the highest consequence have been thrown open to the profession. The mode generally adopted of conducting competitions, not seeming to produce the results to be desired, either by the public or the profession, a committee of members was appointed "to consider the practicability of adopting means to secure more satisfactory decisions." These gentlemen, without entering upon the subject of the policy of competitions in general, or the comparative advantages of open or select competitions, or the question whether the standard of the national architecture is likely to be raised or lowered by this mode of procuring designs for public buildings, took a general view of the subject, stating some of the objections to which the manner in which they are carried into effect is liable, and suggesting some remedies. This report was printed, and has been extensively circulated.

The three subjects still open to the enterprise of the architect are, the Nelson Monument, the St. George's Hall at Liverpool, and the Royal Exchange of London. In the first of these a preliminary decision has been pronounced, and the council are gratified in recording, that the two prizes awarded to architectural subjects have been gained by fellows of this Institute, Mr. Railton, and Mr. Fowler, the honorary secretary. The two other subjects are still open. It is necessary, upon occasions of such magnitude and importance, that adequate time should be allowed to the competitors, to deliberate upon subjects requiring so much experience and consideration, both as to arrangement and decoration;—occupied as the architect is in his professional engagements, it is highly necessary that he should be allowed ample time for digesting the conception of monuments, which are to endure for ages, involving his reputation as an artist, and perhaps the character of the periods in which they are erected in point of taste.

The prize drawings for the present year, namely, the restoration of the

Baronial Castle of Sheriff Hutton, in Yorkshire, affords the opportunity of again bearing testimony to the research and skill evidenced in the drawings and description, to which the Soane Medallion has been awarded. The general meeting felt that Mr. Samuel Sharp, the associate, the author of this restoration and of the one which was successful last year, had not only displayed great merit in this production, but had also deserved well of the Institute for the zeal with which he had again offered himself to the approbation of his professional brethren. It was accordingly decided that his medallion should have a further distinction of a gold rim. In order, however, to avoid discouraging in future the exertions of competitors, who might in such cases be deterred from undertaking the labour and expense of such subjects, from the fear of being deprived of their reward by the superior merits of a candidate, whose already acknowledged talent might bar the hope of success, the Institute have reserved the power of awarding the Soane Medallion to the second in merit, and of adjudging to the first such other reward as they may think fit and adequate.

The Council entertain the hope that the fellows may hereafter deem it expedient to publish the best of the restorations, on which premiums have been bestowed. They consider that such a work would reflect credit upon the Institute, as containing a body of novel, useful, and interesting information. It would also afford a stronger inducement for future competitors to make the sacrifice of their time and talents, in the hope of obtaining such a distinction.

Medals of merit have been adjudged to two essays upon the subject of an analytical investigation of Greek and Roman architecture, as indicating considerable research and care.

The services of able men of science have continued to be rendered available, by means of lectures, for the purpose of developing the general principles of the sciences connected with architecture, offering to the professor sources of information and instruction, and means of practical application to the purposes of construction. The adaptation of such sciences to the peculiar purposes of architecture has not hitherto engaged the immediate attention of those occupied in the investigation of these branches of knowledge. Although the manner in which the subjects have been treated hitherto in this room, has been necessarily elementary and general, yet the Council feel convinced that much good has resulted, and that by a steady perseverance in the same course those subjects will come to be studied by professors in each department with more special reference of the sciences to construction. The present session will be marked by courses on geology and acoustics, and probably during the next, the attention of the members may be drawn to mechanics, optics, and the principles of colour. Without a knowledge of the laws which control the harmonious decoration of buildings by colour, the architect may destroy the effect of the most graceful combinations of mass and form, and the grandest arrangement of lines. Colour is capable of producing the most important effects upon the mind. It gives character to the hall, the staircase, and the chamber—effectually calls the imagination into play—requires no previous study to render its effects to be deeply felt by the uneducated and the refined mind. It acts upon the feelings by sensations, either sublime, cheerful, or gloomy. It is a principle by which the artists of all nations and of all periods have sought to appeal to feelings. Egypt, in all her sublimity; Attica, in all her purity and grace; Asia, in all her wild luxuriance; Europe, in the middle ages, and the architects of the "Revival," have derived powers of expression and emotion from this source, which was subsequently neglected, but which it is the interest of the architect of the present day to revive and render his own.

It is with great pleasure that the Council have observed, that at length the constructions connected with the new Houses of Parliament are commenced. This important work has given rise to an investigation of the utmost consequence to the profession. Upon the suggestion of Mr. Barry, the architect of the building, government has directed a commission to investigate the qualities of stone in various parts of the kingdom; with the view to adopting that which should best ensure perpetuity to this grand national fabric. This commission, consisting of Messrs. Barry, Delabeche, Dr. Smith, and Mr. C. H. Smith, have visited 105 quarries, and examined 175 edifices, and collected specimens from various parts, which have been submitted to tests both mechanical and chemical by Professors Wheatstone and Daniel. The publication of the results of these valuable trials will be of incalculable importance to the public and to the profession, as the subject, pursued in this complete manner, will render the professor better acquainted with resources for building stone, of which he may avail himself—improve property, by perhaps bringing into use quarries hitherto neglected or unknown,—and may possibly ensure to our public edifices a quality of material better adapted to resist the changes of temperature of this variable climate, and to withstand the peculiar atmospheric influences of this metropolis. It may lead perhaps to the adoption of a stone more brilliant in hue than those at present in general use, so as to shed somewhat of the glow of an Attic or a Roman tint upon the architectural features of the public edifices of London. The enquiry, thus pursued, fully confirms the important connection of chemistry and geology with architecture, and proves the importance and advantage of the course adopted by the council of calling the attention of the members to those subjects by lectures.

Since the last annual meeting six new fellows have been elected, one Honorary Fellow, one Honorary Member, Mr. Wilkinson, distinguished by his valuable researches in Egypt, seven Honorary and Corresponding Members, 16 Associates—making 31 new members, and forming with those previously elected an aggregate of 152 contributing and 52 Honorary members, besides eight Students. The Institute and the art have lost a distinguished member by the death of Monsieur Percier; a short memoir was read of this esteemed artist at one of the ordinary meetings, collected from various brief notices of him published at the time in France. It is to be expected that a fuller account of his brilliant talents, his valuable productions, his estimable personal character, and of his influence upon the French school, of which he was the leading master during a very long period, will be published and do justice to the reputation which he so justly acquired throughout Europe. The council are led to hope that Monsieur Vilain, his nephew and heir, will accede to the request, which has been made to him for one of the drawings of Monsieur Percier. This application arose from the conviction of its being extremely important that the Institute should, if possible, possess some autograph specimen of the talents of every distinguished architect, as they may hereafter enable those, who may write on the history of the arts or the biography of architects, to refer to authentic records. The Institute owe to the liberality of their Fellow, Mr. Mylne, autographs of Piranesi, Robert Mylne, Bonomi, and Lewis. It is hoped that this collection may receive ample additions from those who may have similar documents in their possession, which derive value from forming part of a series, although when separate they are of comparatively little importance. To Mr. Mylne the Institute is also indebted for a copy of the "Editio Princeps" of Vitruviu , a rare and valuable volume, and of peculiar importance in the library of an institution like this. The council, conceiving it desirable that the Institute should possess a complete series of the editions of our Latin classic, have purchased three other editions, and four more have been presented by other Fellows. The donations of drawings have been more than usually numerous and interesting, and consist principally of delineations of buildings in foreign parts. Among these must be particularly noticed the valuable series illustrating Indian buildings, forwarded to the President by the Rajah of Tanjore, which were prepared by order of his highness for the express purpose of being sent to the Institute. The council have to record with deep regret the loss which the Institute has experienced in the death of their liberal benefactor, Sir John Drummond Stewart, who within a few days of his decease had transmitted further additions to the collection of drawings which he had already presented. The foreign members have as usual been liberal in their contributions to the library, and Messrs. Albertolli, Hittorff, Blouet, Vandoyer, Roelandt, Laves, Suys, Serrure, and the Chevaliers Gasse and Bianchi have added many valuable volumes and drawings to the collection. Those foreign architects who have visited this country have been cordially received by our members. Two striking instances have occurred of the influence which architecture has exercised upon the minds of gentlemen, distinguished by their rank and fortune, and who are engaged in works the fruits of their travels in foreign lands, and more especially connected with the art. Gally Knight, Esq., M.P., was already advantageously known for his previous investigations in the architecture of Normandy. His work, now in the course of publication, entitled "Norman and Saracenic Remains," four numbers of which have already appeared, and have been presented by him to our library, is of great value, beauty, and research. It is impossible to omit noticing the exquisite illustrations of many striking edifices, hitherto unknown, contained in Mr. Vivian's work entitled "Views in Spain and Portugal."

It will be perceived by the balance-sheet, that the considerable accession of new members has of course produced a corresponding increase to the income of the Institute—by the contributions of four honorary fellows 100 guineas have been invested in the consolidated annuities—the travelling fund, originally founded by J. Newman, Fellow, has received a considerable addition by the donations of Messrs. Rhodes and Chawner. It is proposed that the dividends and subscriptions for this fund should be allowed to accumulate, until the amount of stock should be sufficiently productive to enable the Institute to assist effectually some meritorious student to pursue his studies on the classic soils of ancient art. It is to be hoped that the liberality of members by special subscription may effectually promote this object.

The council would ill discharge their duty, if they retired from office without claiming for their successors a generous confidence in their discretion and judgment; an unreserved reliance, which may encourage them in the difficult path of duty. Taught by their own experience and judging from their own impressions, they are convinced that without this confidence no men of independence and feeling—none, who rank high in the profession, and who have no ultimate motive but a disinterested desire for the prosperity of the Institute, can be induced to undertake this responsible and arduous task.

They would also urgently call upon the members for their more active co-operation in furtherance of the exertions of future councils. With the council should rest merely the ministerial and executive functions of the Institute. The fellows and associates must consider it a more positive duty to furnish their officers with communications, which should give interest to the ordinary meetings, and eventually constitute materials for the volumes of transactions. It was said of a distinguished philanthropist, that he could contract into the smallest dimensions or expand into the largest for benevolent purposes. So let no member consider any exertion too insignificant, or any effort too great, which may advance the interests of the Institute, the profession, and the art.

Gentlemen,—Have we not seen the gratifying and encouraging anticipation with which our first formation was hailed on all sides—the generous sympathies which our first efforts excited—the liberality by which our narrowed means were increased into ample funds? Have we not witnessed the patronage of the nobility—the support of the profession—and the cordial concurrence of our invaluable foreign brethren in art? Has not success attended our first essay at publication? Have not competitors pressed forward for our prizes? Have we not by one sovereign been incorporated under a charter, and has not our Queen graciously honoured us by her patronage? When we reflect on this career of success, and the activity, perseverance, and disinterested efforts of successive councils,—when we see our President using every exertion and losing no opportunity for promoting the efficiency and prosperity of our society by his judicious counsels, by his animating example and by his munificent hospitality,—may we not with confidence call on our members to press forward and carry out the purposes, for which we are associated, in a manner commensurate with the expectations of the public, consistent with the character of the profession, and corresponding with the rank which the Institute holds among the scientific bodies of Europe?

COUNCIL, 1839—40.

PRESIDENT.—Earl De Grey.

VICE-PRESIDENTS.—Messrs. Basevi, Blore, and Burton.

HON. SECRETARIES.—Messrs. Fowler and Poynter.

ORDINARY MEMBERS.—Messrs. Bellamy, Cundy, Chawner, Ferrey, Mocatta, Salvin, and Shaw.

HON. SEC. OF FOREIGN CORRESPONDENCE.—Mr. T. L. Donaldson.

ROYAL SOCIETY.

APRIL 11.—The Marquis of Northampton, President, in the chair.

The following paper was read :—

On a new Equi-atomic compound of Bicyanide with Binoxide of Mercury, by JAMES F. W. JOHNSTON, Esq.—In this paper an account is given of the properties of a salt, obtained by agitating with red oxide of mercury a small portion of hydrocyanic acid, and which the author finds to be distinguished from the bycianide of mercury by its sparing solubility in cold water, by the strong alkaline reaction exhibited by its solution (a property which indicates an excess of mercury), and by its susceptibility of detonation by heat, depending on this excess being in the state of an oxide, and on the action of the oxygen on a portion of the carbon of the cyanogen it contains, and the presence of which is shown by the disengagement of hydrocyanic acid gas when acted on by hydrosulphuric and hydrochloric acids. The analysis of this salt, given by the author, shows it to consist of

Carbon	5.203
Nitrogen	6.025
Oxygen	3.098
Mercury	85.674
	100.

The formula of which composition is as follows :—

$$Hg.\ Cy._2 + Hg.\ O._2$$

APRIL 18.—J. W. Lubbock, Esq., V.P., in the chair.

J. T. Graves, Esq., of the Inner Temple, and the Rev. S. R. Maitland, were elected fellows.

The following paper wsa read :—

On the Constitution of the Resins; Part I., by J. F. W. JOHNSTON, Esq. The object of the general investigation, of which the commencement is given in this paper, is to determine the relative composition of the various resins which occur in nature, and to trace the analogies they exhibit in their constitution; and also to ascertain how far they may be regarded as being derived from one common principle, and whether they admit of being all represented by one or more general formulæ. The chemical investigation of the resin of mastic shows that this substance consists of two resins; the one soluble, and acid; the other insoluble, and having no acid properties. The formulæ expressing the analysis of each of these are given by the author. He also shows that a series of analyses may be obtained which do not indicate the true constitution of a resin. The soluble resin, when exposed to the prolonged action of a heat exceeding 300° Fahr., is partly converted into a resin containing three, and partly into one containing five equivalent parts of oxygen, the proportion of carbon remaining constant. The same resin combines with bases, so as to form four series of salts; which in the case of oxide of lead, consist of equivalents of resin and of oxide in the proportions, respectively, of two to one; three to two; one to one; and one to two. This soluble resin, in combining with bases, does not part with any of its oxygen; but if any change takes place in its constitution, it consists in the hydrogen being replaced by an equivalent proportion of a metal; and formulæ are given representing the salts of lead on this theoretical view. By boiling the resin in contact with ammonia and nitrate of silver, or perhaps with nitrate of ammonia, it is converted into a resin which forms a bisalt with oxide of silver, in which there is also an apparent replacement of hydrogen by silver. The resin next examined is that of dragon's blood; and the conclusions deduced from its analysis are the following :—first, that the lump dragon's blood is the natural and pure resin, while the strained and red varieties, being manufactured articles, are more or less decomposed; secondly, that this resin retains alcohol and ether, as most other resins do, with considerable tenacity; but that these solvents may be entirely expelled by a long-continued exposure to a temperature not higher than 200° Fahr.; and lastly, the formulæ representing its chemical composition is given.

GEOLOGICAL SOCIETY.

April 10—Rev. Dr. BUCKLAND, President, in the chair.

A paper was read, *On as much of the "Transition or Grauwacke System" as is exposed in the counties of Somerset, Devon, and Cornwall*," by the Rev. D. WILLIAMS, F.G.S.

The author commenced by stating, that his views respecting the structure of the country had been derived from independent observations; but that while he claimed originality for himself, he did not in the remotest sense impugn the originality of the views of other geologists who have examined the same districts. The sedimentary deposits older than the new red system, and constituting the whole of Cornwall, and the greater part of Devon, and the south-west of Somersetshire, are arranged by Mr. Williams, in the transition class, and under the following formations, commencing with the youngest, 9, Floriferous slates and sandstone; 8, Coddon Hill grits; 7, Trilobite slates; 6, Wollacombe sandstone: 5, Morte slates; 4, Trentishoe slates; 3, Calcareous slates of Linton; 2, Foreland and Dunkerry sandstone; 1, Cannington Park limestone. Of these formations, only 9, 8, and 7, were described in the paper, the other six not occurring in Cornwall or in Devonshire, except in the north-west corner of the county, and are reserved by the author for future consideration. The floriferous slates and sandstone (9), arranged in the true coal measures by Professor Sedgwick and Mr. Murchison, on memoirs read before the British Association in 1836, and the Geological moiety in 1837, Mr. Williams considers to be a grauwacke formation, because he has traced passages into the subjacent deposit (8); and he employs the term "floriferous," to avoid the ambiguity which he conceives would arise from using the word carbonaceous; and he objects to the expression culmiferous, as anthracite constitutes but a very small part of the formation. The deposit occupies a large portion of Devonshire, and detached minor districts of Cornwall. The sandstones, he says, are quite distinct, but that the slates are occasionally undistinguishable from those employed for roofing. The Moddon Hill grits (8) constitute, on the north, a narrow band from Fremington, near Barnstable, to Holcomb Rogus; and in the south a broader districts flanking the floriferous sandstones, from Forrabury, by Launceston, to the granite of Dartmoor. The deposit passes gradually upwards into No. 9, and downwards into No. 7, the intermediate strata being termed by the author neutral beds. The grits which compose the greater part of the formation are perfectly distinct from any other in the district, and afford most valuable assistance in tracing the range of the deposit: they contain also the wavellite, for which the north of Devonshire has been long distinguished. In the middle of the series are lenticular masses of limestone, associated with beds of black shale—the former containing Goniantites and Posidonia, and the latter plants with flakes of anthracite. The trilobite slates (7) constitute, in the north of Devon, a band ranging from Braunton on the west, nearly to Milverton on the east, and on the south, extensive districts around the granite of Dartmoor. He believes that the whole of the slate series of Cornwall belongs to them. In the north and south, they gradually pass upwards into the Coddon grits, and in the north downwards into the Wollacomb sandstones (6), the expression *neutral* being also applied to these passage beds. In some parts, the slates abound with trilobites; and the limestones of Plymouth, Newton Bushell, and Torbay, which belong to the formation, in corals and shells.

The remainder of the series, from 6 to 1, will be described in a future memoir.

April 24.—Rev. Dr. BUCKLAND, President, in the chair.—Communications were read :—

1. *On the Climate of the Newer Pliocene Period*, by Mr. SMITH, of Jordan Hill.

An examination of the shells contained in the newest tertiary deposits on the shores of the Clyde, has convinced Mr. Smith, that the climate of this part of the globe, during their accumulation, was colder than it is at present. His attention was first called to the subject, by observing that the shells found at Uddevalla, and described by Mr. Lyell in his memoir on the change of level in the Baltic, agreed with some of those most common in the raised shelly beds of the Clyde; and his views respecting the northern aspect of the peculiar or most abundant of the Scottish fossils have been confirmed by Mr. Gray, Mr. G. Sowerby, and M. Deshayes.

2. *Remarks on some Fossil and recent Shells collected by Capt. Bayfield, R.N., in Canada*, by Mr. LYELL.

Several eminent conchologists having observed that in the English crag there are certain shells which indicate a somewhat colder climate than that which now prevails in our latitudes, and it having been supposed that a similar inference may be deduced, but with greater certainty, from shells found in the Newer Pliocene strata of Scotland and Ireland, Mr. Lyell has been induced to examine, with great care, a collection of shells sent to him by Capt. Bayfield, consisting partly of fossils procured from the most modern tertiary deposits bordering the Gulf of St. Lawrence, and partly of recent testacea from the Gulf itself. The shells were found principally at Beauport, about two miles below Quebec, in a deposit similar to that now forming in the bed of the St. Lawrence; and the uppermost stratum, nearly 100 feet above the level of the river, is almost exclusively composed of bivalves. Similar shells occur at a still higher elevation, in the valley of the St. Charles, three miles from Beauport; and at Port Neuf, forty miles above Quebec, at heights varying from 50 to 200 feet. Numerous boulders of primary rocks are imbedded in the strata at different levels, and appear as if they had been dropped there from drifted masses of ice, at widely distant intervals of time. Though some of the shells are broken, yet many are perfect; and it is impossible to imagine that the clay, sand, and gravel, composing the strata, could have been forced, together with the boulders and testacea, into their present position by a violent current, as the fragile *Terebratula psittacea* is found with both valves united, and its long, brittle, interior appendages entire. The shells bear a strong resemblance to those found in the newest tertiary deposits at Uddevalla, in Sweden; and some of the most abundant at each locality are common to both. The Canada fossils, however, so far as they have hitherto been examined, do not agree as a whole, with the testacea now inhabiting the Gulf of St. Lawrence: many of the species ranging, in a living state, from the Gulf to the border of the North Polar Circle, or are now only known in high northern latitudes, as in the seas of Greenland, Iceland, and Norway, or agree with shells found in the newer Pliocene of Scotland and Sweden. On the contrary, many of the shells most conspicuous in the Gulf of St. Lawrence, have not been found in a fossil state. As the climate of Canada is now excessive, it is natural that many northern and arctic shells should exist in the Gulf of St. Lawrence, without any mixture of tropical forms; it is very probable, also, that in the period immediately antecedent to the present, the climate of Canada was even more excessive than it is now, and that the shells resembled still more closely that small assemblage existing in high northern latitudes. It is likewise evident, from the manner in which the large fragments of rock are interspersed through the shelly strata near Quebec, that while these deposits were forming, blocks of ice were annually transported as at present. Among the fossil shells near Quebec, not one has yet been found which can be affirmed to be extinct. They relate, therefore, to an extremely modern period, and, though the climate may then have been more excessive than at present, a more equable one may have preceded, and the alterations may have been connected with the geographical changes which upheaved the shelly deposits of Canada 200 feet above their former level.

3. *An Extract of a Letter from Herr F. A. Roemer to Dr. Fitton, dated Hildeshaim, March 20.*

The Wealden formation, including the Purbeck stone, is very extensively developed in the North of Germany, and is overlaid by a great argillaceous deposit, containing marine shells, similar both to the oolitic and the cretaceous systems. Of the fossils found in the Wealden of England, almost every species occurs in Germany, including even the minute *Cypris tuberculata*, *C. granulosa*, and *C. Valdensis*. Last autumn, Herr Roemer discovered the Wealden, with its characteristic shells, near Bottingen, in the High Alps. He possesses also the *Lepidotus Mantelli*, of the English Wealden, from Saxony. The Portland sand occurs in the North of Germany, but the Portland stone and the Kimmeridge clay are so intimately connected by their fossils, that the intermediate sandy beds cannot be considered as a separate deposit. The chalk with flints occurs possibly in the Hartz. The green-sand series is extensively developed, the Flammenmergel of Hausmann being the upper green-sand of England, and the quader-sandstein the lower. Herr Roemer believes that the gault also exists in Northern Germany.

4. *Classification of the Older Rocks of Devonshire and Cornwall*, by Prof. Sedgwick and Mr. Murchison.

In a former communication to the Society the authors explained their general views respecting the older rocks of Devonshire and Cornwall, but having recently been induced, on zoological evidence, not then obtained, to make a change in the lower part of their classification, they give in this paper their reasons for doing so. With respect, however, to the geological age of the culmiferous strata occupying the greater portion of Devonshire, they adhere to their first opinion, and consider them the equivalents of the true coal measures of other parts of England. In the grouping, succession and lithological characters of the great series of beds underlying the culmiferous strata, they likewise make no alteration, and used, in reading the paper, the same section which they exhibited to the British Association, at Bristol, in 1835, when they first explained the true position of the culm deposit. On their first examination of Devonshire and Cornwall, they were induced to consider the great slaty and sandstone districts forming Exmoor and the Quantocks on the north, and a large portion of southern Devon and the whole of Cornwall, as the lower part of the Silurian system and the upper part of the Cambrian, having been misled by the slaty character of the rocks, and its supposed proof of geological antiquity. A recent examination, however, of the fossils collected by the authors, or kindly sent to them for the purpose by the Rev. R. Hennah and the Rev. D. Williams, has proved that the strata immediately subjacent to the culm series (shown on a former occasion to contain true coal-measure plants), inclose fossils resembling those in the lower carboniferous strata of the north of England; that the great mass of intermediate beds are characterized by peculiar fossils; and that the lowest strata contain some which partake of the same type, and others which belong to the upper Silurian formations. On these grounds, therefore, the authors have been induced to remove the slates and older sandstones of Devon and Cornwall from the position they first assigned to them, and to place them on the parallel of the old red sandstone, the intermediate series of strata between the carboniferous and Silurian systems. Had, however, the whole of the evidence derived from organic remains been before the authors in 1836, the geological age of the strata could not then have been determined, as the fossils of the Silurian system, one of the terms of comparison, had not been fully ascertained. In the gradual passage of the strata from one group to another, and in the recurrence of the same groups north and south of the great culmiferous or carboniferous series of central Devon, there is the most decided stratigraphical evidence of the whole of the country belonging to one geological epoch. The marked difference between the slates of Devonshire and Cornwall, and the sandstones of Herefordshire with the adjacent counties, hitherto considered types of the old red system, the authors showed can be no valid objection to the proposed classification, as lithological characters have been long proved to be of little or no importance in connecting deposits, at even very limited distances. The absence of the true carboniferous limestone was also shown to be no argument against the arrangement of the authors, as on the western extremity of Pembrokeshire, that formation is entirely wanting, and the culm or coal-measures rest immediately on older rocks. Lastly, the authors proposed, in consequence of the strata in Devonshire yielding the best zoological type, to substitute the term Devonian system for old red, and they expressed a hope that the determination of these fossils would assist in filling up the sequence of geological formations, and enable observers to discover, in other parts of the world, a series of deposits hitherto supposed almost peculiar to the British isles. The authors acknowledged the assistance they have received from Mr. James De Carle, Sowerby; and that Mr. Lonsdale first suggested that the limestones of South Devon would prove to be of the age of the old red sandstone. The paper was illustrated by the large index map of the Ordnance Survey, coloured by the authors, and it exhibited the range of the several systems through North and South Wales, the border counties of England—Devonshire and Cornwall.

5. *A Notice on the general relation of the various Bands of Slate, Limestone, and Sandstone in South Devon*, by Mr. R. A. C. Austen.

Commencing with the oldest deposits east of the Teign, there appear—1, Slates; 2, A band of black limestone containing corals and shells, and sometimes thin seams of anthracite—it ranges from Staple Hill through Bickington, Ashburton, Buckfastleigh, and Dean; 3, Fine-grained schistose shale and slates; 4, The limestones of Plymouth, Dunwell, Shilstone, Ugborough, North Huish, Little Hempston, &c.,—they are associated with scistose rocks; 5, A great arenaceous deposit, often coarse and resembling old red sandstone: sometimes conglomeritic, when it resembles the new red; it ranges from Plymouth Sound and Bigbury Bay, across the central part of South Devon, by Modbury and Blackdown, cutting the Dart below Totness, and ranging thence through Marldon, Cockington, and Barton; in some places it contains thin bands of limestone; 6, The limestones of Torbay. Mr. Austen says the carbonaceous rocks of central Devon form no part of this series, but rest upon it unconformably.

Lastly. A Notice, by Mr. Miller, of Cromarty, *On the exact position in the old red sandstone, of the bed containing fossil fishes and exposed in the cliffs of the Moray Frith.* It is overlaid by a yellow sandstone and rests upon a deposit of a red sandstone, chocolate coloured conglomerate, and impure limestone. The base of the whole is stated to be granatic gneiss.

May 8.—The Rev. Dr. Buckland, President, in the chair. Three communications were read :—

1. *On Casts or Impressions of Vermiform Bodies on thin Flagstones, belonging to the Carboniferous series near Haltwhistle, in Northumberland, by* Mr. G. C. Atkinson. The bed of sandstone is about eighteen feet thick, and the surface of the layers of which it is composed, present, in almost every instance, tortuous impressions, or casts marked by a longitudinal furrow, and occasional transverse closely set lines.

2. *On the London and Plastic Clays of the Isle of Wight, by* Mr. Bowerbank. The object of this communication was, to show that there is no zoological distinction between the two clays, the author having found that many of the same species of testacea range through the whole series of beds in White Cliff and Alum Bays.

3. *On the relative Ages of the Tertiary Deposits commonly called Crag, in Norfolk and Suffolk, by* Mr. Lyell. Three points of great importance relative to the Crag of Norfolk and Suffolk are discussed in this memoir. 1st. The direct superposition of the red to the coralline crag, as pointed out by Mr. Charlesworth in 1835. 2ndly. Whether mammalia are really imbedded in undisturbed marine strata of the crag of Norfolk. 3dly. Whether the proportion of recent shells, as compared to the extinct, is decidedly larger in the crag of Norfolk, so as to indicate a posteriority in age relatively to the Suffolk crag. With regard to the first point, Mr. Lyell states, that the red crag is clearly superimposed on the coralline at Ramsholt, Tattingstone, and Sudburn, resting at the two former localities on denuded beds of the lower deposit. He ascertained, also, by the assistance of Mr. W. Colchester, that at Sutton, near Woodbridge, the red crag abuts against a vertical face or cliff of the coralline, and likewise overlies it. In this instance, the sand which composes the older bed, or coralline crag, had evidently acquired a certain consistency at the bottom of the sea before the red crag was deposited, for it has been perforated by numerous pholades, the tortuous holes of which descend six or eight feet below the top of the bed, and still contain the shells of the pholas, while the remainder of the cylindrical hollows has been filled with the sand of the superincumbent stratum. With regard to the second point, the occurrence of mammalia in undisturbed beds of marine crag in Norfolk, Mr. Lyell states, that he had ascertained, by an examination of this crag near Southwold and Norwich, that it is not purely marine, but contains everywhere an intermixture of land, freshwater, and seashells, with bones of mammalia and fishes. In this deposit near Southwold, Captain Alexander, who accompanied the author, found, some time since, the tooth of a horse, within a large specimen of *Fusus striatus*, and he informed Mr. Lyell that bones of mammalia are frequently associated in the same beds with those of fishes, marine shells, and crustacea. In the neighbourhood of Norwich, this deposit forms patches of variable thickness, resting on chalk and covered by gravel. It is well exposed at Bramerton, Whitlingham, Thorpe, and Postwick, and presents beds of sand, loam, and gravel, containing a mixture of marine, terrestrial, and fluviatile testacea, ichthyolites, and bones of mammalia. The chalk on which it rests was shown, by the late Mr. Woodward, to have been drilled by marine animals; and the Rev. Mr. Clowes, of Yarmouth, presented Mr. Lyell with a specimen of chalk containing a *Pholas crispatus* in a perforation several inches deep. That this portion of the crag was slowly accumulated, is evident from Captain Alexander having found, at Bramerton, the tusk of an elephant, with many superlæ on its surface; and, from this fact, Mr. Lyell infers that the bones

of quadrupeds were really washed down into the sea or estuary of the Norfolk crag, and were not subsequently introduced into the deposit by diluvial action. The fresh-water shells are rare in the neighbourhood of Norwich in comparison with the marine, and the terrestrial species are still more scarce. Mr. J. B. Wigham, however, has ascertained that the freshwater testacea predominate in a bed at Thorpe. The same gentleman found at Postwick, in a stratum containing marine shells and fishes, a portion of the left side of an upper jaw of a Mastodon, containing the second true molar, and the indications in the socket of the first. This specimen Mr. Owen has been enabled to refer to the *Mastodon longirostris*, discovered at Eppelsheim. In the same bed were found the teeth and jaw of a mouse, larger than the common field species; also bones of birds, and of several species of fishes. The horns of stags, bones and teeth of the horse, pig, elephant, and other quadrupeds, have been likewise detected at Postwick, Thorpe, Bramerton, &c.; and this association of the Mastodon and horse near Norwich, as well as in many other places in Europe and in America, Mr. Owen considers to be a subject of interest. The third point, respecting the relative antiquity of the Norfolk and Suffolk crag, was discussed at considerable length, and the author acknowledged the great assistance afforded him by Mr. Wigham, who has nearly doubled the number of species obtained from the former deposit near Norwich; also the aid which he has received from Mr. Searles Wood, who submitted to Mr. Lyell's examination the whole of his magnificent collection of crag shells; and from Mr. George Sowerby, to whose extensive knowledge of recent testacea the author stated that he is indebted for a rigid determination of the existing shells found in the crag. The number of well-defined species in the Norfolk crag is 112, out of which eighteen are land and fresh-water; compared with the Suffolk crag this number is small, but Mr. Lyell showed from the Fauna of the Baltic, that species are much less numerous in brackish than salt water, the latitude, climate, and other conditions being the same; he also showed that, in analogous deposits in the valley of the Rhine, the amount of species is small. Of the ninety-four marine shells, seventy occur in the red crag, and therefore it might be inferred, that the two deposits are nearly of the same age; but in the Norfolk beds the recent species, both of fresh water and marine testacea, amount to between fifty and sixty per cent., and are nearly all British shells; whereas in the red crag, there are only thirty per cent., and in the coralline but twenty. This comparatively recent origin of the Norfolk deposit, had been previously inferred by Mr. Charlesworth, from the general character of the fossils. In the examination of the collections which led to the above results, the greatest care was taken to reject those shells which might have been washed out of the red crag into the Norfolk beds, or those species which apparently did not live in the waters, which deposited this division of the crag. From the numerical proportion of recent testacea, Mr. Lyell infers, that the coralline and red crag belong to his Miocene division of the tertiary series, and the Norfolk strata to his older Pliocene; he also showed, that the lacustrine beds at Grays, in Essex, and many other places, constitute another link in the geological sequence of formations, as they contain ninety per cent. of recent testacea, and must consequently be referred to the newer Pliocene epoch. Lastly, a comparison of the crag with the tertiary strata of the faluns of Touraine, has convinced Mr. Lyell that M. Desmoyers was right in considering the Suffolk and Touraine deposits to be of the same age, although he formerly dissented from that conclusion.

AMERICAN INSTITUTION OF CIVIL ENGINEERS.

We feel great pleasure in giving the following address to our Transatlantic brethren, agreed to at preliminary meetings at Augusta in Georgia, at Boston, and at Philadelphia.

Public works are now so extended in our country, and the mass of experimental knowledge to be gained from those in use is so great and so peculiarly applicable to our circumstances, that it is even more valuable to the American engineer than what he can learn in Europe, where larger means have permitted greater expenditures. In this country it is of paramount importance to obtain the greatest amount of useful effect at the smallest cost; and of attempts to attain this end, the Union now contains a multitude of instructive examples. Some have been eminently successful, and others less so; but of either kind, the student, or the more advanced engineer, too often seeks in vain for any satisfactory written or printed description, and is unable to obtain any thing more than vague, doubtful, and incorrect information. This evil can only be removed by the exertions of the engineers themselves.

They are now established as a distinct class, and have long felt the want of such an association as that proposed, but it has hitherto been supposed that the proper time for its organization had not yet arrived.

The success that has attended the labours of the London Institution of Civil Engineers, its high standing and great usefulness, prove that such societies may be of great public utility, when properly conducted, and are incentives to induce us to imitate so excellent an example. It is admitted, however, that a society in this country must differ somewhat in its plan of operations from the British Institution, which can readily give utterance to its opinions elicited after frequent and full discussion, since a large portion of its members during the winter have their residences within the limits of London. Here, however, owing to the vast extent of territory over which are scattered the members of our profession, the usefulness of the society must (for the present at least) depend more upon the facts and experience of its members, made known in written communications, than upon their opinions orally expressed in public discussions.

The very fact that our improvements are so widely spread, that few, if any members are able to give even the most important of them a personal examination, affords, perhaps, the strongest argument in favour of a society that shall, by a concert of action, bring the experience of the whole country within the reach of each member.

The difficulty of meeting at any one point, caused by the time and expense required in travelling from distant portions of so extensive a country as the United States, is a serious obstacle, but it has been much diminished by the facilities afforded by the railroads already in use, which are among the valuable results of the labours of our civil engineers. Though our society may be less favourably situated than the one in London for frequent and public discussion, we nevertheless anticipate many important advantages to be derived from a personal intercourse and interchange of information among its members, and from the establishment of a permanent repository of the results of experience, obtained from the most authentic sources. The standing of the profession in our country is, fortunately, such, that its importance need not be dilated upon; it is, therefore, the more necessary that every thing in the power of the members should be done to add to its respectability and increase its usefulness. We look forward to the formation of the society as a valuable means of advancing these desirable ends.

We trust, also, that each may appreciate the importance of attending at the time and place appointed for forming the society, and will be willing to make some sacrifice for effecting that object; or if prevented from attending by uncontrollable circumstances, that he will express his views in writing upon the subject of a suitable constitution.

MEETINGS OF SCIENTIFIC SOCIETIES.

Institution of Civil Engineers, 25, Great George-street, Westminster, every Tuesday at 8, P. M.

Royal Institute of British Architects, 16, Grosvenor-street, Monday at 8, P. M. June 10 and 24.

Architectural Society, Lincoln's Inn Fields.—Conversationé on Tuesday, June 4, at 8, P. M.

AMERICAN PATENTS ISSUED IN APRIL, 1838.

WITH REMARKS AND EXEMPLIFICATIONS BY THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

For a Spring Lock for Coach and Railroad Car Doors; Peter Alverson, New Haven, Connecticut, April 2.

We are told by the patentee, that "the object of his invention is a spring lock easily managed, and of sufficient strength to secure the door firmly, and yet in size and form so compact as not to injure the pillar of the door, nor interfere with the run of the lights, and which may be opened and shut from within as well as from without." The lock is then described, but its construction, although not specially recondite, cannot be made clearly known without the drawings.

For a Rotary Steam Engine; Oliver Wright and A. A. Wilder, Warsaw, Genesee county, New York, April 2.

This engine consists of a thin, revolving wheel, or drum, to the periphery of which steam is conducted through hollow arms within the drum, extending from its centre to its periphery, where it issues tangentially; the improvement claimed is to "the application of springs and set screws to the apertures of rotary steam engines; and also the placing a door to the case, so that the apertures may be closed or opened without taking the case apart."

It is not to minor arrangements of this character that the rotary engine will owe its utility, should such a debt ever be contracted by it: they may serve to render one rotary engine better than another; but to enable it to compete with the reciprocating engine requires a radical change, a mode of construction which shall be absolutely new; possibly this may be eventually discovered.

For an improvement in Wardrobe Bedsteads; Z. C. Favor, Boston, Massachusetts, April 2.

For an improvement in the Manufacture of Gunpowwder; Richard J. L. Witty, Lowell, Massachusetts, April 2.

For an improved mode of forming raised Surfaces for Printing on Paper, Calico, &c.; Godfrey Woone, city of London, April 2.

For an improved Machine for breaking Hemp and Flax; Alvin Kyes, Crittenden, Grant county, Kentucky, April 2.

An endless chain of slats, or bars, is made to revolve round two rollers, the bars, or slats, forming the bed of the break. Above this is a platform extending the length and breadth of the break, and having on its under sides projecting slats which are to pass in between those of the revolving apron, but so far apart as to span over two of them. This platform is raised vertically by cams, and falls upon the hemp, which is placed upon the bed above described; the claim is to "the so placing of the slats upon the breaker, at such distance apart as that they shall span over two bars of endless chain, whilst the feeding is to the distance of one bar only; the slats thus striking alternately between each bar, as the endless chain is made to advance."

It does not appear to us likely that this simple device will obviate the difficulties which have been encountered, to a greater or less degree, in all the numerous machines for breaking hemp, &c., that have been contrived and patented; not one of which has fully answered the purpose designed.

For an improvement in the Plaiting Machine for covering Whips; Seymour Halliday, Westfield, Hampden county, Massachusetts, April 4.

For an improved Draft Box for Steam Engines; Andrew M. Eastwick, city of Philadelphia, April 5.

For a mode of forming a Spiral Flue for Steam Boilers; Benjamin J. Miller, city of New York, April 5.

This flue is intended for cylindrical, low pressure boilers, and consists of a flat tube running spirally round from end to end of the boiler, between the exterior case and an interior cylinder. The claim is to "the application of one or more spiral flues to steam boilers, as described."

For an improved Construction of Canal Boats, for conveying the Horses by which they are towed; John H. Long, Lewistown, Miflin county, Pennsylvania, April 5.

"The nature of this invention consists in partitioning off a space about the middle of the boat, on either side, and thus forming a stall, or crib, of suitable length and breadth to receive the horses; and extending from the deck of the cabin to the bottom of the boat, in which is suspended, from the upper deck, a platform by blocks and tackles, for sustaining the horses, and for lowering them to the bottom of the boat when taken on board, and raised to the gunwale when they are to be removed."

"What I claim as my invention consists in the before-described construction of the stall, in combination with the suspended platform, in canal boats, for conveying the horses by which they are towed, so as to have one or more of them at rest whilst the others are towing."

For an improvement in Repeating, or Many-chambered, Fire-arms; Henry and Charles Daniels, Chester, Middlesex county, Connecticut, April 5.

For an improvement in the mode of Printing certain Colours upon Calico or other Fabrics; Bennet Woodcroft, Great Britain, April 5.

After describing the mode of procedure adopted by the patentee, he says: "Now whereas I do not claim, as my invention, either the printing machine, or the particular construction or material of the dress to be used by the said operatives. But whereas I do claim as my invention the enclosing calico or other fabric intended to be printed, along with the printing apparatus, whatever it may be, and the material to be printed upon them, in a chamber, case, or compartment, filled with an artificial atmosphere, deprived of, or devoid of free oxygen, such as atmospheric air deprived of its oxygen, as hereinbefore described, or any other suitable artificial atmosphere, and there printing the said calico or other fabrics, with a solution of deoxydized indigo when required to produce a blue colour, or with a solution of deoxydized indigo and other suitable materials as are usually used in combination with indigo, when required to produce other colours, and subsequently exposing the said calico and other fabrics, so printed as aforesaid, to the action of the atmospheric air, in order to imbibe the necessary quantity of oxygen therefrom to produce and fix the colours required."

An air-tight room is to be made of sheet-iron, and this is to be furnished with an atmosphere of nitrogen; this is accomplished by means of a large air-pump, which pumps the water out of the room, passes it through tubes into purifiers filled with a solution of sulphuret of lime, which deprives it of its oxygen, when it passes again into the room through tubes leading from the purifiers; and this operation is continued until no sensible quantity of oxygen remains in it. The entrance into the room is through a tank filled with water, which forms a water lute, by a partition dipping a little way below the surface of the fluid. This serves also to allow fresh air to be forced in by atmospheric pressure, as the volume is decreased by the absorption of the oxygen. The workmen have dresses of India rubber cloth, similar to diving dresses, and air is supplied to them by bellows and tubes, as in diving apparatus.

For an improvement in the Safety Life Preserver; John J. White, city of Philadelphia, state of Pennsylvania, April 7.

This life-preserver is to pass round the body in the ordinary manner, but instead of being one continued inflated bag, it is formed into a number of separate bags, connected, by mouth-pieces and valves, with one common tube, by which they are all to be inflated. One of these bags is made so as to constitute a bellows, by means of which the whole may be filled. The claims are to "the above method of forming isolated air chambers, rendered independent of each other by the interposition of valves, so that the loss of air in one will not affect the others, and yet capable of inflation from the same source. Also the mode of inflation by the bellows, as a constituent part of the machine, whether applied to life-preservers or other manufactured articles requiring inflation."

For an improvement in the Scythe Snath; Samuel Puffer, Sunderland, Franklin county, Massachusetts, April 7.

The claims are to "a revolving bush, or circular plate, for changing the angle of the scythe, for cutting various kinds of grass, or grain, on various kinds of ground; also the detaching one end of the book of the nib from the other, to cause it to embrace the snath more firmly," &c.

For a Machine for Shearing Cloth; Reuben Daniels, Woodstock, Windsor county, Vermont, April 7.

For an Improvement in Carriage Springs; William Sharp, Burdett, Tompkins county, New York, April 7.

For an Improvement in Coach Lamps; William Lawrence, Wallingford, New Haven county, Connecticut, April 7.

For a Mortising Machine; Francis and Thomas Burdick, city of Brooklyn, New York, April 7.

The general plan of this mortising machine is that of the larger number of similar instruments; the particular difference is in the manner of working the slides up and down, which carry the chisels. There are two slides, each of which carries a chisel, and these slides are carried up and down alternately by means of a pinion placed between racks on the inner edges of these slides, which are guided between vertical cheeks. A pendulous lever, or handle, hangs from the shaft of the pinion, and by swinging this backward and forward, the motion of the slides and chisels is obtained. A feed hand is also made to operate in notches on the sliding bed piece which supports the timber to be mortised. The claim is to "the double rack or slides, to which the chisels are attached, worked by one pinion in the manner described." The granting of the patent is *prima facie* evidence that there is novelty in the thing claimed; we do not perceive, however, in what consists the superiority of this new arrangement of parts, over those of some former mortising machines.

For a Mortising Machine; Ira M'Laughlin, Sunderland, Bennington county, Vermont, April 7.

The claim under this patent is to "the method of securing the chisel, by which means it can be readily reversed; and the method of moving the chisel backward and forward." The remark on the foregoing patent may, we think, apply generally to this.

For a Machine for Paring, Coring, and Dividing Apples; Robert W. Mitchell, Martin's Mill, Richland county, Ohio, April 13.

This, we believe, is the fourth patent obtained for the same purpose; in that before us the apple is to be placed on a fork at the end of a shaft, or mandrel, turned by a crank, whilst the paring knife, furnished with a guard, is held in the right hand, and passed from end to end over the apple: this is then pushed towards the shaft, which is furnished with knives that cut it into quarters; a centre tubular knife removing the core.

For an improvement in Canal Lock-gates; Franklin Livingston, Waterford, Saratoga county, New York, April 13.

The improvements claimed consist in a particular mode of constructing, or forming, the bearings of the gudgeons of valve, or wicket gates; and the application of a screw, working horizontally, for opening and shutting such gates; the arrangements of which require, for their illustration, an examination of the drawings.

For an Apparatus for Extinguishing Sparks in Locomotive Engines; Wm. T. James, city of New York, April 13.

There are several things in the construction of this apparatus analogous to some others intended for the same purpose. The smoke pipe is surrounded by a second pipe sloping outwards from it, and having a wide, or trumpet mouth, extending somewhat above that of the smoke pipe; the smoke and sparks from this latter are to escape through lateral, curvilinear openings, by which it is intended to give to the sparks a rotatory motion between the two pipes, and allow them to fall, by their gravity, into the receptacle formed by the junction of the said pipes. There is a cover to the smoke pipe in the form of an inverted cone, which is designed to co-operate with the other parts of the apparatus in producing the desired effect; likewise a flanch within the upper edge of the outer tube sloping downwards with the same view.

The claim is to "the combination of the outer tube, the flanch, the conical cover, the openings and spiral flues, in their combination with a smoke pipe, or chimney."

We have not heard the result of the experiments with this apparatus, but are convinced that if it is so constructed as to arrest the sparks, it will, like its predecessors, impede the draught.

For a Machine for Plating Dough, and Cutting Crackers, Cakes, &c.; John M. Neagle, New Haven, Connecticut, April 13.

For an Apparatus for obtaining a high degree of Velocity on Rail-roads; Jacob Nollner, city of Washington, April 13.

This is one of those strange conceits which sometimes insinuate themselves into the minds of intelligent men, although it would be difficult for a looker-on to find the avenue by which it could obtain an entrance; indeed, it might well be supposed that every avenue leading into such minds would be so well guarded by the watchful sentinel, good common sense, as effectually to repel such interlopers. The plan proposed is neither practical or practicable, nor did the inventor himself really think it so, but determined to place it upon record, under an impression that it might suggest, or lead to, something useful; "so mote it be."

Let a rail-road be made perfectly level and straight, and solid as the everlasting hills; let a car twenty miles long be placed on this, and be drawn by any adequate power; let another car, say of ten miles in length, be placed on this first car, at its rear end, and let this also have an adequate independent motive power applied to it. Now let the two cars set off together at the rate of twenty miles an hour; the upper car will, in this case, travel over the ground at the rate of forty miles an hour, twenty being due to the motion of the lower car, and twenty to its own motion. In the model at the patent office there are four or five such cars, or moveable rail-roads, stratum superstructum. The following is the claim:—

"What I claim is the placing of two or more moveable railways, platforms, or articles capable of progressive motion, one above the other, so that each may be drawn along by an independent power applied to it, and, like itself, sustained upon the rail-road, platform, mounted rail-way, or other article upon which it is to move; and this I claim, whatever form or arrangement the same may be made to assume, whilst the principle of action is the same with that herein exemplified."

For an Improved Fire Engine Pump; Joseph Newman, city of Baltimore, April 14.

This is a device for converting the common street pump into a fire-engine, by adding a forcing apparatus at its top, furnished with an air vessel, and other appendages. When thus used, the ordinary spout is to be stopped, and a hose or branch applied to the forcing apparatus. The claim is to "the combination of the common pump prepared as described, with the cylinder, piston, valves, or air-chamber of the ordinary hydraulic or fire-engine, which combination produces a two-fold instrument, viz., a self-supplying fire-engine, and a culinary, or common pump."

There is no novelty in the foregoing idea. The late Mr. Dearborn, of Boston, proposed a similar thing more than forty years ago, of which engravings are to be found in our own and in foreign journals. The thing, however, cannot possibly answer a good purpose when appended to the ordinary pump, as the power requisite to raise the water from a well, and to force it to the required height, cannot be applied to such a pump, and if it could, but few such pumps would bear it. Whatever of ingenuity there may be in such a combination, will not be accompanied by a corresponding degree of utility.

For a machine for Mowing, and Cutting, Grass and Grain; David Lewis, Bern, Albany county, New York, April 14.

For a machine for Making Bricks; Samuel B. Brustar, Kensington, Philadelphia county, Pennsylvania, April 14.

In this machine, as in many others, the clay is to be tempered in a circular trough, by means of revolving wheels which roll over it. Outside of the tempering trough there is a moulding trough, within which the moulds are to be laid; and the clay transferred to this trough is to be pressed into the moulds by rollers passing over them. The whole machine is a structure of considerable complexity, not well described or represented in the first instance, and not capable of being clearly presented in words. The claims are to a number of particular things referred to in the specification, and, if given, would not convey any definite idea. The machine may be a good one; but as presented, it does not, to us, wear a promising aspect.

For a machine for Moulding and Pressing Bricks; Stephen Waterman and Charles Learned, Charleston, South Carolina, April 14.

In this machine the clay is mixed in a vessel or chamber in the centre of the machine, in which a shaft revolves that is furnished with knives, in a manner well known for preparing clay at potteries, and in brick making; by them it is forced into moulding boxes at the sides of the machine, under which the moulds are to be placed on a suitable platform. The claim refers principally to the manner of forcing down the vertical pistons within the moulding boxes; this is done by pieces in the form of inclined planes, and carried round by the sweep attached to the centre shaft; which inclined planes pass against friction rollers at the upper ends of the shafts of the pistons, and force them down; after which they act upon vertical shafts connected with levers that raise the pistons, allowing the filled moulds to be removed, and empty ones substituted for them.

CLAIM.—"We claim the application of inclined planes to the forcing down the pistons for pressing brick, in the manner described. We do not claim the mixing, or press boxes, or the oblique knives; these and other parts having been previously known and used; all that we claim as our invention being the inclined planes for forcing down the pistons and slides; the particular combination of the two vertical slides, with their connecting parts for lifting the pistons and causing the moulds to traverse on the ways."

For an improved Water Wheel; John R. Wheeler, Seneca Falls, Seneca county, New York, April 14.

The water is to be made to strike upon the buckets of this wheel by passing through issues in a circular rim surrounding the wheel. Particular directions are given respecting the curved form of the buckets, but there is not anything in this wheel to distinguish it from others that have been previously used, excepting these peculiarities of form which do not seem calculated to alter the action in any appreciable degree.

For an improvement in the Steam Engine; William L. Lightall, city of Albany, New York, April 14.

The object in view in this engine is so to arrange the levers and other working parts, as that the cylinders may be placed horizontally at the bottom of the vessel. This mode of arrangement is described and represented with much clearness and distinctness, and the inventor, after describing it, observes that, "It will appear that the cylinder may, in all cases, be laid horizontally on the keelson, or keelsons, placing it and all the other machinery so low that its weight, instead of its being as it now is, a necessary and unavoidable incumbrance, will act in a great measure as judiciously stowed ballast. That in vessels of war, or armed steamers, all the essential and vital parts of the machinery will be completely protected from an enemy's fire, and that the acting engineer can perform his duty not only with safety, but with that self-possession which personal security could alone insure." The claims refer to the particular description of the respective parts as arranged, but would not, alone, afford any distinct information respecting them.

For an improved mode of Working the Pistons of Pumps; David Whittier, Belfast, Waldo county, Maine, April 14.

"The nature of my invention consists in the application of inclined planes inserted upon the outer circumference of a wheel, or cylinder, (which is made to revolve like the capstan of a vessel,) to the spear, or piston rod of a pump, so as to force it up and down."

In the drawing, force pumps are represented as placed near the periphery of a low, vertical cylinder, or drum, on the deck of a vessel, there being levers, or handspikes, to carry the cylinder round. Projecting inclined ledges come in contact with friction rollers on the piston rods of the pumps, and alternately raise and depress them. The claim is to this mode of working pumps, and we believe that the patentee might have enjoyed the exclusive right thereto without having had it secured to him by law.

For an improvement in Many Chambered Cylinder Fire Arms; Theodore F. Story, Northampton, Hampden county, Massachusetts, April 21.

For improvements in the Machine for making Axes; Demmon C. Stone, Naponock village, Ulster county, New York; assigned to Joseph Wright, of Poughkeepsie, New York, April 21.

For a Saw Mill without Saw Gates; John C. Yates, Columbia, Maury county, Tennessee, April 21.

For an improvement in the Steam Engine; Seth Graham, Roxbury, Norfolk county, Massachusetts, April 21.

For an improved process of Dyeing Wool; Felix Fossard, city of Philadelphia, April 21.

For an improvement in the Art of Dyeing; Patrick Magennis, Paterson, Passaic county, New Jersey, April 21.

For an improved Drill Machine for Sowing or Planting Grain; George A. Hoyt, city of Albany, New York, April 21.

For an improvement in the Working of Bellows by Steam; Martin Bell, Antis, Huntingdon county, Pennsylvania, April 24.

For an improvement in Rail-road Cars, Carriages, or Trucks, &c.; Joseph Harrison, Jr., city of Philadelphia, April 24.

The main object of this improvement is to obtain a more equal bearing upon the rails of the wheels of rail-road carriages than has been hitherto attained. The opposite ends of a spring are to bear upon two sliding boxes, in two plummer blocks, which boxes receive the ends of the two axles of the carriage wheels. The spring is of the usual construction, but mounted so as to vibrate on its centre, allowing the two wheels on each side to adapt themselves to the inequalities of the road, without altering the relationship of the action of the spring. Several variations in the mode of arrangement for carrying out the same principle, are described and represented by the patentee.

"In truck frames which turn on a centre, for the purpose of adapting the wheels to the curvature of a road, the patentee has, in order to render the system of the equalization of the pressure of the wheels upon the rails perfect, so constructed the frames of such trucks as that their sides shall not necessarily continue in the same plane, but be allowed to vibrate vertically to such extent as may be requisite to enable them to adapt themselves, and the wheels which they sustain, to any horizontal inequality in the rails upon which they are to run, as this cannot be effected by the limited action of springs."

In this latter arrangement the wooden sides of the truck frame are connected by transverse and diagonal bars of iron, which work on pins, allowing of the requisite vertical motion in the sides, whilst they are braced perfectly so as to prevent their racking laterally. The claims are as follows:—

"What I claim as my invention in the within described modes of constructing cars, carriages, or trucks, to run upon rail-roads, is the constructing of the springs and their appendages, so that said springs may vibrate upon their centres, for the purpose, and substantially in the manner, set forth. I also claim the carrying out of the same principle, by means of a vibrating beam, or any analogous contrivance, connected and arranged so as to produce the same effect. I also claim the use of a truck frame which may be employed with cars and locomotive carriages of all kinds, to run upon railroads when trucks are required; said truck frame being constructed in such a way as that two parallel sides thereof may be allowed to play, in the manner and for the purpose set forth, whether the same be put together in the method herein made known, or in any other by which the same end is attained, on the same principle."

For improvements in Many Chambered Cylinder Fire Arms; Rufus Nichols and Edward Childs, Conway, Franklin county, Massachusetts, April 24.

For a Horizontal Straw Cutter; R. A. B. Beach, Franklin, Williamson county, Tennessee, April 24.

For an improved Gate for Flumes of Mills; William Buckminster, Framingham, Middlesex county, Massachusetts, April 25.

For a Domestic Spinner, for Spinning Wool, &c.; Hiram F. Wheeler Springville, Susquehanna county, Pennsylvania, April 25.

For a Machine for Pressing Bricks; Gaylord V. Harder, Batavia, Genesee county, New York, April 25.

A horse is to turn a vertical shaft, by means of a lever, or sweep, and this, in its revolution is to operate four or more pistons which press upon the clay, previously tempered, and placed in the moulds for that purpose. The description and drawing do not clearly exhibit the structure, and the claim is merely to "the mode of pressing and discharging bricks, as described."

For an improved Mode of applying the Syphon for the uniform Drawing Oil and other Liquids; James Gray, Fredericksburg, Spottsylvania county, Virginia, April 25.

For improvements in the Many-chambered cylinder Fire Arms; Mighill Nutting, Portland, Maine, April 25.

For a Horse Power for propelling machinery; James Secor, city of New York, April 28.

For an improvement in Water wheels; John Mumma, West Alexandria, Preble county, Ohio, April 28.

The variation in this wheel from some others is not of a character to render particular description necessary; the claim is to "the combination of one, two, or more, tub wheels, with the wheel placed next the schute, and the mode of regulating the outlet of water, as described."

For a machine for Mortising and Tenoning Timber; Henry Barnes, Munson, Geauga county, Ohio, April 28.

The subjoined claims, although they do not lead to a knowledge of the particular structure of the parts, serve to show that the improvements are in mere matters of arrangement, leaving the rest of the structure the same with that of other mortising machines.

"I claim the construction of the carriages with the rests, bar clamps, and clamp bolts, as described. The arrangement of the lever and wedge for throwing the pinion out of gear, with the racks, as described. The method of connecting the pulley with the piston shaft by the spring, for allowing the pulley to turn on the shaft as the cutting tool enters the wood."

For an improvement in the Saw Mill; James Secor, city of New York, April 28.

The claims are to a mode of feeding the carriage, and to a connecting lever for giving motion to the saw gate. The arrangements in this mill are such as to render it portable, and to adapt it to its being driven by horse, or other power, applicable to such mills. The saw frame is to be worked up and down by means of a lever beam, operated by a crank on the fly wheel, and there is, as the claim indicates, some novelty in the mode of feeding.

For improvements in the Machinery for making Brooms, Brushes, Mops, &c.; John M. Spooner, Belchertown, Hampshire county, Massachusetts, April 28.

For a Churn; Joshua G. Pike, Lisbon, St. Lawrence county, New York, April 28.

For an improved mode of forming Kilns for making Charcoal; Michael Carroll, Tellico Plains, Monroe county, Tennessee, April 28.

For a Hinge for Doors, denominated the helical spring joint hinge; D. A. Hoyt, and P. W. Bulkley, Danbury, Fairfield county, Connecticut, April 28.

This hinge is to operate as a door spring, and for this purpose it is so constructed that instead of the middle knuckles of the hinge, a helical spring surrounds the joint pin, the two ends being so attached as to cause the hinge to close by the elastic force of the spring. Two portions of the hinge may, if desired, be so provided with helical springs; these may be made of brass wire, and they have a very neat appearance. The claim is to "the coiling of a spring around the joint pin of door, or other hinges, in the manner set forth, such tension being given to said springs as shall cause them to close a door or other hinged article to which they may be applied; said hinge being constructed substantially in the manner set forth."

MISCELLANEA.

The Union Plate-Glass Company's Works.—On Thursday, the 16th ultimo, the directors of the Union Plate-Glass Company gave a general invitation to shareholders to inspect the company's works, at Pocket Nook, near St. Helen's, and, accordingly, about thirty gentlemen went from this town by the 10 o'clock train, and were received by Mr. Lacy, chairman of the board of directors, by other gentlemen of the directory, and by Mr. West, manager of the works, by whom they were conducted round the various departments of the works, witnessing almost every process in the art of of manufacturing plate glass, from the making and purification of the alkali, and the preparation of the sand, to the last processes of polishing the glass, and silvering it for the purposes of looking-glasses, &c. The works are very extensive and spacious, covering an area of nine statue acres, surrounded by high wells, with a handsome substantial entrance gate of stone, at the principal entrance to the works on the St. Helen's Railway. The situation could not have been better selected whether the facilities of supply of materials, or of transit of the manufactured article be considered, or the position of the works be regarded in reference to the two large and opulent towns of Manchester and Liverpool, with the great export trade of that port, and the centrality of the works in the midst of so many railways, which for their carriages require a large supply of plate glass; indeed, in all respects, there are few finer sites in the kingdom. Within a quarter of a mile of St. Helen's, and still nearer to coal-pits; the railway running close by the works on their eastern side; the Sankey navigation flowing close past the western side; and an abundant supply of water obtained from a subterranean river or stream, supposed to take its rise to the northward, and locally known by the name of "Roaring Meg;" all these advantages are rarely found in such complete combination. The water is raised from "Roaring Meg" by a small steam-engine, of eight or ten horses' power, and conveyed in pipes of eight-inch and six-inch bore, to the different parts of the works.—*Manchester Guardian.*

British Association.—The Model Committee, appointed to superintend the exhibition of models at the meeting of the British Association for the Advancement of Science, to be held in this town on the 26th of August next, are desirous of receiving specimens of manufacture and works of art by the 15th of that month, in order that they may be properly arranged and classified.—*Birmingham Advertiser.*

The Dowlais Iron Company have just laid the foundation stones of two new furnaces; and intend commencing two others very shortly.—*Cambrian.*

Conflagration of the Cheltenham Theatre.—On Friday morning the 3rd ultimo, the Cheltenham theatre was totally destroyed by fire, together with two or three small houses adjoining it. The theatre was built in 1806, by Mr. J. Watson, a coadjutor of John Kemble and Mrs. Siddons, both of whom in the early part of their career had appeared on the Cheltenham boards. The house was preparing for the appearance of Mr. and Mrs. Yates, and Mrs. Wood, at the time of the accident. The property, which is insured for 2,000*l.* in the Phœnix Fire-office, was of the value of about 5,000*l.* It was in the hands of trustees for the benefit of the proprietor's creditors. To such a degree has the taste for theatricals fallen off since Lord Segrave and his brothers were in the habit of acting, that it is doubted if another theatre will be built at Cheltenham.

Photogenic Drawings.—Mr. Robert Mallet has communicated to the Royal Irish Academy a notice of the discovery of the property of the light emitted by incandescent coke to blacken photogenic paper; and proposed it as a substitute for solar light, or that from the oxy-hydrogen blowpipe with lime. One of the most important applications of the photogenic process, as yet suggested, is its adaptation to the self-registering of long-continued instrumental observations. Unless, however, an artificial light, of a simple and inexpensive character, can be found to supply the place of solar light at night, the utility of this application will be much limited. Few artificial lights emit enough of the chemical rays to act with certainty on the prepared paper; while those which are known to act well, as the oxy-hydrogen lime light, are expensive, and difficult to manage. A considerable time since, the author discovered that the light emitted by incandescent coke, at the "Twyer" (or aperture by which the blast is admitted) of a cupola or furnace for melting cast iron, contained the chemical rays in abundance; and on lately trying the effect of this light on the prepared paper, he found it was intensely blackened in about forty-five seconds. In the single experiment made, the heat, which was considerable, was not separated from the light; but the author purposed to make further experiments, in which this precaution will be attended to. There is no difficulty to be apprehended in contriving an apparatus to burn a small quantity of coke at a high temperature. A diagram of an apparatus for this purpose was shown.

Rodda's Patent Method of Consuming Smoke.—Amongst the numerous patents which have lately been obtained for plans for consuming smoke, there are none which can vie in simplicity with that invented by a Mr. Rodda; and its efficiency, as far as it has been tried, has been unequivocally attested by the engineer and others who have superintended the operation of the plan at Truman, Hanbury and Co.'s brewery. The method adopted is to partition of a portion of the back of a furnace with fire-brick, so that when the coal has been coked in the fore part, it is thrust into the hinder division, and the smoke from the freshly supplied coal being compelled to pass over the incandescent coked fuel, is consumed. The principal merit of this invention is in its simplicity, consisting merely of a few fire-bricks, which may be placed in any furnace without expensive alteration. We shall hereafter publish a full description and engravings of the plan.—*Mechanics' Magazine.*

Pontypool Iron Trade.—On Tuesday, the 14th ultimo, was started for the first time, the new forge erected at Pontnewyneld (near this town), by the Pentwyn and Golynos Iron Company. The powerful engine, with all its complication of machinery, trains of rolls and hammers, were set in motion in the presence of a large assemblage of spectators, who cheered heartily as the first bar was rolled out; and went off in it manner that reflected the highest credit on the engine manufacturers who erected a (Messrs. Otway and Winnington, of Staffordshire) and much to the satisfaction and pleasure of those proprietors who were present on the occasion. This large work being so near to the town, promises great advantages to the tradesmen of Pontypool.—*Monmouthshire Merlin.*

Sir James Anderson's Steam Carriages.—The indefatigable exertions and untiring energy of this scientific gentleman, have at length been crowned with complete success. The first of these carriages, built for the English Steam Coach Company, has been dispatched to London *via* Dublin. Previous to its starting, it underwent repeated experimental trials of its power and capabilities. Too much praise cannot be awarded to Sir James Anderson for his perseverance, despite of every obstacle, universally believed by his friends that "he was hoping against all hope." The ultimate satisfactory accomplishment of his object must, independently of the great pecuniary gains which will certainly result from it, prove a rich reward for all his labours and disappointments, and ought to hold out encouragement to our scientific countrymen, not to be deterred by the most apparently stupendous difficulties, which, as in this case, may be overcome by zeal and industry.—*Cork Standard.*

The Atmospheric Railroad.—A second series of experiments, with models, upon a modelled railroad, of Clegg's atmospheric principle of propelling carriages by means exhausting a tube laid down the line of road to be traversed, of the air contained in it, and creating a vacuum, was made on Tuesday forenoon at the iron works of Messrs. Samuda, Southwark. The tube being exhausted by means of an air pump, the models, the leading one having a piston which forced open the valve of the tube, proceeded at a rate of extreme velocity along the line, a distance of thirty or forty yards, the ascent being one foot in thirty. The models were heavily laden, each carrying a couple of persons, and upwards of 15 cwt. of ballast being disposed over the whole. There were present several members of Parliament, and railway directors, engineers, &c. The machinery performed to perfection, and gave general satisfaction. The advantages that this system proposes, both for the public and the railroad proprietors, are very obvious—cheapness, security, speed, and no danger of explosion; it is, in fact, free from those disadvantages which the present system in operation abounds in. —*Daily Papers*

LAW PROCEEDINGS.

CLARIDGE'S PATENT ASPHALTE.

VICE-CHANCELLOR'S COURT, WEDNESDAY, MAY 8.

Claridge v. Louis Latrade.

Mr. Wigram, Mr. Richards, and Mr. Chichester, moved to dissolve an injunction obtained upon notice on the 13th of February, whereby the defendant was restrained from forming a mastic cement or composition by means of heat, of asphalte or asphaltic rock from Val de Travers, or any other natural composition consisting principally of lime and bitumen, with a small portion of aqueous or other matter, by whatever name such compound might be called or known, with bitumen, or mineral, or other pitch, and from laying down in Oxford-street or elsewhere any blocks formed of such mastic, cement, or composition, and granite or other stone, or with any mixture of grit and sand, and from cementing such blocks, or from selling or putting in practice the plaintiff's invention. The plaintiff was the patentee of the well-known invention employed in paving some parts of the metropolis, which he described in his specification to consist of a natural compound extracted in masses from mines at Pyrmont, near Seyssel, in the department of l'Ain, and other parts in the Jura Mountains, which contained, in addition to a small portion of aqueous matter, about 90 parts of carbonate of lime, and 10 of bitumen, and which was reduced by means of heat to a mastic cement or composition, and united with bitumen or mineral, or other pitch. This, combined with sand or gravel, formed a substance applicable to paving and road making, and was an invention the plaintiff claimed under his patent granted in November, 1837. The defendant had obtained a similar natural compound or asphalte from Val de Travers, and had produced a mastic composition resembling the plaintiff's, using only tar instead of pitch, which he also applied to the purposes of making roads and pavement. A portion of it had been laid down with the other experimental pavement in Oxford-street, but, as it was merely intended for experiment, had been compounded with pitch, and not with tar. It was now contended the defendant's invention was no infringement of the plaintiff's patent, tar being a substance that contained many component parts, of which the pitch or bitumen used by the plaintiff was only the residuum. It was also shown from several scientific and philosophical dictionaries that asphaltum had been used in various parts of the globe for making walls and pavements many years before the plaintiff obtained his patent, and that therefore the invention had not a sufficient claim to novelty to support it. The defendant also alleged that before the bill was filed Mr. Claridge had assigned his patent to a company who were not made parties to the suit. On these grounds it was contended the injunction ought to be dissolved.

Mr. K. Bruce, Mr. Jacob, and Mr. Ellis supported the injunction. The only question was whether the tar admitted by the defendant to have been used by him in forming the composition was not in effect precisely the same as the bitumen which constituted the only disputed ingredient of the patent. Whether the asphalte came from Seyssel or from Val de Travers, its properties were the same, and both were embraced by the specifications: so that it only remained to be shown from an affidavit the defendants had not thought proper to read, and which had received no answer, that the tar in fact became in the process of heating converted into pitch, and that every portion of the defendant's composition was identical with that included in the plaintiff's patent. The learned counsel then read the affidavit of Mr. Woolrich, a professor of chemistry at Birmingham, which stated that tar consisted of volatile and aqueous matter and pitch, and that in order to combine tar with asphalte to make a mastic cement, heat must necessarily be used, which caused an evaporation of the volatile properties, and that the only portion of the tar which entered into the combination was asphalte and the pitch which the tar contained.

The Vice-Chancellor said it was the simplest case in the world. It came to no more than this, that the plaintiff took out a patent for a combination by heat of asphalte with bitumen or mineral, or other pitch, so as to produce a composition applicable to the purpose of paving and so on; and then it was said the defendant had not infringed the patent because he had used a combination, by means of heat, of asphalte with tar. The defendant admitted that a portion of the pavement laid down in Oxford-street was made with asphalte and pitch, but that occurred before the discussion arose. Then the question was, whether it was an infringement of the patent to substitute tar for pitch. If the effect of combining asphalte with tar by means of heat was to leave the tar in a state of combination in respect to itself, in its own original state, and possessed of all its qualities, so that the composition should contain asphalte as such, and tar as such, there might have been no infringement of the patent; but if the necessary process of attempting to combine them by means of heat was, that those circumstances and things which constituted the distinction between tar and pitch were taken away, and the residue of the tar only formed a combination of asphalte and pitch, he thought, for the purpose of considering whether there had been an infringement of the patent, tar and pitch must be considered the same. So that he was of opinion, upon the evidence before him, the defendant ought not to be at liberty to go on thus violating the patent, and the injunction must be continued, the plaintiff bringing forthwith such action as he should be advised to try the validity of the patent, and whether what the defendant had done amounted to an infringement.

EASTERN COUNTIES RAILWAY.

The Queen v. the Directors of the Eastern Counties Railway Company.—In the Court of Queen's Bench, May 6, 1839, before Mr. Justice Williams.—The Attorney-General said that he was instructed to make an application to the court, the success of which would, he hoped, produce the most salutary consequences to the public in respect of the company against which he applied, as well as all others of a similar description. The object of the application was to compel the defendants to perform the whole of the contract which they had entered into with the public, and to prevent them from picking out some particular parts of it, and executing only those parts, as being the only parts likely to be beneficial to themselves. It appeared that the company had been established in 1836, by the 6th and 7th William IV., chap. 106, and that the act of Parliament was for laying down a railway from London to Norwich and Yarmouth, through Colchester, Ipswich, and several other intermediate towns. The undertaking, upon the supposition that it would be carried on throughout the whole of the line described in the act, had met with great encouragement and support from the landowners of Norfolk and Suffolk, and upon the same ground the landowners of Essex made no objection to its passing through their properties. It now appeared, however, that the directors wanted only to make the road from London to Colchester, and no further. If an application for that part of the original line had been made to Parliament in the first instance, it never could have succeeded. But the company having proposed to make a road from London to Yarmouth, now intended to stop at Colchester, which, as the learned counsel contended, was a manifest breach of faith with the landowners of Norfolk and Suffolk, and with the general body of the shareholders. The manner in which the company proposed to effect their object was by placing themselves in such a situation that they could not by law continue the line beyond Colchester. It appeared that some deviations from the original line between that point and the more northern parts were provided for by another act procured by the company, the 1st and 2nd Victoria, c. 81, in the 2nd section of which act it was directed, that unless such deviations should be laid out before the 27th of July, 1839, it should not be lawful for the company to proceed with that part of the line at all. The company therefore, by merely omitting to lay out the line of the deviation, would place themselves in the position which they desired, and would have no power in law to proceed beyond Colchester. They had been called upon several times by parties interested in the undertaking to mark out the deviation, but had refused to do so, for reasons which were sufficiently obvious from the statements which he (the Attorney-General) had addressed to the court. The learned gentleman then referred to the case of "The King against the Severn and Wye Railway Company," 2 B. and A., in which the defendants were commanded by this court to make a road for the public accommodation. A railway was not a private way, but a common highway, and any other person as well as the company may travel upon it with his own engines, upon observing the necessary regulations. In the case referred to, it had been admitted by the court that the defendants were liable to an indictment for not laying down the railroad; but, as such a proceeding, however it may afford the means of punishing the defendants, could not procure any accommodation to the public, the court granted a *mandamus* commanding the company to do what was desired. The circumstances of the present case were exactly the same. The company had, by their act of Parliament, entered into a contract with the public, who could not have the advantage which the legislature intended they should derive from the proposed undertaking, unless it were completed altogether. It was quite clear that the company could not legally stop at the end of half a mile, as the road would, by that means, become a public nuisance. They were, therefore, bound to proceed, stage by stage, until they arrived at the termini appointed by the act. The affidavit was from a great number of landowners in the neighbourhood of that part of the line which ran from Colchester to Yarmouth, a distance of about 70 miles. The other deponents were shareholders in the concern and all swore that they, as well as the public, would be very seriously prejudiced unless the company should be compelled to complete their line according to the original plan. In these circumstances, his application was for a rule calling upon the defendants to show cause why a *mandamus* should not issue, commanding them to proceed to point out the deviations referred to, so that the whole of that duty might be performed before the 27th day of next July.

Mr. Justice Williams inquired why, in a case of so much novelty and importance, the Attorney-General had not applied to the full court?

The Attorney-General answered, that in the state of business in that court, he had not been able to obtain an opportunity to make the application there.

Mr. Justice Williams observed, that the case was certainly one of great importance and granted the rule.

HARBOURS ON THE SOUTH-EASTERN COAST.

We are glad to see that Government are awakening to this important subject, and that there is a prospect of something being done. We only hope that it is not a job. We give below an extract from the debate on the 2nd ultimo, in the House of Commons:—

HARBOURS ON THE SOUTH-EASTERN COAST.

May 2.

Mr. E. Rice moved, pursuant to the notice he had given, for an address to inquire into the state of the harbours on the south-eastern coast. The question was one which had met the approbation of all the distinguished naval officers in and out of that house with whom he had conversed. It was the more necessary that our south-eastern harbours should be placed in a fit and safe state for the reception of vessels, as we were about to have a greatly increased intercourse with the continent. A line of railroad from London to Dover had received the sanction of the legislature, and was now in a state of considerable forwardness; and a line of railroad from Calais and Boulogne to Paris had received the sanction of the French Chambers. When these were completed, it was natural to expect a vast increase of intercourse between London and Paris, and other parts of the continent. Under these circumstances, the condition of the south-eastern harbours was a matter of considerable importance. He did not wish by his motion to pledge the Government to any outlay of money; all he wanted at present was, an examination of the condition of those harbours by scientific men. He had brought forward this motion as the representative of a port where the necessity of such improvement was greatly felt.

Mr. S. Rice stated that he did not wish to throw any difficulty in the way of the honourable member's proposition. It was highly important that both Government and Parliament should have the best information that skill and science could give on this subject; but he wished it to be distinctly understood to what extent he was willing to go, because, if undue expectations were excited respecting this inquiry, and if it were thought that Government would expend large sums of money in obtaining information respecting these harbours, the result would be to paralyse all private and local efforts for effecting the object in contemplation. In consenting, therefore, to this inquiry, he wished it to be clearly understood that it was only so far that he would go, and no further. The first was to consider the present state of the harbours, and the next would be to consider the best mode of improving them; the latter, however, would depend upon local questions; and the greatest good that could be done was to give the persons locally connected with them the best information that could be obtained.

PARLIAMENTARY PROCEEDINGS.

House of Commons.—List of Petitions for Private Bills, and progress therein.

	Petition presented	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour	Feb. 6.	Feb. 27.	Mar. 12	April 15	—
Aberdeen Harbour	Feb. 8.	Mar. 15.	April 15.	—	—
Ballochney Railway	Feb. 12.	Mar. 14.	April 8.	May 3.	—
Barnsley Waterworks	Feb. 21.	—	—	—	—
Bath Cemetery	Feb. 22.	—	—	—	—
Belfast Waterworks	Feb. 22.	—	—	—	—
Birmingham Canal	Feb. 20.	Mar. 15.	April 12.	—	—
Birmingham & Gloucester Railway	Feb. 21.	Mar. 15.	April 8.	—	—
Bishop Auckland & Weardale Rlwy.	Feb. 22.	Mar. 18.	April 15.	—	—
Blackheath Cemetery	Feb. 22.	Mar. 18.	—	—	—
Bradford (York) Waterworks	Feb. 21.	—	—	—	—
Brighton Gas	Feb. 21.	Mar. 18.	—	—	—
Brighton Cemetery	Feb. 21.	Mar. 18.	—	—	—
Bristol and Gloucestershire Railway	Feb. 21.	Mar. 7.	Mar. 19.	May 13.	—
British Museum Buildings	Feb. 22.	—	April 12.	May 2.	—
Brompton New Road	Feb. 22.	Mar. 18.	April 30.	—	—
Cheltenham Waterworks	Feb. 22.	Mar. 12.	Mar. 22.	—	—
Commercial (London and Blackwall) Railway	Feb. 14.	Mar. 8.	Mar. 21.	—	—
Dean Forest Railway	Feb. 19.	—	—	—	—
Deptford Pier	Feb. 22.	Mar. 18.	—	—	—
Deptford Pier Junction Railway	Feb. 22.	Mar. 20.	—	—	—
Deptford Steam Ship Docks	Feb. 22.	—	—	—	—
Edinburgh, Leith, and Newhaven Railway	Feb. 19.	Mar. 11.	Mar. 27.	—	—
Eyemouth Harbour	Feb. 12.	—	April 8.	—	—
Fraserburgh Harbour	Feb. 20.	—	April 8.	April 10.	—
General Cemetery	Feb. 20.	Mar. 11.	Mar. 21.	—	—
Gravesend Gas	Feb. 21.	Mar. 18.	—	—	—
Great North of England Railway	Feb. 18.	Mar. 13.	Mar. 25.	May 3.	—
Great Western Railway	Feb. 14.	Mar. 4.	Mar. 13.	May 1.	—
Great Central Irish Railway	Mar. 12.	—	—	—	—
Herefordshire and Gloucestershire Canal	Feb. 20.	Mar. 13.	—	—	—
Herne Gas	Feb. 22.	—	—	—	—
Liverpool Docks	Feb. 21.	—	—	—	—
Liverpool Buildings	Feb. 21.	—	—	—	—
Liverpool and Manchester Extension Railway	Feb. 14.	Feb. 28.	Mar. 12.	May 13.	—
London and Birmingham Railway	Feb. 8.	Feb. 22.	Mar. 6.	—	—
London Bridge Approaches, &c.	Feb. 19.	April 11.	April 26.	—	—
London and Croydon Railway	Feb. 19.	Mar. 18.	April 8.	May 3.	—
London Cemetery	Feb. 19.	Mar. 18.	—	—	—
London and Greenwich Railway	Feb. 21.	Mar. 18.	April 8.	May 3.	—
London and Southampton (Guildford Branch) Railway	Feb. 22.	—	—	—	—
London and Southampton (Portsmouth Branch) Railway	Feb. 6.	Feb. 25.	Mar. 7.	May 3.	—
Manchester & Birmingham Railway	Feb. 18.	Mar. 18.	April 23.	—	—
Manchester and Birmingham Extension (Stone & Rugby) Railway	Feb. 11.	May 1.	May 14.	—	—
Manchester and Leeds Railway	Feb. 18.	Mar. 8.	Mar. 19.	—	—
Marylebone Gas & Coke Company	Feb. 22.	Mar. 18.	—	—	—
Monkland & Kirkintilloch Railway	Feb. 12.	Mar. 14.	April 8.	May 3.	—
Necropolis (St. Pancras) Cemetery	Feb. 21.	Mar. 15	—	—	—
Newark Gas	Feb. 14.	Feb. 28.	Mar. 11.	April 18.	—
Newcastle-upon-Tyne and North Shields (Extension) Railway	Feb. 18.	Mar. 15.	—	—	—
Northern & Eastern (No. 1) Railway	Feb. 22.	Mar. 18.	—	—	—
Northern & Eastern (No. 2) Railway	Feb. 22.	Mar. 27.	April 16.		
North Midland Railway	Feb. 11.	Mar. 4.	Mar. 14.	May 1.	—
North Union Railway	Feb. 22.	—	—	—	—
Nottingham Inclosure and Canal	Feb. 10.	Mar. 18.	—	—	—
Over Darwen Gas	Feb. 21.	—	April 12.	—	—
Perth Harbour and Navigation	Feb. 14.	—	—	May 2.	—
Portishead Pier	Feb. 22	—	—	—	—
Preston Gas	Feb. 6.	Feb. 20.	Mar. 6.	Mar. 19.	—
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	—
Preston and Wyre Railway, Harbour, and Dock	Feb. 21.	Mar. 18.	April 12.	—	—
Redcar (No. 1) Harbour	Feb. 19.	—	—	—	—
Redcar (No. 2) Harbour	Feb. 22.	Mar. 27.	—	—	—
Rishworth Reservoirs	Feb. 21.	Mar. 6.	Mar. 26.	—	—
Rochdale Waterworks	Feb. 7.	Feb. 21.	Mar. 6.	May 6.	—
Rochester Cemetery	Feb. 22.	Mar. 18.	—	—	—
Sawmill Ford Bridge and Road	Feb. 21.	Mar. 18.	—	—	—
Slamannan Railway	Feb. 12.	Mar. 18.	Mar. 27.	—	—
South Eastern Railway	Feb. 11.	—	Mar. 25.	May 15.	—
South Eastern (Deviation) Railway	Feb. 22.	May 6.	—	—	—
Teignmouth Bridge	Feb. 21.	—	—	—	—
Tyne Dock	Feb. 22.	Mar. 15.	May 7.	—	—
Tyne Steam Ferry	Feb. 21.	—	—	—	—
Walsall Junction Canal	Feb. 22.	—	—	—	—
West Durham Railway	Feb. 21.	Mar. 18.	April 8.	May 14.	—
Westminster Improvement	Feb. 21.	—	—	—	—
Wishaw and Coltness Railway	Feb. 12.	Mar. 14.	April 8.	May 3.	—
Wyrley and Essington and Birmingham Canal	Feb. 18.	—	—	—	—

STEAM NAVIGATION.

Steamers from the Clyde to New York.—A joint-stock company is now forming in Glasgow, for carrying passengers and merchandise between the Clyde and New York, by means of an iron steam-ship of great power and capacity, to sail at the rate of at least sixteen miles an hour, thereby making a passage in about ten days, and enabling this vessel to make nearly a monthly voyage to America. The capital to be £50,000.—*Glasgow Chronicle.*

Iron Ships.—The *Ironsides*, the first sailing vessel constructed of iron, which has ever crossed the Atlantic, has just returned to Liverpool with a cargo of cotton from Brazil, after a passage of forty days, though during the whole trip light winds prevailed. This has completely established the practicability of navigating the ocean in ships of iron. The compasses, whose action it was predicted would inevitably be deranged, worked very correctly; and the superiority of the material of which the vessel is built, is proved by the fact, that in the course of the whole voyage it was never once necessary to use the pumps. In fact her hull is absolutely water-tight. The success of this experiment is highly important, occurring, as it does at a time when timber is scarce and dear. So little has the *Ironsides* suffered from exposure to wind and weather, that her appearance would induce the belief that she had but lately been launched. Her tonnage is 264; draft of water aft, 8ft. 7 in. and forward 8ft. 3 in.—[This is a very important notice, and we commend it to the consideration of our commercial readers. In the adoption of iron ships several points are to be considered. Economy and durability, we suppose, are in their favour. Their sailing qualities seem by this experiment to be at least equal to those of wooden ships; but these depend less upon the material of which a vessel is built than upon her model. The thing that strikes us most, however, is the extreme buoyancy of the iron ship. She is said to be 264 tons—we presume by the new mode of admeasurement: if so, she carries probably 400 tons, and yet she draws only about eight and a half feet of water, or perhaps, with a heavier cargo, nine and a half feet or ten feet at the utmost! Now, the great drawback upon the profit of the coasting trade, at least in this part of England, is the impossibility of constructing a vessel that will carry a large cargo with a draft of water suitable to our tide-harbours. A vessel of one hundred tons will draw as much water as this ship; and if the burden be carried up to 150 or 200 tons, the draft of water becomes a serious impediment, and what is gained in freight is lost in frequent and vexatious delays, and in injuries sustained from grounding on bars and sandbanks. But a vessel of 100 tons cannot be sailed in winter, and ought not to be sailed at any time, with fewer than four men and a boy; making for four such vessels twenty hands; while such a ship as the *Ironsides* might be sailed with twelve or fourteen hands at all seasons. But will an iron ship take the ground with a heavy cargo? That seems to us the principal question; and if it be found that she will—if it be found that a ship of large burden can be so constructed as to be fit for all the purposes of the coasting trade, and capable of enduring the severe trials to which the best and strongest ships are exposed in it, and yet so buoyant as to enter all the Welsh and Cornish ports, at neap tides—if this be ascertained, we may expect in a month or two, to see half the smiths of Hayle and Neath turned into shipbuilders.—Ed. *Cornwall Gazette.*]

English and American Steamers.—The Hon. S. Cunard has contracted to convey the mails from England to Halifax twice a-month, in steamers of not less than 300-horse power; the first vessel to leave Liverpool on the 1st of May, 1840. The contractor to forward the mails to Boston in small steamers, and to run a steam-boat between Pictou and Quebec. Contract for seven years at 55,000*l.* sterling per annum.—*Manchester Guardian.*

Steam-boat Explosion.—A steam towing-vessel, the Venus, met with an accident at Havre. While it was towing out a brig into the roadstead one of the boilers blew up. A boy was seen to be thrown up into the air, along with broken planks, &c., but his body has not since been found, and the stoker and engineer were both severely injured.—*Galignani's Messenger.*

PROGRESS OF RAILWAYS.

South Eastern Dover Railway.—Between Dover and Folkestone the works are progressing rapidly, the tunnel (or tunnels, for there are two parallel to each other) through Shakspere's cliff, has been for a length of time opened from end to end, and the enlargement of them has progressed considerably, these tunnels are each twelve feet wide and thirty feet high formed with a pointed arched roof; the pier or space between the tunnels is ten feet in thickness, and where the shafts have been sunk from the surface, there is a lateral opening connecting the two tunnels, these openings being formed of the same height as the tunnels, and its roof being similarly excavated forms a groined roof, which has a remarkably good effect, there are seven shafts and consequently seven of these openings in the length of three quarters of a mile. The eastern face of the tunnel is formed by excavating the chalk to the depth of 110 feet which is now being finally trimmed down. At the western face of the tunnel a splendid piece of side cutting presents itself, upwards of 150 feet high. Westward of this tunnel, the sea wall of concrete to protect the railway embankment has been commenced; it is contracted for by Mr. Lambert, the contractor, who executed the concrete sea wall at Brighton; the wall at Dover will average 50 feet in height and about three quarters of a mile in length; the railway along this portion of the line is to be formed partly of side cutting from the cliffs and partly of embankment which the concrete wall is intended to protect, groins will hereafter be carried out into the sea to collect the beach for the further security of the works. Between the sea wall and Folkestone two other tunnels are to be constructed, the shafts of which are sunk nearly to the required depth, and which, together with other preliminary works, are nearly completed; it is expected, therefore, that the excavation of these two tunnels will be proceeded with forthwith; preparations are also making for the erection of an oblique bridge of two arches over the junction of the Dover and Canterbury roads near Folkstone.

London and Birmingham Railway.—On the 20th instant, the speed of the mail trains on the London and Birmingham Railway will be accelerated. The day mail will leave the Euston-grove station at half-past 9 in the morning, and will arrive in

Birmingham in 5 hours. A stoppage of 8 minutes will be allowed at Tring, 10 minutes at Wolverton, 3 minutes at Weedon, and 9 minutes at Coventry; making a total of 25 minutes occupied by the stoppages, and only 4 hours and 35 minutes in performing the journey of 116 miles 6 furlongs. The day-mail train from Birmingham will accomplish the journey in the same time, allowing the same stoppages at the different places above-mentioned. The night mail train will leave Euston-grove station at half-past 8, and complete the distance in 5 hours and a half; the stoppages to be for the same periods and at the same places as those named for the day-mail trains.

North Midland Railway.—The Yorkshire directors of this important public undertaking have, during the present week, been examining into the progress of the whole work in their county. They commenced at the Treeton contract, near Derbyshire, and walked nearly the whole distance to Woodlesford, a tract of about thirty-seven miles. The works in every part of the line were found to be proceeding most satisfactorily, so as to afford the best ground for expecting that the whole line will be completed by the time specified in the contracts—namely, the close of the present year; and we hope that early in the spring of 1840 the travelling and carrying business of the line will be in full operation. Owing to the obstacles in the way of the company until very recently, that portion of the line between Woodlesford and Thwaite Gate has not yet been commenced: these difficulties are, however, now removed, and the contracts for the few miles will be let during the present month, with a view to the entire line up to Thwaite Gate being opened at the close of the year. The railway is in a still more advanced state in Derbyshire than in Yorkshire.

Clay Cross Tunnel.—It is expected that this Herculean department of the North Midland Railway will present a clear passage from one end of it to the other in July next. 1,500 yards are completed. The portion contracted for by Messrs. Harding and Cropper is finished; and the excavation remaining to be completed extends somewhere between two and three hundred yards.—*Leeds Intelligencer.*

As the *Derby and Birmingham Railway* is expected to be open in July, as soon as the North Midland is completed, there will be an unbroken railway conveyance all the way from Leeds to London, except one mile at this end, which we hope will soon be supplied. No fewer than 8,000 men are directly employed on the line, to say nothing of the very great number indirectly employed, as brickmakers, &c. in order to complete this great undertaking.—*Leeds Mercury.*——The open cutting through the town of Belper is expected to be completed in about four months. The bridges over the several streets and lanes are commenced, as are also the retaining walls, for which a vast quantity of stone is prepared. The bridge for the new turnpike road, north of Belper, is completed, and will soon be ready for use. The passage under the bed of the Gromford canal at Bull Bridge, has been open some time, and the works are proceeding there with great activity. The last of the foundations of the large bridge over the Derwent, near Amber Gate, was put in this week, considerable difficulty has been experienced here, as the workmen have been many months, night and day, at work, assisted by a powerful steam-engine.—*Derby Reporter.*

Glasgow and Ayrshire Railway.—We have stated, from time to time, the progress of the works on this line of railway between Ayr and Kilwinning; and we are now gratified in being able to communicate that the operations thence towards Glasgow are also proceeding with great spirit, so that no doubt is entertained that the entire line will be open to the public by May, 1840. But we believe it is still the intention of the directors to open that part of the line between Ayr and Irvine some time during the present summer. There have been of late, at the ports of Ayr and Troon, numerous arrivals of cargoes of rails, from Newport in Wales, which are being laid down permanently. The freights on these we hear have fallen from 15s. to 10s. per ton. We understand that while the harbour dues exacted at Ayr for these rails are only at the rate of 4d. per ton, those at Troon are 18d. The erections at the depôts, both here and at Irvine, are proceeding expeditiously.—*Ayr Advertiser.*

Cheltenham and Great Western Union Railway Company.—Extracts from the Report of the Directors, May 1, 1839.—Since the last general meeting contracts have been made for the formation of the line from the Barnwood-road to the Gloucester depôt, and also for sinking the permanent shafts in the Sapperton tunnel.

All these contracts have been satisfactorily let to responsible parties.

By the amended Act of last session it was provided, that all the land required for the railway, between the depôts at Cheltenham and Gloucester, should be purchased and paid for on or before the 25th of March last; which enactment has been fully carried into effect.

The contracts for the execution of this part of the line expire in March 1840; and from the progress made during the winter, and the very unfavourable season during which the works have hitherto been carried on, there can be no doubt of the ability of the contractors to complete their works within the prescribed period.

About 160,000 yards of earth have been excavated during the past winter, and there remain about 400,000 to complete. The masonry and brickwork are in an advanced state. The ballasting for the permanent way is also preparing; and your Directors have taken measures for securing an ample and early supply of such of the other materials as require time to prepare, so that no delay may hereafter occur in completing this important part of the work.

Every preparation is making for proceeding with the construction of the depots at Cheltenham and Gloucester, in the arrangements of which your Directors propose to study every possible economy consistent with the accommodation of the public, on a part of the line where so very large a traffic must ultimately be provided for.

Of the 17¼ miles from Cirencester to Swindon, the land on 15¾ miles has been contracted for, and a large proportion has been taken possession of and paid for. The works on this portion, which had been let just before your last meeting, have been commenced at different points as rapidly as the land required could be procured, and are now proceeding satisfactorily, and your Engineer has no reason to doubt that they will be completed by the periods fixed in the contracts, which all expire in the latter end of 1840. These periods are calculated so as to allow of the whole distance from Swindon to Cirencester being opened simultaneously, or as nearly so as possible with the opening of the line of the Great Western Railway from London to Swindon. Upon this district, as upon that between Cheltenham and Gloucester, although commenced later, and consequently not proportionably advanced, it is satisfactory to be able to state that as much has been done as the season and other circumstances could allow of, and that the works are in that state which admits of the full advantage being taken of the more favourable period of the year which we have now entered upon. Five of the permanent shafts of the Sapperton tunnel are proceeding very satisfactorily. Three of them have already reached rather more than half the required depth, and the other two about one third—no difficulties have been experienced, and at present there is every appearance of the materials through which the tunnel itself will be excavated, being as favourable for this work as was originally anticipated. The sixth shaft will not be so deep as the others; some difficulty has occurred in procuring the land, but there is now every prospect of this cause of delay being speedily removed, and that all the shafts will be ready by the autumn of this year, so that the tunnel may be commenced as soon after as may be desired. The preparatory steps necessary for setting out the works and determining the lands required in the Stroud Valley, have been put in hand and are nearly completed. The Directors have agreed with the Birmingham and Gloucester Railway Company for the purchase of about four acres of land at Gloucester near the Cattle Market for their depôt at Gloucester. It was provided by the Act of Parliament that there should be one principal depôt at Cheltenham for the joint use of the Companies, to be formed at the expense of this Company, and a similar depôt at Gloucester to be formed at the expense of the Birmingham and Gloucester Company; but it has been apprehended that, under the particular circumstances, much confusion and inconvenience might result in practice from that arrangement, and the Directors of the two Companies have therefore come to an agreement to have distinct depots at both places, to be formed separately by each Company—an arrangement which will contribute greatly to the facility and regularity of management in the traffic of both lines.

Glasgow, Paisley, and Greenock Railway.—On Saturday, the 11th ultimo, the Directors made their periodical visit to the road. After inspecting the new carriages at Glasgow, which are of the most elegant and comfortable description, they proceeded along the line to Greenock, examining every part of the works with much attention. Between Glasgow and Paisley the progress is rapid, and a great part of the permanent road is in course of being laid. The drift-way through the Arkleton tunnel is almost completed, and the tunnel is widened out for a considerable part of its length. In Paisley the bridge and walls are very forward, and the large bridge over the Cart has its centre ready for turning the arch. Proceeding westward beyond Paisley, the walls and embankments are creeping up, and the railway is already carried over the moss. The consolidation is becoming daily more apparent, and there is no doubt that an excellent bit of road will be the result of the precautions adopted. At Bishopton all is bustle and activity, and nowhere is there greater evidence of the late delightful weather. Between West Ferry and Port Glasgow the work is comparatively light, and has made great progress since the last inspection.—*Greenock Advertiser.*

Great Western Railway.—The travelling on the line to Maidenhead has greatly increased with the favourable change in the weather, and appears likely, as the summer comes on, greatly to exceed that in the corresponding period of last year. During the week ending the 5th inst. upwards of 12,000 passengers were conveyed, and the receipts, we believe, exceeded 2,000*l.* The Directors have concluded contracts for some miles of the road between Bath and the village of Box, and the contracts lately advertised will complete the entire line between Bristol and London, with the exception of a small portion near Bath, and one or two bridges, for which the plans will soon be ready. We understand that, generally speaking, the works along the line are pushed forward with great energy, and though much remains to be done before the bridges and tunnels in this vicinity can be completed, there seems no doubt that the line to Bath will be ready for traffic in the course of the next nine months. About half a mile of the great tunnel at Box is now completed, and not the slightest difficulty exists in keeping the works free of water. Where the excavation is carried through the oolite, or freestone, the work proceeds with a rapidity greater than that required by the contract; and as this may be considered the key to the whole line, we have no doubt the Directors will take care that no unnecessary delay takes place in its completion.—*Bristol Mercury.*

Sheffield and Rotherham Railway.—A slendid locomotive engine from the manufactory of Messrs. Fenton, Murray, and Jackson, of Leeds, called the *Agilis*, has arrived at the Sheffield station of the Sheffield and Rotherham Railway, and is now in active operation upon the line. We understand that some of its excellencies consist in being provided with flanges on each side of the six wheels, thereby affording additional safety from being run off the rails, compared with those engines whose driving wheels are without that very material part. Another advantage which it possesses, is that if either one or all the excentrics which move the valves, were broken, disarranged, or even lost off or taken away, it is still under the control and management of the engineer, who can safely conduct it along the railway nearly as well as if those parts had remained entire.—*Sheffield Mercury.*

Eastern Counties' Railway.—The company have commenced laying the foundation and building their warehouses and offices, at the station adjoining the Red Lion, at Ilford, for the purpose of receiving and warehousing goods, and landing passengers. They will be very extensive and convenient. The buildings at the Shoreditch terminus will shortly be commenced. The Northern and Eastern Railway, which is to join the Eastern at Stratford, will of course bear a part of the expense; the Bill to so far unite them being in Parliament, and is expected to pass without opposition. The terminus will command the trade and traffic from the north and west part of the metropolis, and of England, and is not more than half a mile from the centre of the city of London. At Ilford the permanent rails are laid down nearly as far as Mr Curtis's brick-field, and the works are proceeding very rapidly. The railway from Mary-le-point as far as is completed, to the east of Ilford, is said by competent judges to be the best piece of railway in the kingdom. The state of the bridge over the turnpike road between Ilford and Chadwell, still continues in a very unsatisfactory condition, and nearly all the magistrates of the county have been and examined it during the last week, and insist on having the walls of the bridge carried higher, in case horses should take fright and jump over them; and also walls on the sides of the approaches. The company appear to have got into a labyrinth respecting this bridge, which will require all their wisdom and talents to extricate them from.—*Essex Standard.* We understand that it is now fixed to open the line from London to Romford, the first week in June, and shortly after from Romford to Brentford, a distance of 19 miles; there are about 7,000 persons employed on this great undertaking besides several locomotive engines and horses.—*Suffolk Herald.*

Bristol and Exeter Railway.—The directors are pledged to open the line to Bridgwater, before they proceed with the works to Taunton, in order to make the outlay as small as possible before an income can be secured; but if a single line to Taunton can be constructed for a few thousands more than a double one to Bridgwater, and if the additional income, when it is open to Taunton, will be at least 20,000*l.* a year, I think it is the duty of the directors to adopt for the present a single line.—*Bristol Gazette.*—The works on this line are proceeding with great spirit and effect as far as Bridgewater, to which town the line is expected to be opened from Bristol next spring. The works are also proceeding steadily westward, and no doubt exists of the intention of the Board to carry the line on to its final destination without making a temporary halt at Taunton.

Bolton and Preston Railway.—The workmen are proceeding rapidly with the works on this line of railway. The rails are now laid down as far as the footpath leading up to Dean Church. Further up the valley, Lady Bridge has been taken down, a temporary wooden bridge has been erected in its stead at a short distance, and the workmen are now engaged at a magnificent stone bridge on the site of the former one. The line from Bolton to Preston will be one of the most picturesque in the north of England.—*Preston Observer.*

The Manchester and Leeds Railway.—The directors of the Manchester and Leeds Railway, accompanied by their engineer, Mr. Gooch, inspected the works of the line between Manchester and Todmorden, on Friday, the 17th ult., proceeding by the Stanley engine, made by Robert Stephenson and Co., from Rochdale to the summit tunnel; this part of the line being already complete, although the time contracted for has not yet expired.

Newcastle and Carlisle Railway.—The works of the Newcastle and Carlisle Railway, on the north side of the river Tyne, are rapidly progressing towards completion. —*Newcastle Journal.*

ENGINEERING WORKS.

River Coquet.—We are glad to find that some enterprising parties have obtained an Act of Parliament, and are about to carry into effect considerable improvements at the mouth of the River Coquet, about twenty miles northward of the River Tyne, for the purpose of shipping coals and corn to the London markets, and importing the various other necessary commodities for which the extensive surrounding districts stand much in need. The works are designed by Sir John Rennie, and we hear that they are calculated to render the port as effective as the Tyne or the Wear. These works necessarily prove of considerable public benefit, combined as they are with the Coquet Island, which is situated about a mile from the shore and immediately in front of the River Coquet, forming as it were a natural breakwater, with a spacious well-protected Asylum Harbour within, capable of receiving the largest class of vessels at low water. This valuable roadstead has, until lately, been almost unknown, or at least but little made use of, but the Trinity Board, with that laudable energy which characterises their efforts, have taken the matter up and are going to construct a light house upon the Island, and the entrances to the roadstead will be properly buoyed out, so that it will be easy of access night and day. We hope by these improvements that the numerous wrecks, attended with melancholy loss of life, which have so frequently taken place heretofore on this dangerous coast will be henceforward avoided.

Mount's-bay Breakwater.—On Saturday, the 18th ultimo, Lord Eliot, M.P., Sir H. Vivian, M.P., Sir C. Lemon, M.P., Mr. Pendarves, M.P., Major Vivian, M.P., and Mr. C. J. W. Ellis, had an interview with Lord Melbourne and the Chancellor of the Exchequer, on the presentation of a memorial to the Government for the construction of a breakwater and harbour of refuge in Mount's-bay.

NEW CHURCHES, &c.

New District Church at Sibford, near Banbury.—On Monday, the 6th ultimo, the ceremony of laying the first stone of a new church about to be erected at Sibford took place.

West Bromwich.—The Earl of Dartmouth has most liberally offered a piece of land near Hill Top, in the parish of West Bromwich, for the site of a new church, and also the sum of 1,200*l.* towards the erection of the edifice, and 300*l.* to be invested as a fund for keeping it in repair. His lordship's offer has been accepted, and a subscription has been entered into to carry this desirable object into effect.—*Wolverhampton Chronicle.*

New Unitarian Chapel and Sunday Schools.—On the 1st ultimo the ceremony of laying the first stone of a new Unitarian chapel and Sunday schools, about to be erected on Newhall Hill, took place. Estimated cost of the building, 3,000*l.* Mr. D. B. Hill, architect; Mr. R. Turner, builder.

Lord Dynevor is erecting at his sole cost a chapel of ease to the parish of Llandilo Fawr. The ceremony of laying the first stone of the edifice was, within the last few days, performed by his lordship's eldest daughter, the Hon. Fanny Rice.—*Hereford Journal.*

The Salisbury Diocesan Church Building Association have appointed T. H. Wyatt, Esq., their architect.

Staffordshire.—On Sunday, March 24, the collegiate church of Wolverhampton was opened for divine service. The interior of this church has been repaired with oak framings, new oak screens, new galleries, new carved gallery fronts in oak, and the whole of the interior has been restored to correspond in character with the style of this beautiful old fabric, together with a new and splendid west entrance window. The cost has been nearly 8,000*l.*, chiefly by voluntary subscriptions, a grant of 350*l.* by the Lichfield Diocesan Society, and 250*l.* by grant from the Incorporated Society. A most liberal collection of 335*l.* 10s. was made at the opening, after the sermons preached on the occasion by the Venerable Archdeacon Bather (Archdeacon of Salop). The restoration has been done under the direction of Robert Ebbels, Esq., Architect, of Trysull, Wolverhampton, and under his direction the exterior is now about to be repaired and restored.

Staffordshire.—On the 14th ult. the new church at Tipton, near Dudley, was opened by license. (The consecration does not take place until August.) This church is a Gothic building, with a tower, crocketed pinnacles, &c., and is built entirely of brick, with moulded brick copings, cornices, reveals, &c. The interior has a very fine effect with the handsome moulded bracketed beams, on corbels, with pierced quartre-foil spandrils, and moulded binders, to form compartments in ceiling. The length from the west door to altar tables, 105 feet 6 inches; width in clear of body, 48 feet 6 inches; height to ceiling, 29 feet 6 inches: it contains 548 sittings in pews, and 774 free seats, including children's;—total, 1,322 sittings; cost, about 3,700*l.*, including vaults underneath. Her Majesty's commissioners granted 2,000*l.*, the Incorporated Society, 350*l.*, and the Lichfield Diocesan Society, 750*l.*; the remainder was raised by subscription. The church has been erected for her Majesty's Commissioners for building Churches, from designs, and under the direction of Robert Ebbels, Esq., architect.

Warwickshire.—A new church is going to be erected in the parish of the Holy Trinity, Coventry. Robert Ebbels, Esq., is appointed the architect.

Berkshire.—A new church is going to be erected in the parish of Old Windsor, Sunning-hill. Robert Ebbels, Esq. is appointed the architect.

Sir Charles Wolsely, Bart, is reported to be about to erect a Roman Catholic church at Colwich, near Rugeley.—*Worcester Journal.*

Clydesdale Bank.—On Wednesday, 15th ultimo, the ceremony of laying the foundation stone of the handsome edifice, now erecting in Queen-street, Glasgow, took place. Under the stone was deposited a plate, on which were engraved the names of the directors, manager, architect, and builders; and also a bottle hermetically sealed, containing a copy of all the Glasgow newspapers, coins of the present reign, deed of co-partnery, one of each description of the notes issued by the Clydesdale Bank, almanacs, &c., &c.—*Edinburgh Chronicle.*

FOREIGN INTELLIGENCE.

The Font which is to serve for the christening of the Count de Paris has already been taken to the Cathedral church of Notre Dame; it is carved out of a solid block of stone, and is a very beautiful specimen of the flamboyant Gothic, richly ornamented with a great number of little figures, and the most exquisite foliage in the mouldings.—*The Nouvelliste.*

The Monument of Schiller, at Stuttgard.—The inauguration took place on the 6th ultimo, with great pomp. In the morning a procession of 5,000 persons entered the square. The great officers of State, the members of the two Chambers, the Foreign Ministers, and other high personages, were stationed in a gallery erected for the purpose, with Charles and Ernest Schiller, the sons of the poet, and M. de Gleichen, his son-in-law, in front. A deputation from the school in which Schiller received his education attended, and with it some of his old schoolfellows, and even one of his tutors, Colonel Rosch, now 96 years of age. The statue was uncovered amidst the enthusiastic acclamations of all the spectators. The house in which Schiller lived when surgeon of a regiment was decorated with an appropriate inscription, and all the principal buildings of the town were adorned with flags.

The Tomb of the Emperors of Austria, and other members of the house of Hapsburgh, in the convent of the Capuchin Friars, at Vienna, is about to be enlarged to such an extent, that it will receive their descendants for 200 years to come.

French Harbours.—It appears from a statement drawn up by the Administration of Bridges and Roads, that there are in France no less than 400 harbours and landing places. According to the same document, a sum of 165,000,000 francs would be required for the improvement of the most important harbours alone, of which sum the Ministry has demanded of the Chamber an advance of 44,000,000 francs, to be divided among 18 of them, as follows:—Calais, 2,700,000f.; Boulogne-sur-Mer, 1,200,000f.; Dieppe, 2,500,000f.; Havre, 6,000,000f.; Rouen, 1,500,000f.; Brest, 300,000f.; Redon, 4,000,000f.; Croisie, 1,400,000f.; Nantes, 1,000,000f.; La Rochelle, 3,000,000f.; Rochefort, 600,000f.; Chateau, in the Island of Oleron, 300,000f.; Verdon, 2,500,000f; Cette, 7,000,000f.; Marseilles, 8,000,000f.; St. Nazaire, 600,000f.; Ajaccio, in Corsica, 600,000f.; Ile-Rousse, in Corsica, 800,000f.

Mr. R. Stephenson, the able engineer of the London and Birmingham Railway, who left London for Italy a few weeks ago, to superintend the preliminary arrangements for the construction of the Florence and Leghorn railway, arrived in Florence on the 22nd of April.—*Railway Times.*

We understand from a correspondent at Munich that the greater part of the railway between that town and Augsburg, thirteen leagues in length, will be finished in July, and the remainder before the end of autumn. The diligences, waggons, and locomotive engines are already at Munich. The last have all been made in England, costing one with another, about 72,000f. a piece.—*Railway Times.*

Brunswick, April 8.—The railway from Brunswick to Wolfenbuttel is far more frequented than was expected. There are days on which the number of passengers is above 1,000. The undertaking has, therefore, fully succeeded, and does great honour to the projector.

GEOLOGY.

Singular Fossil Production.—There is now in the possession of Mr. B. Froggatt, miner, of Matlock Bath, a fossil specimen of a most extraordinary form. The general contour of the stone, or rather stones (for there appear to be two) although inseparably united, is that of a battle-axe or Indian tomahawk. The greatest peculiarity of the fossil is, that the part resembling the head of the weapon, comprised apparently of a dark-coloured limestone, absolutely passes through a cavity in the shaft part (which is a light-coloured magnesian limestone), and is much larger on each side the orifice than the aperture itself. It would seem, from this circumstance, that the head was originally the root of some plant, and that during its growth it had accidentally inserted itself in the orifice of the stone, and afterwards became petrified. It was found near the old Ecton mine, about two feet from the surface.—*Staffordshire Advertiser.*

Elephant.—The *Journal de la Haute Loire* states, that some labourers at Epsley, near Puy, who were extracting some blocks of basalt from a field, met with an entire skeleton of a fossil elephant; which, however, they broke to pieces in their carelessness; and it is supposed that it dates a period posterior to the last volcanic formation France.

Paleontology.—The indefatigable M. Lartet, of whose labours we have so often spoken, announces the discovery of two fossil Carnivora, one of which appears to constitute a sub-genus, intermediate between the badger and the otter, and the second approaching to the dog, differing but little from that gigantic fossil which he has described under the name of Amphicyon. He is of opinion that the latter is the same animal as that of which some remains were found at Epelsheim, and which constitutes the genus Agnotherium of M. Kaup. "There are," says M. Lartet, "a considerable number of fossil mammiferæ found on the borders of the Rhine, which appear to me to be identical with those which are daily brought to light at the foot of the Pyrennees. These affinities are the more interesting, because the intermediate countries, Auvergne, for instance, possessed very different traces of animals.—*Athenæum.*

Interesting Discovery.—An interesting discovery was lately made of numerous fos il remains of one of the larger pachadermatous (or thick-skinned) animals, most probably of an extinct species of elephants. They were accidentally turned up by some labourers at work in a gravel pit, not far from the Grand Junction Railway station at Coppenhall. As far as our information extends they are apparently remains of one animal, and amongst the most remarkable is a fine molar tooth, weighing more than seven pounds.—*Chester Courant.*

ANTIQUITIES.

Discovery of Roman Remains at York.—The railroads are about the best friends which antiquarians have in this world. Since the commencement of the York and North Midland Railway, many valuable discoveries have been made, and many noble relics added to the museum of the Yorkshire Philosophical Society. Lately, the workmen of the railway discovered in the garden lately in the possession of Mr. Blackhouse, some relics, and among them a Roman altar, of which the following is the inscription: Deae Fortvnae Sosia Ivncina Q. Antonn Isavricit Leg. Avo. To the Goddess Fortune, Sosia Iuncina (daughter) of Quintus Antonius Isauriaa of the Augustan Legion.—*Monmouthshire Merlin.*

Discovery of an Ancient Chapel at Chester.— Some years ago Messrs. Powell and Edwards, cutlers of this city, discovered at the back of their premises some traces of Gothic architecture, and to a certain extent they removed the rubbish which had hitherto concealed the archwork. However, conceiving it was merely a cellar which had in course of time got filled with rubbish, they did not proceed in clearing it until a few weeks back. To their credit they have carried upwards of 100 loads of rubbish out of the place, and now is exposed to view to the lovers of antiquity a chapel upwards of 15 yards long, 153 broad, and 14 feet in height. The arches are gothic, beautifully groined, resting on pilasters, about half way down the wall, very much resembling those at the entrance into the cloisters of our cathedral near Little Abbey-square; the whole is in an admirable state of preservation. At the west end are two niches, in which the baptismal or sprinkling founts (for holy water) have been kept, one of which was found in the rubbish, and is now placed in the situation it originally occupied; the other was broken by the workmen. At the east end of the chapel are steps which have led up to the altar; and on the south side of the chapel are a flight of steps leading into a subterraneous passage, now choked up. It is plain that this was anciently a place of worship for the monks belonging to the monastery of Gray Friars, which was situated near where the St. Bride's new church, opposite the Castle, now stands. Many conjectures have arisen as to the date of the foundation of this place of worship, but all is mere conjecture, as nothing has been discovered which could lead to fixing the point of time. Antiquaries will enjoy a rich treat in surveying this relic of the ancient devotional scenes of our forefathers; and we have no doubt vast numbers will avail themselves of the kindness and civility of Messrs. Powell and Edwards, and visit it. —*Chester Gazette*

Queen Elizabeth's Statue.—On Friday morning, 10th ult., the recently discovered statue of Queen Elizabeth was erected in St. Dunstan's Church avenue. The pedestal is fixed over a Gothic portico on the eastern side of the church, which has been erected for the purpose. Underneath is a block of black stone, on which is engraved the following inscription:—"This statue of Queen Elizabeth formerly stood on the west side of Ludgate, and was presented by the city to Sir Francis Gosling, knight, alderman of the ward, who caused it to be placed here."

NEW PATENTS.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 25th APRIL AND THE 25th MAY, 1839.

John Boyd, of College-street, South, and Hugh Francis Rennie, of Glengall-street, both in the town of Belfast, and county of Antrim, Flax-spinners, for "Certain Improvements upon the Spinning Frame used for spinning Flax, Hemp, and Tow upon the wet principle."—April 30; 6 months to enrol the specification thereof.

Julian Skrine, of Cambridge, Esquire, for "Improvements in Manufacturing Forks and Spoons, Coins and Medals."—April 30; 6 months.

James Smith, of Deanston Works, in the parish of Kilmardock, county of Perth, Cotton-spinner, for "Certain Improvements in the Machinery for Spinning and Twisting of Wool and other similar Fibrous Substances."—April 30; 6 months.

John Rostron, of Edenfield, in the county of Lancaster, Manufacturer, for "Certain Improvements in the Construction of Looms for Weaving."—April 30; 6 months.

Joseph Hunt, of Dalston-terrace, Middlesex, Gentleman, for "Improvements in the Manufacture of Soda and other valuable products from Common Salt."—May 7; 6 months.

David Naylor, of Copley-mill, Halifax, in the county of York, Manufacturer, and John Crighton, Junior, of Manchester, Machine-maker, for "Certain Improvements in Machinery for weaving Single, Double, and Triple Cloths by Hand or Power."—May 7; 6 months.

George England, of Gloucester-terrace, Vauxhall-bridge-road, Engineer, for "An Improved Screw Jack for Raising or Moving Heavy Bodies, both vertically and laterally."—May 7; 6 months.

William Davis, of Leeds, Machine-maker, and George Kinder, of Aldmansbury, Cloth-dresser, both in the county of York, for "Certain Improvements in Machinery for Dressing and Cleansing Woollen Cloths."—May 7; 6 months.

Joseph Maudslay and Joshua Field, of Lambeth, Engineers, for "Improvements in the construction of Marine Steam-engines which are particularly applicable to Steam-engines of the largest class."—7th May; 6 months.

James Whitelaw, of Glasgow, Engineer, for "An Improved Rotary Machine to be worked by the pressure and reaction of a column of water, which Machine may be used as a Steam-engine; also an Improved Water Meter, and a Machine for Raising Water or other liquid by its centrifugal force."—7th May; 6 months.

Edward Oliver Manby, of Swansea, Glamorgan, Civil Engineer, for "A New Method of Manufacturing Gas for the general purposes of Illumination."—8th May; 6 months.

Germain le Normand de L'Osier, of the Tavistock-hotel, Covent-garden, Merchant, for "Improvements in Machinery for Raising Water."—8th May; 6 months.

Richard Prosser, of Birmingham, Civil Engineer, for "Certain Improvements in Machinery for making Nails and Screws."—8th May; 2 months.

William Harper, of Cooper's-court, Cornhill, Patent Stove Manufacturer, and Thomas Walker, of Birmingham, Machinist, for "Improvements in Stoves and Grates."—10th May; 6 months.

George Stocker, of Birmingham, Brass-founder, for "Certain Improvements in Cocks or Apparatus for drawing off Liquids."—13th May; 6 months.

Moses Poole, of Lincoln's-inn, Gentleman, for "Improvements in reducing the friction of Axletrees and Axletree Boxes, and other such moving parts of machinery."—13th May; 6 months.

John Henry Rodgers, of Birmingham, Merchant, for "Improvements in Clasps or Fastenings, principally applicable to certain articles of Dress."—13th May; 6 months.

John Williamson Whittaker, of Bolton, Lancaster, Joiner, and Rowland Hall Heaton, of the same place, Cotton-spinner, for "Certain Improvements in the means of connecting or uniting Straps or Bands for driving Machinery, and other similar purposes, and in the Apparatus for effecting the same."—20th May; 6 months.

John George Bodmer, of Manchester, Engineer, for "Certain Improvements in Machinery, Tools, or Apparatus, for cutting, planing, turning, and rolling Metals and other Substances."—20th May; 6 months.

John Walker, of Allen street, Surrey, Oven-builder, for "Certain Improvements in Coke Ovens."—22nd May; 6 months.

William Jefferies, of Holme-street, Mile-end, Metal Refiner, for "Certain Improvements in the process of smelting or extracting Metal from Copper and other Ores."—22nd May; 6 months.

Thomas Harper, of the Grange, near Newnham, Gloucester, Merchant, for 'Certain Improvements in Railways or Tram Roads."—22nd May; 6 months.

James Vardy, of Wolverhampton, Stafford, Gentleman, for "Improvements in rolling Iron."—22nd May; 6 months.

Nicholas Troughton, of Leicester-street, Regent-street, Gentleman, for "Improvements in obtaining Copper from Ores."—22nd May; 6 months.

Nicholas Troughton, of Swansea, Glamorgan, for "Improvements in the Manufacture of Zinc."—22nd May; 6 months.

Lieutenant William Oldmixon, of Her Majesty's Navy, for "Means of Saving Human Life in cases of disasters at sea, by certain arrangements of Vessels, Decks or parts thereof, which he terms Safety Decks or Deck."—22nd May; 6 months.

Henry Griffiths, of Acton-place, Camden-town, Artist, for "Improvements in the Process of Producing Prints or Impressions from Steel, Copper and other Plates."—25th May; 6 months.

Martial Augustin Joseph de Herrypon, of Leicester-street, St. Martin in the Fields, Mining Engineer, for an "Improved Machine or Apparatus, for washing and bleaching Wool, Cotton, Silk, Linen, and other Fibrous Materials, either in a manufactured or unmanufactured state."—25th May; 6 months.

Thomas Clark and Charles Clark of Wolverhampton, Ironfounders and Copartners, for an "Invention for glazing and enamelling Cast Iron Hollow Ware, and other Metallic Substances."—25th May; 6 months.

Benjamin Hick, of Bolton, in the county of Lancaster, Engineer, for "Certain Improvements in Machinery or Apparatus for drying Cotton, Woollen and other fabrics, and other Fibrous Substances or Materials."—25th May; 6 months.

ERRATA.

In the Table of Public Buildings, page 187, the lines in the fourth column of "Remarks," do not range properly—the line opposite "Adelphi," and the four lines below should each be a line lower.

Page 192 in the last line of the Proceedings of the "Institution of the Civil Engineers," *for* 500 *read* 5000

TO CORRESPONDENTS.

The communication of M., on Railway Curves, will be inserted next month, if it be found upon examination essentially different from what we have already published.

B's Parody is not admissable.

We have been obliged to postpone our reviews until next month in consequence of a press of matter and arrears which we were desirous of clearing off.

The continuation of Mr. Curtis's Railway Improvements will appear in our next Journal.

We shall feel obliged to our country correspondents if they will forward us any account of works in progress, or any newspaper containing articles connected with the objects of our Journal.

Communications are requested to be addressed "To the Editor of the Civil Engineer and Architect's Journal," 57, King-street, Westminster; or to Mr Groombridge, Panyer-alley, Paternoster-row—if by post to be directed to the former place.

*** The first volume may be had bound in cloth and lettered in gold, price, 17s

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

ANIMAL LOCOMOTIVE, OR MACHINE FOR MULTIPLYING THE VELOCITY OF BEASTS OF BURDEN.

Fig. 1.—Front view of the Machine.

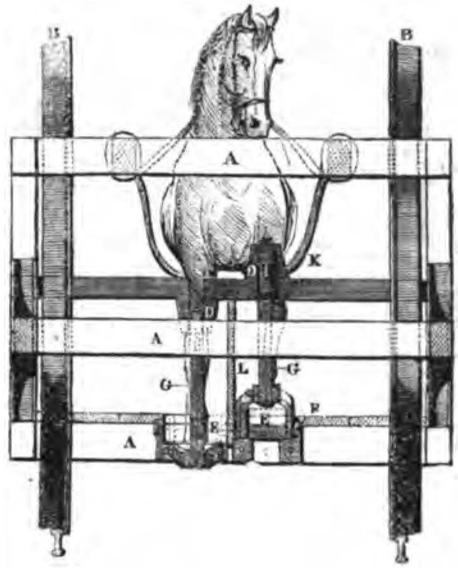


Fig. 2.—Side view of the Machine.

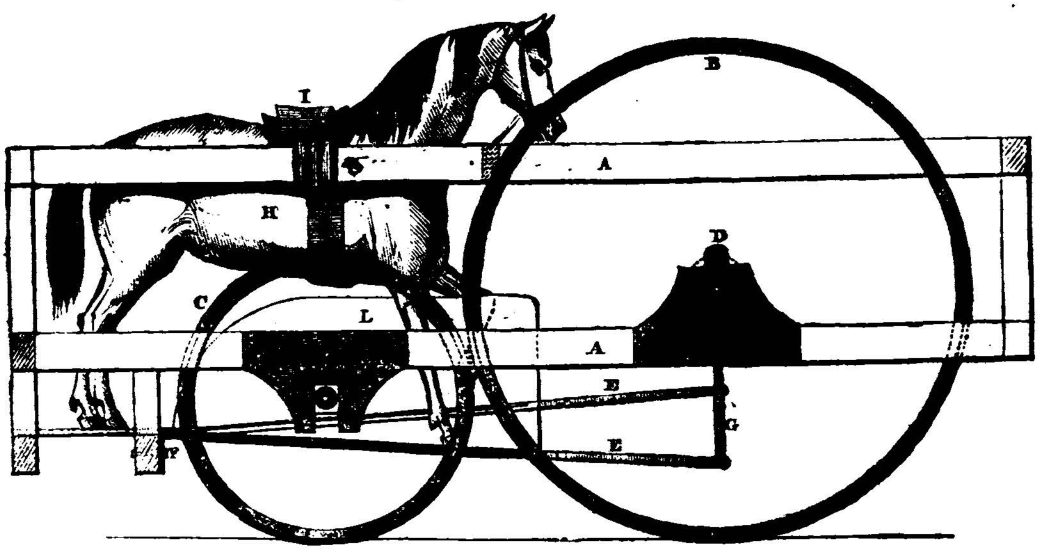


Fig. 5.—Side view of the Third Modification.

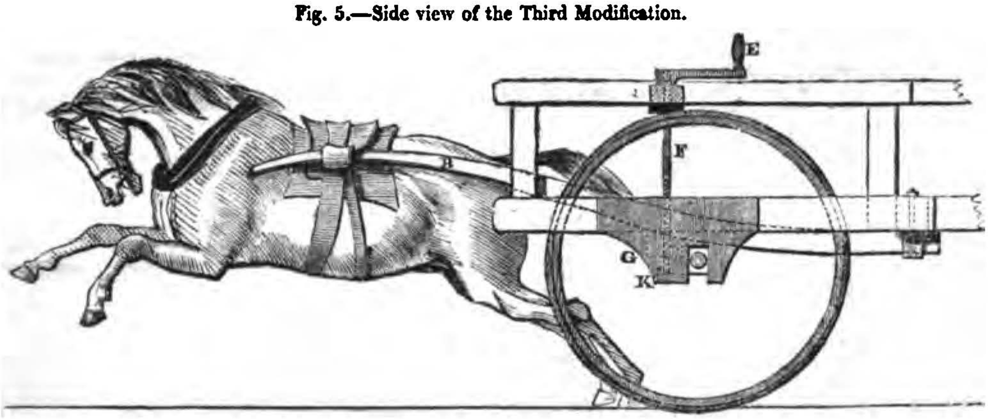


Fig. 6.

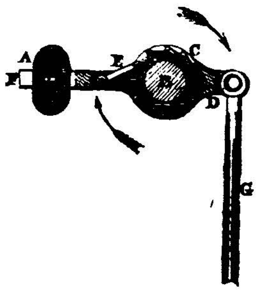


Fig. 7.

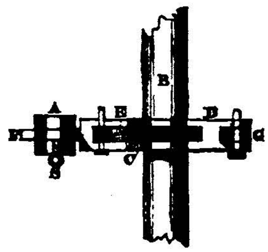


Fig. 8.

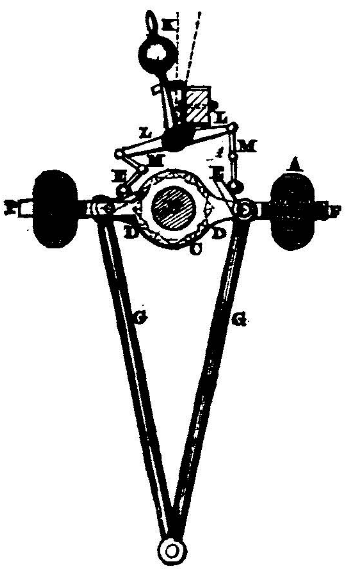


Fig. 9.

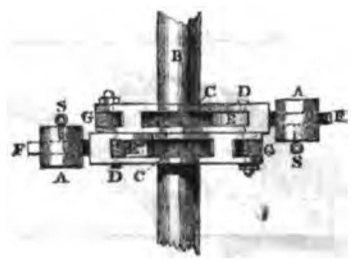


Fig. 10.

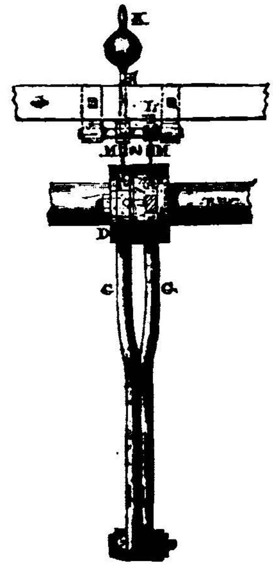


Fig. 11.

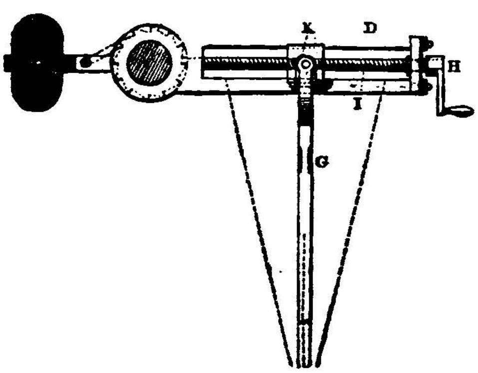


Fig. 12.

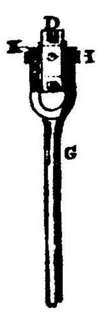


Fig. 13.

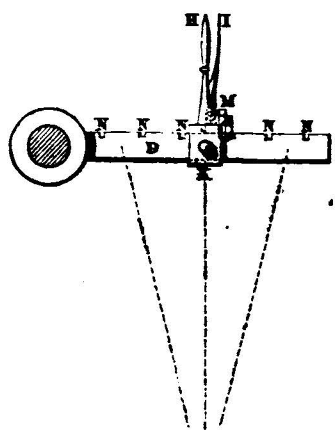


Fig. 14.

Fig. 3.—Side view of the Second Modification.

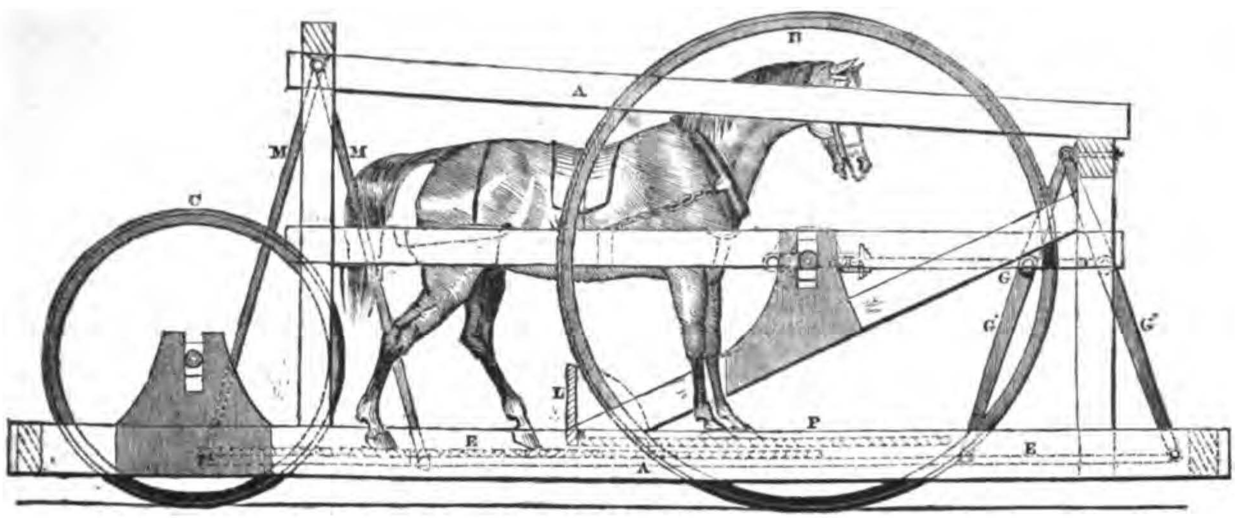
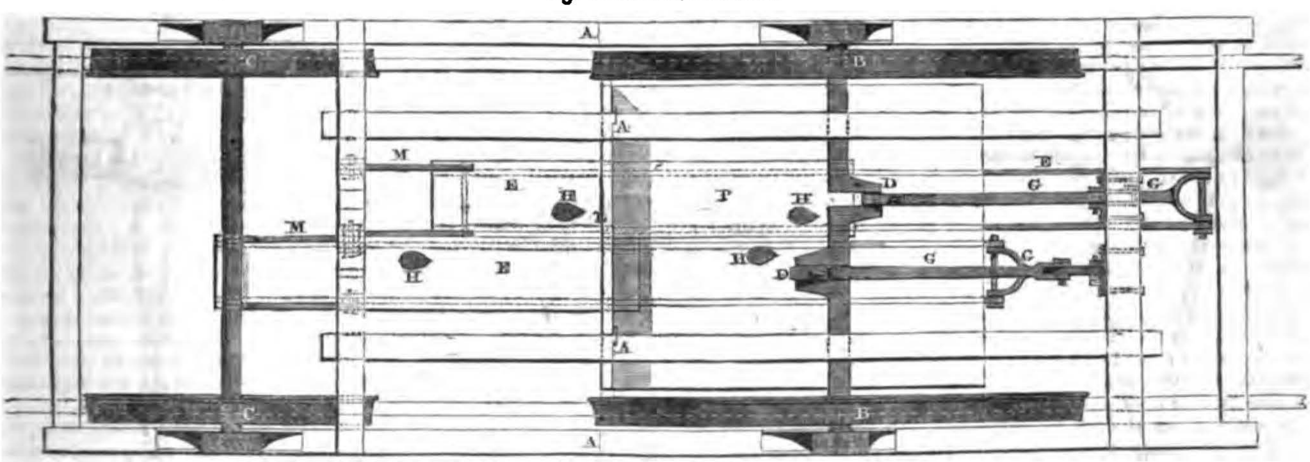


Fig. 4.—Plan of the above.



CURTIS'S PATENT RAILWAY IMPROVEMENTS.

(Continued from page 123.)

ANIMAL LOCOMOTIVE; OR, MACHINE FOR MULTIPLYING THE VELOCITY OF BEASTS OF BURDEN.

The machinery or apparatus is described by the inventor under three modifications, as shown in the annexed engravings. Figure 1 is a front view, and Figure 2 is a side view of a machine, in which an animal produces a motion in the machine by his weight, and the muscular force of his fore legs alone; this is effected thus: upon the shaft of the driving wheels B, cranks D, are formed in the same manner as for a locomotive, excepting that the cranks are opposite, and not at right angles to each other, as in a locomotive; to the cranks are attached the connecting links, GG, and to these are likewise connected the treadles EE; the horse, or other animal, H, then alternately depresses the treadles EE by his fore legs, and thus the wheels BB are turned round in the same way as in a steam-engine, or in a grinder's barrow; the effective force of the animal is increased by using the strap or band I, which passes over his back, thus enabling him to exert the muscular force of his fore legs, as in the act of lifting, or getting up; the powerful and broad belly-band, K, is secured to the framing, and is placed to catch the animal, in the case of his falling on the treadles, and breaking them; the partition-board L is placed between the legs, to prevent the animal by any chance placing his foot upon the wrong treadle; A is the framing of the machine, C the passive wheels, F the joints upon which the treadles move, and are fixed to the cross-framing of the machine as shown; the same letters apply to both figures, and the description, so far as the parts are shown in each, applies likewise.

Another modification of this machine is shown in figures 3 and 4, in which the animal exerts the force due to his muscular power alone, as in the act of drawing a load. Figure 3 is a side view, and figure 4 a plan of the machine; cranks DD, are formed upon the shaft of the driving-wheels BB, as in the last described machine, and connecting rods G'G', are connected with the cranks as before; but the rods are now placed in a horizontal position, and are connected with the vertical links G'G'; to the lower ends of the vertical links G'G', are attached the front ends of the treadle bars EE, and the after ends of the bars EE are attached to the vertical links MM; thus the treadles are suspended by the vertical links G' and M: upon the bars EE boards are fixed, upon which the animal stands, and exerts his force, as in the act of walking and drawing. Another method to support the ends of the treadles will be to use friction-wheels instead of the hanging links MM, but I prefer the method drawn; a board may be placed to separate the legs of the animal, as shown in L, in figure 2, the animal is yoked in a collar, and the drag-chains I, are fastened to the framing, so that the horse, as drawn, is in the same position as if placed in a cart; a platform P is placed forward for the animal to rest his fore legs upon, and a shutter or partition upon hinges L, so that the animal in the act of working shall always step upon the treadles; this partition shuts down when the animal is placed in the machine, or withdrawn from it; the treadle bars EE pass under the platform P, as shown by the dotted lines, and pass to the hanging links G'G', as shown; the dark footmarks HHHH, in figure 4, denote the position of the feet of the animal upon the treadles, and platform A is the framing, CC the passive wheels, and the rails throughout the plate are denoted by the dotted shading.

The next improved apparatus is shown in figure 5; in this instance the horse is represented as in the act of drawing upon the common road, and is yoked, as in a cart, between the shafts or springs B; the shafts or springs B are raised or depressed by means of the screw F, and handle E; a cross piece G connects the two shafts or springs together, and a nut is fixed into the cross piece, in which the screw F works; the toe of the screw works in the fixed cross piece K; and thus, by turning the screw, the rise or fall in the springs B is produced. A powerful girth passes round the animal as far forward as possible, and is fastened to the shafts, as shown, so that when the animal has started the machine by his weight and force, as in starting a load in a cart, the springs or shafts are gradually screwed up, as the velocity of the animal increases, so as to carry a certain proportion of the horse's or animal's weight, which becomes then transferred to the machine, and the horse will take longer steps, and longer springs or leaps, as in galloping, in the same way as a man upon a velocipede. Any other suitable method may be adopted to fix or sling the animal than that drawn either by a spring like a coach-spring, fixed to suitable framing, placed over the horse's back with any screw or lever-method to produce the object of relieving the horse of his weight as his velocity increases, which is the particular object of this combination. The machine may be made as drawn, or the horse or other animal may be placed in front of the carriage, which is the better method.

Figure 6 and 7 is a substitution for the crank-motion shown and described in figures 1, 2, 3, and 4, in which figures it is necessary that the animal should time the movement of his feet conformably with the position of the cranks, but substituting the ratchet-motion shown—it will be immaterial whether a long or short step is taken or both feet applied at once, the requisite movement of the driving wheels will be produced; the action is as follows: B is the shaft of the driving wheels, C a ratchet wheel fixed upon it, D the crank or sheave of the ratchet working loose upon the shaft, E the paul taking into the ratchets united by a pin in the usual way to the sheave or crank D, F is the tail of the sheave upon which the counterbalance A is fixed; the distance of the weight from the centre of the shaft B, is regulated by the weight of the connecting rod G, and the treadles connected with the fore end of the sheave, and this is kept in its place by the set screws; the weight of the counterbalance and its leverage must be such as to bring back the treadle the moment the animal has lifted his foot, when the sheave goes back and the paul falls into another ratchet, the animal again applies his feet and force to the treadle, and a new impulse is given to the wheels. Figure 6 is a section, and figure 7 a plan of this contrivance, figures 8, 9, and 10, are three views of a compound variation of the above-described method to produce a rotary motion from a reciprocating one, by which a forward or backward motion may be produced by merely changing the pauls from the forward or backward ratchets; the general construction of the ratchets and sheaves is the same as in the last-described figures, but here two ratchets and sheaves, one right hand and the other left hand, are placed side by side upon the shaft, and the connecting links GG upon opposite sides of the shaft B are connected with the same treadle, so that by throwing into gear with the ratchets either the left hand or right hand pauls, a forward or backward movement is produced upon the machine, the pauls are connected by the lever *l l*, and the jointed rods *m m*, so that by a simple movement of the lever *k* the one ratchet is withdrawn and the other thrown into gear, or when the lever *k* is vertical both pauls are disengaged.

The apparatus, as shown in the drawing, is adapted for the particular machine shown in figures 1 and 2, where the action of the animal is a vertical action, to apply it for the modification shown in figures 3 and 4; when the action of the animal is horizontal, either the crank or sheave D must be made at right angles to the tail F, so as to allow the counterbalance weight A to act by its gravity, and the horizontal treadles must be connected at once with the crank or sheave D, or the crank or sheave D must be still vertical as above described, and the connecting rods G connected with the vertical links G'G', as shown in figures 3 and 4, the counteraction of the treadles may be produced by a spring or other suitable method; likewise a change from a forward to a backward motion, and *vice versa*, may be effected by making both ratchets and sheaves or cranks loose upon the shaft, and placing on each side clutches sliding upon the shaft in the usual way, and throwing the one or the other clutch into gear with the right or left hand ratchet and sheave or crank, as it may be desirable; the same letters refer to the same parts of the various figures, as each is respectively shown in the drawing. Figure 8 is a side view and section; figure 9 an end view; and figure 10 a plan of the same. Figures 11 and 12 is a modification by which an increased or diminished leverage may be produced upon the crank or wheels when the machine is either at rest or in motion, so that a longer lever may be applied when most force is required; viz. at starting the machine, and a reduced leverage and more rapid movement of the wheels when the carriage is in motion. The general form of the ratchets and counterbalance is the same as that before described; but the crank end is made longer, so that the end of the connecting link G, which is fixed to the crank D in the former cases by a pin-joint, slides along the crank, and approaches to or recedes from the centre of the shaft by means of the screw I, and sliding nut K, so that by turning the handle H, the nut K is brought by means of the screw I to the extreme end of the lever D, and the link G then occupies the position shown by the dotted line; then as the velocity increases, the nut is advanced by the same means towards the centre, the leverage is diminished, and consequently the velocity of the wheels is increased by the same movement of the animal's feet. Figure 12 is an end view of the lever D, link G, nut K, and screw I. Figure 13 is a modification of the same invention, the only variation being in the form of the lever D, and the sliding nut or apparatus K; here the lever is a solid lever, and the nut K a hollow socket, sliding along the lever; this is moved forwards or backwards by the handle H; the spring I is formed at its lower end into a bell-crank, and fixed to the stem of the handle by a pin-joint, which, when the spring is compressed and brought close to the handle, as it will be when a man grasps the handle and spring in his hand, lifts the latch in the lower end, which latch fits into the notches *n, n, n*, and the socket and connecting-link may then be advanced or drawn back along the lever; when the spring and handle is let go, the latch falls into the notch when the nut or socket K is held securely upon the lever, the variation is thus evidently produced as in the last figure, and the link G made to occupy any position with respect to the lever as may be desired. Figure 14 is an end view of the same figure—lever D—handle H—spring I—latch M.

PAPER READ BY W. TITE, ESQ., PRESIDENT OF THE ARCHITECTURAL SOCIETY, AT THE LAST SOIREE OF THE SEASON 1839.

The Report just read will have communicated to you the general results of our labours during the present session; in the interval since November, when I had the honour of accepting the chair of this society, as president, I hope that the suggestions I ventured to make on that occasion have been followed out, and that something has been done in extending its usefulness, and in promoting and advancing the studies of our younger members.* We do not propose to ourselves the making a display among the literary societies of Europe, nor the assuming a rank which neither our numbers nor our influence would justify us in seeking; but we would desire to advance our art by extending information amongst its individual members, and by liberally including within our naturally limited circle all who have a claim upon us by honourable character and scientific pursuits. Usefulness was always the aim and object of this society. Usefulness will, I hope, be its motto as long as I have the honour of presiding over it. With this impression, on the present occasion, I am rather disposed to consider generally two or three topics of interest to architects, which have arisen during the past year, than to confine my remarks to one subject, or to give to any thing that I may have to communicate the formal character of an essay.

The first subject I shall refer to, and the one of the greatest importance to architects at the present period, is that of the public competitions which have been lately proposed for several large buildings, such as St. George's Hall at Liverpool, and the Royal Exchange of London. Opportunities such as these are of the greatest value, even nationally; for placed as England is in the scale of nations, the eyes of the world are upon us, and if we do not avail ourselves of these opportunities to remove the reproaches which have been cast (and often but too truly) upon our national taste, we shall be accused of having retrograded, when our manufacturers, our commerce, and all the other arts of life have advanced, and of being behind our continental neighbours in the science and in the practice of architecture.

Open competitions, such as have been proposed for the Houses of Parliament and the Nelson Monument, and those now proposed for the Royal Exchange and the Hall at Liverpool, offer splendid opportunities, which if fairly offered to the profession, would, I doubt not, be generally and eagerly embraced. The course taken with the first was on the whole satisfactory: the appointment of the commissioners was a judicious measure, and the world seems generally agreed that the result, (the choice of Mr. Barry's design, and his appointment as architect,) have been fair as regards the competitors, and successful in a national point of view. In the Nelson memorial the course has been manly and straightforward; and I think public opinion seems to support the committee in their determination that, though the designs chosen to receive the premium had considerable merit, yet it was wise and judicious to give another opportunity to architects and artists, because neither of them seemed to realize the wishes and expectations of the public upon the subject.

* At the last election of students at the Royal Academy, all the student members of the society (five in number) who were candidates, were elected.

The Royal Exchange, however, is an object which in a national point of view may never occur again; its purpose brings us in distinct competition with the other nations of Europe, but particularly with France; the situation is as striking as could well be chosen in London, the means are ample, and, with a fair opportunity, I cannot but believe that most of the architectural talent of England would have been enlisted in the competition. I am sorry, however, to say that in this matter the expectation of the public, with respect to public competition, will probably be disappointed. So far as I am able to judge, this feeling prevails throughout the profession generally, and from communications we have received from the Institute, they appear to have not only felt but acted as we have done. The course we have thought it right to take has been shortly this; a special committee was summoned on the 15th of April to consider the subject, at which the following resolutions were agreed to:—

At a special meeting of the Architectural Society held on Monday evening the 15th April, 1839, for the purpose of considering the resolutions of the Gresham Committee, issued as instructions to architects furnishing designs for the new Royal Exchange; it was

Resolved,—That this society beg respectfully to represent to the Gresham Committee the difficulty under which it appears to them that architects must labour in preparing designs for the new Royal Exchange, from the indistinctness of the instructions contained in resolution No. 13.

That the arrangement of a well considered plan is of the greatest importance to the value of a design; and that it is not possible to meet the obvious necessities of the case, unless the objects proposed in the general distribution of the apartments be specified, together with the individual application of each of those apartments.

That it is a matter of notoriety that, under the roof of the Old Exchange, accommodation was provided for the Lord Mayor's Court office, the Merchant Seaman's Asylum, Lloyd's Coffee House, and the Royal Exchange Fire Office; it is presumed, however, that one or other of these establishments must now be omitted, because three only are spoken of.

That it appears to this society that there could be no objection to the explanation now sought, similar information having been universally given in competitions for other buildings, without which, indeed, they cannot conceive that a design of any value could be submitted.

That the block plan required in resolution No. 4, would be inconveniently large at the scale determined upon.

That a question has arisen as to the exact meaning of resolution No. 5, in which the words "coloured drawings" occur, in conjunction with the "two perspective drawings" required to be made, this society having been led to understand that all drawings, whether views or otherwise, are to be tinted in Indian ink only.

And lastly, That it appears exceedingly desirable for the uniformity of the arrangement of the facades, that the levels of the ground should be furnished.

(Signed) William Tite, *President.*

35, *Lincoln's-inn Fields*, 15*th April*, 1839.

These were sent by the secretary to the clerk of the Gresham Committee; on the 27th April, following, this answer was received.

Mercers Hall, 25*th April*, 1839.

Sir,—I am directed by the Joint Gresham Committee to acknowledge the receipt of your letter of the 18th instant, enclosing copy of the resolutions passed at a meeting of the Architectural Society of the 15th, in reference to the printed instructions to architects who may wish to send in designs for the new Royal Exchange, and to state in reply, for the information of the Architectural Society, that the committee having sent out their instructions to architects, cannot now, without great inconvenience to all parties, alter what they have done, except to say that the rooms required are for three distinct companies. I have the honour to be, Sir, your most obedient humble servant,

James Barnes,
Clerk of the Gresham Committee.

William Grellier, Esq.,
Hon. Secretary, &c. &c. &c.

The Institute of Architects, it appears, by a letter obligingly communicated by that body, also addressed the committee on the same subject; the answer to them was as follows:—

Mercer's Hall, 25*th April*, 1839.

Sir,—I am directed by the Joint Gresham Committee to acknowledge the receipt of your letter of the 17th instant, respecting the printed instructions to architects who may wish to send designs for the new Royal Exchange, and to state in reply, for the information of the Royal Institute of British Architects, that the committee regret they cannot accede to their request for an extension of the time already determined upon.

That with respect to the questions whether the committee require a tower with a chime of bells? and whether there will be any objection to the principal entrance floor being raised upon a flight of steps? the committee leave those subjects entirely to the taste and judgment of the architects. And that the three series of rooms as described in the printed particulars are intended for three distinct companies.

The committee are perfectly satisfied that the anonymous advertisement mentioned in your letter, had not the sanction of the Royal Institute of British Architects. I have the honour to be, Sir, your most obedient humble servant,

(Signed) James Barnes,
Clerk of the Gresham Committee.

Thos. L. Donaldson, Esq., *Hon. Sec.*, I. B. A.

Now surely any thing more unsatisfactory than these answers, particularly the former, can scarcely be conceived; how easy would it have been to have issued explanations, as was done in the case of the Houses of Parliament, and a short advertisement would have announced them—but every thing is refused, and a competitor can only grope in the dark unless assisted by private information unfairly obtained. The labour of such a design must be excessive, the drawings enormously and uselessly large at the prescribed scale, the premium almost paltry, and as it appears the successful competitor is not to be employed as architect, the whole affair may be considered in the words of Shakspeare, as an attempt "to keep the word of promise to the ear, but break it to the hope."

Leaving now this unsatisfactory topic, I pass on to notice one or two matters of interest which it appears to me desirable to mention. There are first, as a matter of great usefulness, the experiments of Mr. Hodgkinson and Mr. Fairbairn, in the seventh report of the British Association of Science, on the mechanical properties of cast-iron.

The results of these experiments are shortly given in the Appendix to Professor Moseley's Illustrations of Mechanics, and some of the most important to us are comprised in the following extracts:—

The experiments of Mr. Hodgkinson and Mr. Fairbairn have been published, in the Seventh Report of the British Association of Science, since our chapter on the strength of materials went to press. Their great practical importance will sufficiently account for their introduction here, as an appendix to that chapter. They have reference—

1st. To the resistance of cast iron to rupture by extension.

2d. To the resistance of cast iron to rupture by compression.

3d. To the resistance of cast iron to rupture by transverse strain.

4th. To the destruction of the elastic properties of the material as the body advances to rupture.

5th. To the influence of time upon the conditions of rupture.

6th. To certain relations of the internal structure of metals to their conditions of rupture.

7th. To the relative properties in all these respects of hot and cold blast iron.

The experiments of Mr. Hodgkinson on *transverse* strain present less of novelty and importance; they fully, however, confirm the views previously taken on this subject by him, and detailed in articles 66, 68, &c. A series of them, directed to the verification of the commonly assumed principle, "that the strengths of rectangular beams of the same width, to resist rupture by transverse strain, are as the squares of their depths," fully established that law.

With regard to the destruction of the elastic properties of the material, as it approaches to rupture, the experiments of Mr. Hodgkinson possess great interest and importance.

It has been asserted by Mr. Tredgold, and commonly assumed, that this destruction of elastic power, or displacement beyond the elastic limit, does not manifest itself until the load exceeds *one third* the *breaking weight.*

Mr. Hodgkinson found that, in some instances, this effect was produced, and manifested in a permanent *set* of the material, when the load did not exceed *one sixteenth* of the breaking weight. Thus, a bar one inch square, supported between props 4½ feet apart, which broke when loaded with 496 lb., showed a *permanent deflection*, or *set*, when loaded with 16 lb. In other cases, permanent sets were given by loads of 7 lb. and 14 lb., the breaking weights being respectively 364 lb. and 1120 lb. These sets were therefore given by one-fifty-second and one-eightieth the breaking weights respectively. Thus, then, there would seem to be no such limits, *in respect to transverse strain*, as those known by the name of elastic limits; and it follows from these experiments that the principle of loading a beam within the elastic limit has no foundation in practice.

It was ascertained by a very ingenious experiment, that a bar, subjected, under precisely the same circumstances, to extension and compression by transverse strain gave, for *equal loads, equal deflections*, in the two cases.

The most remarkable results on the subject of transverse strain were, however, those of Mr. Fairbairn, having reference to the influence of time upon the deflection produced by a given load.

A bar one inch square, supported between props 4½ feet apart, and loaded with 280 lbs., being about ⅗ths its breaking weight, had its deflection accurately measured, from month to month, for fifteen months, and it was found that, throughout that period, the deflection was continually increasing; the whole increase in that period amounting to the fraction ·043 of an inch. A bar of the same dimensions, similarly supported, and loaded with 336 lbs., being about ⅘ths of its breaking weight, increased its deflection similarly, and in the same period, by the fraction ·077 of an inch. Another similar bar, loaded with about ⅞ths the breaking weight, similarly increased its deflection by the ·088th of an inch. The deflection of these bars still daily advances under the same loads, and, a sufficient period having elapsed, will no doubt proceed to *rupture*. A *fourth* bar of the same size was loaded with 448 lbs., being very nearly its breaking load. It bore it for thirty-seven days, increasing its deflection during the first few days by the fraction ·282 of an inch; thence retaining the *same deflection* until it broke.

The fact thus established, that a beam loaded beyond a certain limit continually *yields* to the load, but with an exceedingly slow progression, unless the load very nearly approach the breaking load, is one of vast practical importance; *it opens an entirely new field of speculation and inquiry*. The questions, what are the *limits* of loading (if any) beyond which this continual progression to rupture *begins?* what are the various *rates* of progression corresponding to *different* loads beyond that limit? and what are the effects of *temperature* on these circumstances? remain, as yet, almost unanswered.

A series of experiments was directed by Mr. Hodgkinson to the verification of this law, usually assumed in respect to the transverse strength of rectangular beams, that, when their lengths and breadths are the same, their strengths are as the squares of their depths.

His experiments fully established this law. Thus he placed between props, 4 feet 6 inches apart, castings of Carron iron No. 2., which were all 1 inch broad, and respectively 1, 3, and 5 inches deep; these broke respectively with weights of 452 lbs., 3,843 lbs., and 10,050 lbs.; which are very nearly as the numbers 1, 9, 25; that is, as the squares of the depths."

In the original report at page 355, is the result of certain experiments on Carron iron, and the two last in the table are of the greatest value, as shewing the importance of those inquiries to an architect, and the necessity for his obtaining scientific knowledge upon this subject in order to a successful and economical application of materials. In these tables then it appears that a cast iron bar of the T form usually adapted, but with table upwards, thus, T, broke with 280 lbs., whilst another bar of the same size and, *cæteris paribus*, but with the table downwards, thus, ⊥, broke with a weight of 980 lbs.

Another subject, as it appears to me, of great interest, though not exactly in an architectural, but in an archæological point of view, is that of the researches lately made on the pyramids of Ghizeh, for Colonel Vyse, by Mr. Perring the engineer, and Mr. Andrews.

These wonders of the old world are situated near Cairo, N. W. of the site of the ancient Memphis; and the principal ones are three in number. The largest (supposed to have been built by Cheops or Suphis, 2100 years before Christ), has been the main object of these researches. They inform us that the principal part of the stone composing the pyramid has been taken from the rock on which it was built; the blocks are roughly squared, but built in regular courses, varying from 4 feet 10 inches to 2 feet 2 inches in height, in which the breaking of the joints is carefully preserved wherever these courses are exposed to sight, as in the platform at the top of the building in the Queen's chamber; and in the passage leading thereto, and likewise in some other places at the exterior, circular holes are to be observed, about 8 inches in diameter and 4 deep, apparently intended to support the machinery mentioned by Herodotus to have been used for raising the stones from one course to another, and which seem to have been similar to the Polyspaston described by Vitruvius.

The stone for the revêtement, or casing of the exterior, and for the lining of the chambers and passages, is a compact limestone, known to geologists by the name of swinestone or stinkstone, from emitting, when struck, a fetid odour. It was brought from the Gebel Mokattam, on the opposite or Arabian side of the valley of the Nile, and the ancient quarries seem to have been in the neighbourhood of the present village of Tourah. It is of a very compact formation, with but few fossil remains; the rocks on the Lybian side, where the pyramids are placed, are, on the contrary, of a loose and granulated texture, abounding in marine fossils, and consequently unfit for fine work, and liable to decay.

The blocks appear to have been finally prepared on the level rock in front of the northern face of the pyramid, where several rows 4 or 5 feet asunder, of 3 or 4 circular holes, about 12 inches diameter, and 8 or 10 deep, have been cut, apparently for the purpose of inserting shears, or for forming a scaffolding for turning or moving the blocks.

The stone cuttings and rubbish were thrown over the front of the rock in prodigious quantities, where they still remain.

The mortar used for the casing and lining of the passages was composed entirely of lime, but in the body of the pyramid it was formed of ground red brick, gravel, Nile earth and crushed granite, or of calcareous stone and lime; and in some parts, a grout of liquid mortar and desert sand and gravel only has been used.

The joints of the casing stones which were discovered at the base of the northern front, those in the king's and queen's chambers, and also in the passages, are so fine as to be scarcely perceptible.

There has been considerable discussion among the learned respecting the term in Herodotus translated by Larcher "revetir et perfectionner:" if the latter word expresses the whole meaning, all difficulty ceases. Part of the revêtement of the central pyramid of the three to the eastward of the great pyramid, which remains unfinished, shews the manner in which this was accomplished. The casing, composed of stones roughly cut to the required angle, was built in horizontal layers corresponding with the courses of the top, till the whole was reduced to one uniform surface. (Beloe.) The ancients always left the face of their work to be finished off after the building was in other respects completed.

In preparing the base of the pyramid, proper care was taken to ensure the stability of the superstructure, by leveling the rock to a flat bed: and where advantage was taken of it, to form part of the body of the pyramid, it was stepped up in horizontal beds, according to the thickness of the layers of stone used in the building. The general result of these enquiries appears to be the discovery of several chambers immediately over the central or king's chamber, the paved platform and the remains of the ancient revêtement still existing at the foot of the pyramid, and, contrary to general belief, the discovery of the fact that the main passage is so constructed as to allow of the sarcophagus having been carried in subsequently to the completion of the pyramid. The upper chambers thus discovered are called by Mr. Perring chambers of construction; they are four in number, of no great height, and appear to have been principally intended to diminish the weight of the ceiling of the king's chamber; they have never been opened before, and on the walls and ceilings are the chalk marks of the workmen, and rude hieroglyphics coeval with their construction; one of these hieroglyphics in a cartouche appears to read as the name of Suphis. The revêtement appears to have been beautifully wrought, and the mortar so good that the stones have broken when violence has been used, whilst the joint has held soundly.

The third and last matter I would notice, is the very curious subject of painted architecture and sculpture. It is but few years since the polychromy of the ancient Greeks has forced itself on the attention of the admirers of classic remains; the dandy amateur puts the subject aside by a sign of horror at the idea of painting white marble, and the learned "find it not in their philosophy." Nevertheless, that Greek architecture and statuary were painted, rests on the simple fact that *they remain so still*.

Our own ancestors, it is well known, painted the interior of their buildings, as well as their statues, with great and brilliant effect; and it is now clear that the Greeks did the same.

The account in a leading periodical seems to sum up our present information on the subject, and to give a sensible reason for this practice. [Given by us at page 220 of the last Journal.]

To this curious account may be added the still more curious circumstance that even the great pyramids themselves were painted. H. C. Agnew, Esq., who has published very lately a very curious work, makes the following statement in "a letter from Alexandria on the evidence of the practical application of the quadration of the circle in the configuration of the second pyramid at Gizeh." In examining the surface I have not been able to detect any coating like that produced by common paint, much less any distinct layer of plaster; but the stone seems to have been saturated with some fluid, as oil or varnish, which has rendered the surface harder as far as it penetrated. Whole acres of this lubricated surface still remain upon the upper part, or casing, as it is called, of the second pyramid."

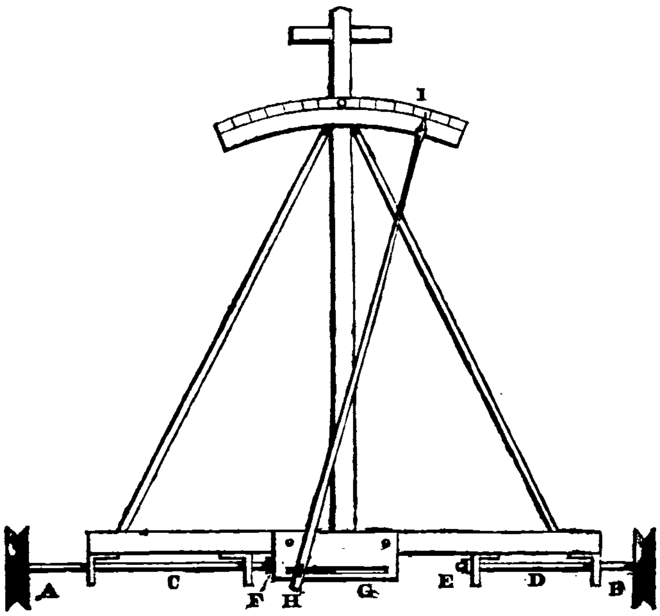
In speaking of the great pyramid, Pliny says, "est autem saxo naturali elaborata et lubricata." The present colour of this outer surface is of a brownish yellow, or yellowish brown. It has become darker by time and exposure, like the marble of many antique statues, &c.

I have thus completed the reference to the subjects I have considered it desirable to notice; it has been very imperfectly done, but it may serve to attract your attention to some matters that are useful and essential, and to give you an interest in others of the most curious character. We may not be called upon to build pyramids, nor would our climate permit us to indulge in the gay decorations of the architecture of the Athenians; but the care and thought, and science exhibited in the construction of the pyramids ought to be useful to us as examples, and the principles which guided the Greeks in their combinations of colour, if discovered, might lead us to results which would not only justify what appears to us to be a barbarism, but teach us that in this, as in literature, architecture and sculpture, the Greeks may give lessons to the world.

A new general chart of the banks of Newfoundland, formed by Captain Davaud and the officers attached to his surveying expedition in 1837, 1838, and 1839, in which numerous important errors of former charts are rectified, has just been published by order of the Minister of the Marine.—*Paris paper.*

RUNNING GUAGE,

FOR MEASURING THE WIDTH OF THE RAILS OF A RAILWAY.



This apparatus is, as it were, a skeleton hand truck, consisting of a pair of small wheels and axles, and a handle to drive them.

The wheels A B are grooved after the manner of pulleys, so that they rest on a narrow or wide rail without shaking; they are fixed on the axles C D, and are therefore without shake; the axles turn in bearings; one of the axles D has a shoulder and pin at its end E, and a washer between the pin and the bearing allows the axle to revolve freely, and yet have no shake endwise. The other axle C moves freely on its bearings endwise; it has a long shoulder at its end, on which is fitted a brass tube F, and a pin and a washer keep it in its place; the tube has a projecting pin, which passes through a long hole in a piece of iron or brass G, fixed to the framework of the instrument; the pin projects far enough to enter the short end of a light wooden lever or index H, the long end of which points to a graduated arc I. As the instrument is pushed along, the free axle C slips in and out as the wheel A follows the irregularity of the rail, and by the connexion of the axle with the index, the index points out the width of the rail on the graduated arc.

Where a rapid examination of the rails is required, the guage may be hooked to the tender, and the man who watches the motion of the index, may throw on the road any distinctive material, such as oyster shells, broken green glass, red brick or tile, broken earth-ware, chalk, or wooden cubes; so that the workmen will find the places marked which they are to repair. A. C.

CURVES ON RAILWAYS.

SIR—In the last number of your journal, a correspondent ("Surveyor") has given a method of setting out circular arcs for railway purposes by means of ordinates measured from and at right angles to the tangent lines, and as from his communication it does not appear clear that he recommends it from his own personal experience in its application, it may not be unacceptable to you to be assured by one who has practised it with success, that the method is good and suitable for almost every variety of surface, occasionally modifying it as any peculiar circumstances arise; it is best suited for setting out curves upon the surface prior to any practical operations being commenced, for in deep cuttings or on high embankments considerable difficulties present themselves to this method, and therefore recourse should be had to other means. One great recommendation to the method of ordinates is, that any error committed in one ordinate is extended no further, and such error may be instantly detected and corrected by the eye, by setting up (perpendicularly) a boring rod about 10 feet long at the extremity of each measured ordinate; when eight or ten of these rods are set up, the observer, upon looking along them, will perceive any irregularity in the curve, even to one quarter of an inch.

I have long since computed a set of tables of ordinates to a variety of radii, and about two years ago was preparing them, together with other methods of setting out curves, and also some useful tables in my possession, for publication, for which purpose I then had the necessary engravings made; business, however, has caused me to defer it from time to time, but I am now making such arrangements for that purpose that I hope shortly to be able to accomplish it.

I am, Sir,

Your obedient servant,

F. W. SIMMS, C.E.

2, *West Square*,
June 15*th*, 1839.

WELL SINKING.

The accompanying drawing is a section of a well sunk at the foot of the reservoir in the Hampstead Road for the New River Company. It also exhibits the strata of the ground passed through. The following account is an abstract of a paper "On the supply of water from Artesian Wells," by R. W. Mylne, Esq., read before the Institution of Civil Engineers, April 30, 1839, fully describing the nature of the works.

Artesian wells, so called from their having been originally adopted in the province of Artois, by the Romans called Artesium, are usually made by boring vertically through a deep stratum of clay into one of sand, which generally contains water. The water will rise to a considerable height, depending on the elevation of the point at which the sand stratum drops out from under the bed of clay. The London basin is peculiarly adapted for these wells, as on the large bowl of chalk is a thick lining of sand, supporting a deep bed of clay, known as the London blue clay. On boring into this sand, or into the chalk, the water rises to various heights, and it has been thought that an abundant supply for the metropolis might thus be obtained. With the view of ascertaining what dependance can be placed on this source, the New River Company sunk a well, the details of which form the subject of this communication. Before entering on these the author mentions several instances of wells supplied from the *sand springs* in various parts of the metropolis, and other parts of the country. In most of these the supply has been so affected by neighbouring wells, or the upper ground and buildings have been so endangered by the large cavities produced in consequence of the fine sand being pumped away, that the wells have been abandoned. Several remarkable instances of the effects of this subsidence are detailed in this communication. Experience thus appearing to shew that little dependance can be placed on the sand springs, it has been suggested to sink through into the chalk; but the supply from this source also is affected in a remarkable manner in various cases.

The author then proceeds to give the particulars of the sinking of the well in the Hampstead Road. In March, 1835, an excavation, 20 feet in diameter, and 23 feet deep, was made: the sides were supported by wooden curbs with puddle at the back, so as to shut out the land springs. At the bottom of the curbs, just in the blue clay, a cast-iron footing was added, and a brick shaft of 12 feet 6 inches diameter carried up to the surface of the ground. The excavation was continued for 59 feet through the clay, steined with 9 inch brickwork in cement, iron rings were placed at every 8 feet of the brickwork, and of a greater diameter than the shaft, and projecting into the clay a few inches so as to support the shaft in its progress; the brickwork was continued through 57 feet only, leaving 2 feet of clay for a foundation. The excavation was now reduced to 10 feet 9 inches, for the purpose of introducing cast-iron cylinders formed of six segments, 6 feet in length, united by bolts through flanches on the inside, and leaving 9 feet 9 inches clear diameter. These being joined together were forced down by hand screws, as the sinking continued through the 2 feet of blue clay and through 10 feet of soft mottled clay, at the bottom of which water appeared.

The well was kept dry by an engine and two 8 inch pumps in two lifts, and the sinking continued for 8 feet, through a bed of fine brown sand. Cavities were now discovered behind the cylinders, which were forced out of the perpendicular by the unequal pressure, and became completed jambed. A second set of cylinders was now prepared, and the sinking continued for 26 feet through the remainder of the dark brown sand, soft mottled clay, a thin layer of pebbles and black sand closely embedded, and 4 feet 6 inches of dark brown sand. Cavities were again formed at the back, and the cylinders again became jambed.

A third set of cylinders was now prepared of 7 feet 4 inches diameter, and the sinking continued through 7 feet of dark brown sand, and 5 feet of dark quick sand, when they again became jambed. During the latter portion of the work great difficulty was experienced from the blowing of the sand often to the height of 6 feet; this occasioned great cavities behind the cylinders and the brickwork; several segments of the former were broken at their vertical flanches, and the lower part of the latter was much cracked. A large cavity also was formed at the back of the brick shaft about 60 feet from the surface. The settlement of the ground at the surface was so extensive that the pumping the works was discontinued until the plan suggested by Mr. Simpson, of continuing the sinking with the water in the well, was adopted.

For this purpose, in August, 1836, a wrought iron cylinder of boiler plates, 62 feet long, and 5 feet 10 inches diameter, was lowered to the surface of the sand, which was hard under the pressure of the water, and removed by an instrument called a miser, and which holds about two bushels. The cylinder was forced down by hand screws on its upper edge, through the remainder of the quick sand stratum, through a bed of sand with flints and pebbles, and through a bed of chalk and flints, into the chalk to a depth of 12 inches. The water and sand being now shut out, the well was dried, and in March, 1837, the sinking continued in the usual manner to a total depth of 183 feet, the chalk being sufficiently indurated to require no lining. The water now increased considerably, and the chalk was excavated to an enlarged diameter below the bottom of the wrought-iron cylinder, for the purpose of forming a brick footing. On the top of this is a broad cast-iron ring, upon which rest cast-iron cylinders of a clear diameter of 4 feet 7 inches, which were introduced within the wrought-iron tube, for the purpose of strengthening and guarding against the admission of sand in case of its failure from corrosion.

In February, 1838, the works being complete, the pumps of 12 inch diameter were introduced in two lifts; and in August, 1838, when the springs were short, and in March, 1839, when the springs are at their best, an experiment of two weeks was made; the result of the former was 14,898, and of the latter, 30,499 cubic feet per day of 24 hours. The total expense of the well was 12,412*l.* 14*s.* 1*d.*

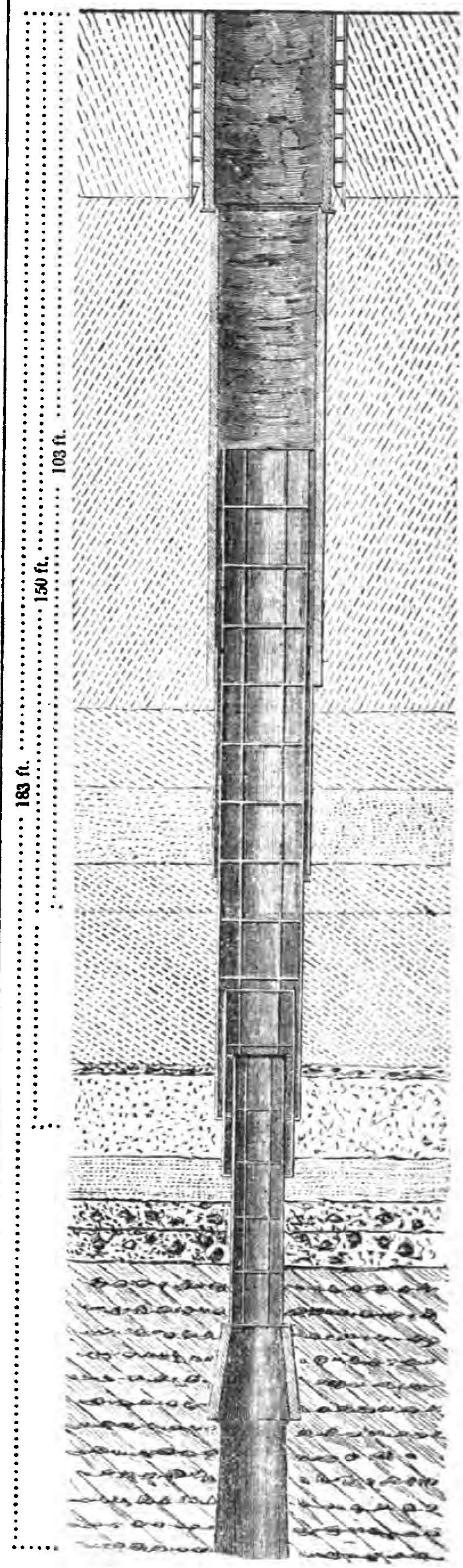
The paper is accompanied by a copy of the report of James Simpson, Esq., in which the plan adopted for the completion of the works is recommended. Mr. Simpson details the difficulties which had been met with, and particularly the extensive subsidence of earth caused by the removal of the sand. This far exceeded the quantity due to the contents of the well at the lower sand stratum, and the subsidence proceeded most rapidly when the water was pumped out of the well. The experience of wells near the metropolis shews that the springs in the chalk are much more abundant than in the sand, but in order properly to avail ourselves of these there must be adits driven to unite the water from the fissures in the cavernous structure of the chalk. The report proceeds to speak of certain methods of securing the present works, and of prosecuting them by either driving an iron pile curb or sinking iron cylinders cast in entire circles. The former cannot be recommended, as a considerable further subsidence would be the consequence, and the shaking of the ram would endanger the works. The latter is performed with common boring rods and tools, the shells or buckets are fitted with valves opening upwards, and the material is raised by them with the greatest ease. When the cylinders become set, or when they do not sink in proportion to the material removed, they are slightly jarred by a heavy sledge hammer. The advantage of keeping the water in equilibrium inside and outside the cylinders is very great, and the method has been found in many cases most efficacious.

The paper is accompanied by a section of the works and the strata, and by drawings of the various tools employed.

Mr. Brunel stated, that the succession of the strata here described was nearly the same as they had met with at the Tunnel.

Mr. Simpson remarked, that the greatest caution was requisite in drawing conclusions respecting the strata in one part of the metropolis from what was known of it in another part. At Lambeth, for instance, in the same shaft, there might be gravel on one side and sand on the other, and the London clay here is about 32 feet below Trinity high-water mark: near Chelsea College the London clay is met at the depth of 38 feet, after passing through sand and gravel, and a little farther on, in the King's Road, the clay is reached without passing through any sand, and in this locality the chalk is touched at 245 feet below Trinity high-water mark. It was a remarkable fact that they should have reached chalk at so small a depth in the Tottenham Court Road well. The alterations in the strata are so great, that no one who has had any experience of wells will venture to infer from one place what will occur at another. The engine employed at this well was a twenty horse, and worked at an expense of about 2*l.* 7*s.* per 24 hours. This, however, is a very small part of the expense of supplying water to houses, as the water has to be raised to the houses, and the cost of pipes must be included. It was not very intelligible how water is to be raised from so many feet from below high-water mark, and supplied at the same cost as water taken from the Thames at the level of high water.

SECTION OF THE WELL AT THE HAMPSTEAD R[...]



CANDIDUS'S NOTE-BOOK.
FASCICULUS VI.

I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please.

I. Had Lord Kingsborough written "I'd be a butterfly," or some such piece of mawkishness, he might have been as *celebrated* as Haynes Bayley, or other celebrity of the same calibre. But the author of the Mexican Antiquities might have put the whole of his public, that is, all the public who know or care any thing about his seven stupendous folios, if not into a nutshell, into a moderate sized room. Truly the F.S.A. author of a recent Architectural Dictionary has been much wiser in his generation than was the noble Viscount; for at all events he knows how to manufacture ware for the market, and to speculate upon the ignorance of the public.

II. Who Madame Flora de Tristan may be I know not, nor am I sure that her "Letters à un Architecte Anglais" are bonâ fide letters really addressed to any one, or merely criticisms and comments on the architecture of London, put into an epistolary form. In all probability the latter is the real fact, because it is not very likely that the lady would have undertaken to enlighten an English architect upon such a subject, more particularly as the general tendency of her remarks are by no means flattering to our national vanity. She is of opinion that since St. Paul's we have produced nothing really noble in church architecture. All our modern buildings of that class are censured by her as being totally deficient in character, mere auditories or lecture rooms, without any thing whatever to impress the mind or excite devotional feeling. Then again she taunts us with the egregious absurdity of the 'Achilles' as it is called, in Hyde Park, with the York column, and the new palace, which latter she justly enough pronounces to be in every respect *mesquin*. "Toutes gigantesques," she says, "que soient vos entreprises de ponts, de chemins de fer, elles ne sont jamais que des *speculations* faites sur une échelle plus ou moins vaste pour satisfaire à des besoins matériels. Parmi les edifices construits depuis la paix dans votre capitale, j'en cherche vainement un qui approche en splendeur de Greenwich, &c." To be sure we are not obliged to pay any regard to the opinions of an impertinent French woman, nevertheless it is rather mortifying to find that such injurious notions spread abroad, and that we cannot compel foreigners to admire the buildings upon which we compliment ourselves. Madame Flora is besides most horribly heterodox, for she pretends that all modern architecture is nothing but copying, without the slightest attempt at invention, as if all possible modes of beauty had been long ago exhausted. Poor creature! poor woman! does she then imagine that architecture is like millinery and bonnet-making? However, the comfort is we are not likely, for some time to come at least, to have architects in petticoats, or else,—but the idea is too awful. After all, to give her her due, the woman has some *nous*, for in speaking of the Royal Exchange that was, she says that statues of celebrated discoverers and inventors who have advanced our commerce, manufactures, and our commercial relations, would be far more appropriate in such a building than those of kings and queens; and that the natural products of our colonies ought, as far as they are capable of being so, to be introduced as symbolical ornaments. Notwithstanding the quarter it comes from, this is a very good hint, which there is now an opportunity for our architects availing themselves of, in their designs for the new structure.

III. What does Bartholomew mean by calling the new front of the Surgeons' College "a barbarous heap of ill-favoured sand," and saying that "it is a creaking mass of fracture?" The original design was barbarous enough, so much so that one might almost have imagined its taste alluded punningly to the company of *barber* surgeons. But as to any fractures the present front exhibits, I fancy Bartholomew would find more cracks in his own head. Pray heaven! he may not be St. Bartholomew'd by being flayed alive by his brother architects for the very scurvy remarks he has cast upon the whole profession; nor has he scrupled to affirm that "architecture sinks in quality, science, curious finish and duration."

IV. St. George's, Hanover-square, which, by the bye, is mentioned in the newspapers very much oftener than by architectural critics, is censured by Pennant for reason which no one, unless previously informed, would be able ever to guess. According to him, it is "too Brobdignagian!" Well, we have many other buildings that may be censured as too Lilliputian, so that between the *too* stools we fairly come to the ground. Lilliput and Brobdignag remind me that a French translation of Gulliver's Travels has just appeared, decorated with a profusion of wood engravings, which are just now all the rage. This, I suppose, will help to bring Swift's satire again into vogue, for it may be questioned whether it has had a score of readers in this country during the present generation. Why does not somebody set about illustrating Holberg? Enough: if I go on upon this crotchet I shall need illustration myself.

V. Schlegel has, somewhat fantastically, it must be confessed, compared architecture to frozen music; and the analogy so far holds good, inasmuch as it may be predicated of some of our buildings, that, if not very *harmonious* they are at any rate *frozen*, having a most chilling and even frost-bitten look. They are not merely "as cool as cucumbers," but actually as cold as icicles,—nay, one or two that might be named, are positively *eye-sickles*—things that cut the eye confoundedly, and which *I* should like to see cut down.

VI. Rare news for architects!—Yes, let them prick up their ears at it, for according to Victor Considerant, the disciple of Fourier, the whole human race is to be not only comfortably but magnificently lodged in palaces, each capable of affording accommodation to three or four hundred families. "The palaces of Versailles, Mannheim, the Louvre and Tuileries, are mere baby-houses in comparison with what such colossal edifices will be." Again we are told: "all those who are now obliged to dwell in miserable hovels and garrets, and sleep on straw beds, will then occupy 800,000 palaces surpassing all those of Rome and Paris!!!" Eight hundred thousand palaces! there is work for architects! plenty of scope for design! Even should there be some *leetle* mistake in the computation—a couple, or for the matter of that, three or four cyphers too many, still there would be a good many very capital jobs and of competitions likewise for a century to come. Pray heaven! it may not be a mistake altogether, that Victor Considerant is a more considerate person than to humbug us with mere dreams, with the fumes of his own imagination. But then if there be truth in the prophecy of the disciple, may there not also be as much, or even more in that of the master? And what did Fourier himself predict on his deathbed? truly nothing more nor less strange than that "in the course of two hundred years men will have tails thirty-two feet long"!! a pretty kind of entailed property that for a gentleman to have to carry about with him, dragging it at his heels wherever he goes. Perhaps it may be merely figurative, and the dying philosopher meant nothing more than that in the time specified by him, the whole human race will have become Dan O'Connells. At all events, it is some comfort to reflect that none of us are likely to live till that tailed generation shall arise; therefore if none of the eight hundred thousand palaces are to be begun until then, the architects of the present day will not be greatly benefitted by the scheme. Besides which, it is possible that there is either some very odd jumble in Victor Considerant's ideas, or some juggling in his language, and his real meaning may be that society will in course of time be lodged entirely in prisons and union workhouses, which for the sake of euphony, he is pleased to designate by the milder appellation of palaces.

APPLICATION AND INTENT OF THE VARIOUS STYLES OF ARCHITECTURE.

[We have made the following extracts from an article of considerable merit which appeared in the 27th volume of the Quarterly Review. The remarks made by its author strike at principles and not at details, and may perhaps be useful in calling the attention of our readers to some important truths.]

When employed by its authors and inventors, the architecture of Attica and Ionia is faultless. The separate members of the building have a definite relation to the whole. They are aggregated by affinity and connected by apposition. Each one is in its destined place; no one is extraneous or superfluous; all are characterized by fitness and propriety. Grecian architecture is a composition of columns, which are intended to assemble themselves only in the form of a Grecian temple. They seek to enter into no other combination. Beauty and elegance result from their union. The long unvaried horizontal line of the entablature rests in stable tranquility upon the even ranging capitals below, and the conical shafts are repeated in unbroken symmetry. The edifice is perfect in itself. Therefore it admits of no change in its plan, of no addition to its elevation. It must stand in virgin magnificence, unmated and alone. The Grecian temple may be compared to a single crystal, and the laws by which it is constructed are analogous to the process of crystallization. Disturb the arrangement of the primitive molecules of the crystal, and they will *set* into a misshapen fragment. Increase the number of these crystals, allow them to fix themselves upon each other, and their individual regularity will be lost in the amorphous mass. Thus, in the Grecian temple, the component parts have settled themselves into a shape of perfect harmony, such as is required by their integral figure, but it is a shape which cannot be varied in its outline, nor can it be changed in its proportions. Neither does it submit to be annexed to any other. Every attempt which is made to blend the temple with any other design, produces a lame and discordant effect. We must reject the arch, the noblest invention of architectural science. Porticos cannot be duplicated. Doric columns cannot be raised in stories. No window can open into the cell. No wing can be added to the right or to the left which does not at once convince the observer that it has no real relationship to the centre which it obscures.

How could any other result be anticipated? The sacred architecture of Greece admits of no habitable interior. A cell of narrow dimensions, lighted by an aperture in the roof, and intended to contain a single statue, is the only chamber which can be placed within the walls of the temple. We are not required to enter into the fane. It is a monument which we are to contemplate from without, and which appears in its pride when considered as a portion of the surrounding landscape. The chaste columns and pure sculptures which are now mellowed by the hand of time to a sad and sober grey, originally shone with all the splendour of the east. Every moulding was distinguished by strongly contrasted colours; and the snowy whiteness of the Parian marble was concealed beneath the glowing layers of gold, azure, and vermilion. In the opinion of the Grecian architect, his building was seldom more than the frame-work of his sculpture. He never intended it for social worship. A temple was a shrine upon which decorations were to be displayed. The altar flamed before the portico. The votary was to offer up his sacrifice in the hypæthrum, looking around to the woods, the purpled hills, and the circling horizon.

From the science of its mechanical execution, aided by the transcendent skill of the sculptor, the beauties of the design of the Grecian architect are doubly enhanced. As masons, the Greeks carried the art of building to the highest excellence. The Grecian architect possessed the means which his mind required. His elements were few. Scarcely any variety of structure was required from his art. He placed a larger number of columns around the more sumptuous edifice, and a smaller number around the more humble structure: he raised the temple and the tomb. His career was definite; he saw the end of it. He was required to perfect, rather than to invent. Grecian architecture submits itself to the judgment, and the judgment is satisfied. A problem has been proposed to which a perfect solution has been given. The Grecian architect performed all that he had promised to himself; all that he wished to have, was given to him: and so soon did the Grecian style attain its wonderful perfection, that, from the earliest to the latest period, a few elegant improvements, scarcely to be discerned even by the practised eye—a few tasteful variations, rather to be described by the learned than felt by the spectator—are the only tokens which denote the progress of Grecian art from infancy to maturity.

Such were not the labours of the Gothic Freemason; he stops frustrated, but not in disappointment. Neither the quarries of Pentelicus nor the chisel of Phidias could assist him. Rude materials and still ruder hands were all that he could command. His architecture must depend upon its innate character and significance. The cathedral is to be considered rather as a forethought than as a finished specimen. It exhibits the effort that has been made to embody those abstract ideas of solemnity and grandeur which could not be fully realized or accomplished by human power. Still the effect has not failed; Gothic architecture appeals to the imagination, and fancy half supplies the deficiencies of the material scene. A Gothic building has always the charms of mystery, it always appears to be larger than its actual dimensions. The mouldings, the pillars, the arches, always create receding shadows; and to the mind, the idea of space arises from a succession of shadows, just as the conception of time results from the succession of ideas. In the earlier Gothic styles, the management of the aërial tints was studied with remarkable skill. The mouldings are all undercut, and the curves are almost invariably of the higher order; and the limbs of the apertures are marked by carrying the mouldings above the level of the wall. A small fillet also often runs down the front of the lesser columns. By these artifices all the forms of the building are brought out, *painted*, as it were, in chiaro scuro; for the minute linear projections catch the light and heighten it, and the undercutting deepens and mellows the shade. In the more luxuriant styles, however, this attention to the tints was neglected, and the mouldings occasionally became shallow and trivial. Daylight is courted by the Gothic architect. The lines and masses of the roofs, and buttresses, and transepts, the ascending pinnacles and towers, are marked and defined by the full blaze of noon, which falls upon them and contrasts itself with the freshness of the apertures, and the darkness of the walls which are behind the sunshine. Gothic architecture seeks to exclude the sight of middle earth. Its genius delights in quadrangles, cloisters, porches; in piles which expand and close round the spectator, leaving him nought to contemplate but themselves and the sky and clouds.

The gothic style always fills the eye, and conveys the notion of comprehension and capacity. Habitation and converse, and congregational worship beneath its roof, are seen to be its intent. We are invited to enter into the cathedral. The portals expand, and in the long perspective which appears between the pillars of the porch, and ends in the distant choir, the light darts downwards through the lofty unseen windows, each marked by its slanting beam of luminous haze, chequering the pillars and the pavement, and forming a translucent gloom. Gothic architecture is an organic whole, bearing within it a living vegetating germ. Its parts and lines are linked and united, they spring and grow out of each other. Its essence is the curve, which, in the physical world, is the token of life or organized matter, just as the straight line indicates death or inorganized matter. It is a combination of arches whose circles may be infinitely folded, multiplied, and embraced. Hence the parts of a gothic building may be expanded indefinitely without destroying its unity. However multiplied and combined, they still retain their relative bearing; however repeated, they never encumber each other. All the arched openings, the tall mullioned windows, the recessed doors, are essential parts; they do not pierce the walls of the structure, on the contrary, they bind them together. The spire may rise aloft, the large and massy walls may lengthen along the soil, but still the building preserves its consistency. Richness of decoration, colour and gold may increase the effect of the gothic style, but the inventor chiefly relies upon his art and science. Gravitation, which could bring the stone to the ground, is the power which fixes it in the archivolt, and every pinnacle bears witness to the mastery which the architect has gained. Frequently the details are bad. Parts considered by themselves are often destitute of beauty, but they are always relevant, and all minor faults are lost in the merits of the entirety. The history of the style accounts for its propriety, its chiefest merit. Gothic architecture, whatever its primitive elements may have been, was created in the northern parts of Europe; it was there adapted to the wants of a more inclement sky. Its structures were destined for the religious worship of the people amongst whom it was matured. In a gothic church no idea can possibly arise, save that of christianity and of the rites of christianity. We cannot desecrate it even in thought. From its mode of construction no convenience which we need, ever becomes a blemish, and its character assimilates itself to every emblem or ornament which its use requires.

Many of our contemporaries, whose genius no one can respect or prize more highly than we do, are desirous of introducing the pure Grecian style for the purposes both of ecclesiastical and of civil architecture. But even their talents cannot naturalize the architecture of ancient Greece in modern England. The Grecian temple will not submit to be transported into our atmosphere. No adaptation can be given which will reconcile it to utility. Plate-glass windows glaring through the intercolumniations, chimnies, and chimney-pots arranged above the pediment, are just as appropriate as English nouns and verbs in a Greek hexameter. When the portfolio is opened and the drawing is shown, these incongruities escape observation in the neat lines and colouring of a geometrical elevation, which can be made to look just as the artist pleases.* But when the scaffold is struck from the real building standing in the open air, then they strike us most forcibly; and we are compelled to acknowledge that its principles are too stubborn and unmanageable. View the Grecian temple as a dwelling and with relation to its inhabitants, and then every part and portion which contributes to comfort or convenience, is a grievous sin against architectural fitness; they are rejected by the very essence of the building into which they obtrude themselves. Is it considered with regard to its destination, is the architect retiring into his study to plan the justice-hall, or the palace, the college, or the church? Why then, every sign which tells the intention of the structure, which connects it with the policy, the learning, or the religion of our age, becomes a monstrous and perpetual solecism. If the aid of the chisel is called in for the purpose of decorating any pure Grecian building, we are compelled to abandon every shape and form which bespeak a modern origin. For instance, in the public buildings of all nations, the architect feels, or ought to feel, the necessity of introducing the

* If solid models were more in use, the effect of our buildings would be better understood both by the architect and by his employer. For models on a small scale, a very ingenious application has been made of *elder pith*, a substance hitherto unemployed for this purpose. It is capable of being stamped into the most delicate architectural ornaments, and the fineness of its texture and the mellowness of its colour, add greatly to the beauty of the minor buildings. This discovery, for it deserves the name, is as yet very little known.

distinguishing symbols of the people in whose land the pile was raised. From them the structure obtains its national character. Heraldic ornaments may therefore be considered, not as ornaments, but as the significant stamp of our edifices; yet an artist would never venture to place the arched crown or barred helmet in the pediment, or to bring the lion and the unicorn in conjunction with the stately Doric portico.* Would a Roman architect have been afraid of the eagle? These observations may appear trifling, but if they are considered, it will be soon understood how such scruples and difficulties estrange the architect from the intellectual cultivation of his art, and reduce him to a mere mechanical draftsman.

The objections which present themselves against the pure Grecian style, do not operate with equal force against that modification of the Roman orders which was invented by the great Italian architects who flourished after the revival of the arts. This style has been called an adulterated style. It may be admitted that a new compound has been formed, but the alloy possesses a ductility which is denied to the purer metal. And we do not scruple to acknowledge, that, if we were practical architects, we would gladly err like Bramente and Palladio, and Michael Angelo. This style has been so judiciously matured and naturalized as to acquire great propriety and a great degree of picturesque beauty. Perhaps it was perfected in England. Wren, the Ariosto of architecture, brought it to the highest degree of excellence. It is a bad omen for the progress of architecture, that so many attempts should now be made to depreciate the productions of this great man, the pride and honour of English art. The exterior of St. Paul's cathedral resulted from the earnest reflection and labour of a most comprehensive mind. From the pavement of the area up to the cross-crowned globe, there is not a portion which can be removed without destroying the integrity of the composition. It was all present and visible to the mind's eye of the architect before a line was drawn upon the paper. It tells a complete story, neither weakened by after-thoughts nor disfigured by redundances. If snail-like we crawl about the surface, we may grope and stumble upon some petty deformities, an unclassical vase or an inelegant scroll, but no one who has the heart to appreciate this master-piece can be patient when he hears such cavilling criticism.

Wren had the conception of a painter. Architects often fail from the poverty and meagreness of the masses and returns. They compose their buildings out of screens and facades. They seem to forget that a building is to be viewed from more than one point of view, and in various lights. One of the pleasures which we derive from the contemplation of architecture, arises from the manner in which the objects unfolds and varies as we approach it, or recede from it, or walk around it. We study the play of the perspective and the changes of the shadowing. The spectator wishes to have a spectacle of which the merits are not to be made out at once. A building destitute of these powers of stimulus and provocation, is like a fair woman's countenance without intelligence or passion, a second look begets indifference, a third, satiety. Wren fully understood the method of giving architectural expression. His lines and masses are always working upon each other. The small low door at the side of each belfry of St. Paul's marks the loftiness of the pile. By coupling the pillars of the double portico he obtained further breadths of shadow as well as greater altitude than he could have done by adhering to the plan of the Grecian portico. And the pyramidical belfreys unite in a symmetrical group with the towering dome, based upon the colonnade which circles and retreats below.

The claims of any particular style, and the merit of any building may be estimated according to a very simple and intelligible principle. The real architect ought not to work by line and rule; he should recollect that he is composing a work which ought to have a given intent. Whenever he determines to adopt any system which prevents him from yielding to the *meaning* of his structure, he ought to apprehend that he is in the wrong. Whenever he feels himself cramped by his pattern, he may be assured that the precedent, however good in itself, is bad for the purpose to which he makes it a slave. Lines of equal length, duly rhymed and well disposed in pages of equal dimensions, do not constitute a poem unless they have sense within them. Columns however prettily arranged, pediments though classical, architraves, friezes, stylobates, do not make an architectural *work* unless they are so disposed as to conform to the end and object of the edifice which they adorn. Should they not perform this duty, the builder is no architect. The fabric may be sumptuous, comfortable and convenient, but as a production of the art it has no more merit than a barn—not even so much,—because the barn-door, and the thatched roof, and the weather-boarded sides, are all in keeping with the threshing floor within;—and this is not the case with such an unmeaning structure. It is the business of the architect to unite splendour when a display of wealth is desired, comfort and convenience in all cases, with that intelligence which alone entitles him to an artist's name. As the poet seeks that every phrase and word which he employs should be poetical and analogous to the style and character of his poem, so should the architect try to keep every member and portion of his building concordant to its intent. It would be a grievous sin against good taste, that is to say against common sense, if in a Christian hymn we were to introduce the mythology of Ovid or Virgil. This will be readily acknowledged, and the fault could not be committed by any one of the present day. But is it less incongruous to adorn the walls of a Christian church with the scull of the slaughtered bull and the sacrificial patera? Architects are perpetually introducing *classical* emblems, as they call them; but if they are employed as things without meaning, they are nonsense. And if we consider them as bearing a meaning, then their signification is so out of place that it becomes an absurdity.

An architect should recollect that he is not a pupil whose merits consist in repeating a lesson by rote, but a man who deserves no praise unless he makes an intelligent use of the lesson. If he would take the liberty of thinking for himself, he would certainly remedy such gross and palpable errors. It would not be difficult to preserve some degree of consistency even in a church built according to the Grecian or Roman orders. Instead of the lotus, or the honeysuckle, or the acanthus, there might be introduced the vine, the palm, the olive; which in a certain degree have the character of scriptural trees. Many of the emblems of Hope, Faith, and Redemption, found on the tombs of the early Christians, might be advantageously employed; and without the slightest approximation to the rank adornments of popery, the artist could adopt such a system of Christian iconology as should be neither ungraceful nor unappropriate.

Texts or inscriptions may be so managed as to become very ornamental and impressive. But the letters should be large and deep, and cut in the hard stone, as a part of the original conception of the building, and not painted on, as a subsequent addition. The architect should also avoid the most vulgar error, so often committed in printed books, of adding chapter and verse at the end of the line. Whenever a quotation is addressed to the *imagination* of the reader, we must assume that we are merely bringing to his recollection the words of an author whose works are already known to him. We should not appear to teach something new. The beauty of an illustrative quotation consists in its being apt, in its being familiar to our minds. It must seem to present itself without labour, not as if we had sought it out. The total want of inscriptions upon our modern buildings is a further proof of the vagueness of modern architecture. It was not thus among the ancients. They built for the people, who saw their chronicles upon the marble. The lines were read by the fathers, the children, the grandchildren, and after the lapse of ages, the moss-grown characters add the most powerful charms to the majestic ruin. These means of giving interest to architecture are now always neglected. The Waterloo Bridge, unquestionably the finest in the world, might for any thing which appears upon the granite, have been erected by a people ignorant of the art of writing. It does not even bear a date.

A church should never vary from the established plans adopted of old; nor should it be wanting in any one of the parts which we have been accustomed to see in sacred buildings. Durandus,* in his de-

* It is lamentable to note the treatment which these respectable animals receive from modern sculptors when they seek to *classicize* them. They are usually compelled to turn their rumps against the shield which they ought to support, and that in the most awkward manner. Artists in general are completely ignorant of the decencies of the science of heraldry. One blunder, which they perpetually commit, and which shocks the eyes and the judgment of the herald, is the practice of bundling up the royal bearings in a circle within the garter, instead of representing them on the shield. The prescriptive forms of heraldic animals should never be varied under the mistaken idea that they are improved by bringing them to a nearer resemblance to nature. They are not intended to represent natural animals, they are symbols like the Egyptian hieroglyphics. Brooke, the herald, once went to the Tower for the purpose of seeing the lions. When the worthy King-at-arms was introduced into the presence chamber of the royal beasts, he swore that the warder was cheating him; he had *tricked* lions any time these forty years, passant, rampant, couchant, regardant, and he ought to know what a lion was. As a herald, Brooke had a right to be incredulous.

† The solemn dulness of the allegories of Durandus is almost amusing:—'Turres ecclesiæ, predicatores sunt et prælati ecclesiæ qui sunt munimen et defensio ejus. Unde sponsus ad sponsam in canticis amoris sic loquitur: Collum tuum sicut turris David edificata cum propugnaculis. Pinaculum turris, vitam vel mentem prælati, quæ ad alta tendit, repræsentat. Gallus super ecclesiam positus, prædicatores designat. Gallus enim profundæ noctis pervigil horas suo cantu dividit: dormientos excitat; diem appropinquantem præcinit, sed prius seipsum alarum verbere ad cantandum excitat. Hæc singula mysterio non carent ....
Virga ferrea in qua Gallus sedet, rectum repræsentat prædicantis sermonem, ut non loquatur ex spiritu hominis sed Dei. Fenestræ ecclesiæ vitreæ, sunt

scription of a church, finds allegories throughout. The four walls are the four cardinal virtues. By the windows the Scriptures are represented. The columns figure the Doctors; the steeples are Prelates: and he ascends unto the weathercock, which he turns into a tale of mystery. It is not necessary to endue porches and steeples with this kind of reverence; but still it is not proper to innovate by mutilating the building of its accustomed members. The influence of visible objects over the mind cannot be resisted, and the absence of architectural costume, if we may so express ourselves, completely destroys the dignity of the building.

In the disposition of the interior, modern architects vary from the proper ecclesiastical arrangements, in a very unjustifiable manner. It is scarcely possible to create a more palpable blemish than that which is occasioned by placing the pulpit in the centre of the nave. In a dissenting meeting-house, it may be proper to assign this station to the preacher, but it is quite inconsistent with the intent of our liturgy, and should never be tolerated. The situation of the reading-desk below the pulpit, like the desk of an auctioneer's clerk, is equally unappropriate. An organ and an organist *over* the altar must also be considered as an inexcusable violation of the decency of the building. By considering the plans of the earlier Christian churches, many useful hints may be obtained, particularly respecting the situations to be assigned to the ministers and the congregation. Much information on this subject is collected in the "Origines Ecclesiasticæ" of Bingham, a writer who does equal honour to the English clergy and to the English nation, and whose learning is only to be equalled by his moderation and impartiality.

Ornaments may be soberly and discreetly introduced. When an altar-piece is admitted, it should never be mounted in a fine guilt frame and considered as a *picture*. In every public building, and, perhaps, in most private habitations, paintings or statues should never bear the appearance of pieces of furniture. They should never look like things which can be put up and taken down at pleasure. The effect produced by such works of art is materially diminished if they seem to be strangers and brought in merely for show. They then are redundant epithets in the *work*, which it would be better to expunge. On the other hand, their value is greatly increased when they have the distinctive character of being required by the predetermined plans of the architect; and indeed they should never be treated otherwise than as ancillary to the architecture. Even the clock, which is usually productive of so much unpicturesque deformity in our steeples, might, if the architect considered it, bear the appearance of belonging to *him*, instead of being supplied "as per order of vestry" by the manufacturer. In the Flemish churches, instead of the solid shining black face and smart gilt numerals, the architects employ large rings or circles of bronze, between which the figures, cut out of plates of the same metal, are fixed. This open-worked metallic tracery agrees completely with the stone tracery, and does not obscure any part of the architecture. A figure of the sun, the measurer of time, is sometimes placed in the centre of the inner circle, which it supports by its rays, and when colouring was required, the architects used azure, the tint of the celestial sphere.

Most of our modern churches have a mean appearance in consequence of their want of elevation; they seldom range higher than the adjoining houses. As long as the custom of depositing the dead in vaults shall continue to prevail, we may add to the grandeur of the building without increasing the expense. The body of the church might be made to stand upon an undercroft, the pavement whereof should not be more than one or two feet below the level of the adjoining ground. This crypt might be divided into sepulchral chapels, and the monies to be raised by the sale of the right of interment to families would go in aid of the building funds. No church should be without a lofty steeple. The "heaven-directed spire" has a sacred dignity which should never be sacrificed except under the pressure of the most imperious necessity.

There is considerable difficulty in combining a steeple with the orders of Grecian or Roman architecture. Wren mastered the difficulty, and produced combinations scarcely inferior to the Gothic. The Grecian or Roman steeple appears worst and ugliest, when, as at St Martin's in the Fields, it is seen *riding* athwart a Corinthian portico, to which it does not bear the slightest affinity;—and best, when, according to the favourite practice of Palladio, it stands by the side of the edifice as a campanile or bell tower. When so managed, it is grouped with the lines of the building into a pleasing mass, without being based upon a discordant feature. In London we have only one example of this arrangement. It is exhibited in a building which has been scoffed at and scorned, but which, in truth, is one of the most picturesque in the metropolis—the church of St. George, Bloomsbury. Let any unprejudiced observer view the front of this building, divesting himself of traditionary prejudice, and he will acknowledge the truth of this observation. We will not even censure the statue, which, placed on the summit of the pyramid, appears to look down like a tutelary saint.

All things fairly considered, the Gothic style appears to be the most reasonable order for an English church. It is consecrated by its associations, and the most ordinary architect may easily learn to avoid any marked impropriety. It should be managed freely, and although we would not admit of any fantastic or capricious alterations of the style as existing in the great master-pieces, with which this island abounds, still the architect should not be inhibited from such a discreet power of adaptation as the circumstances of the case may require. Such variations, however, will be very rarely needed, and then only in the disposition of the subordinate parts of the edifice. Our modern workmen are capable of executing the finest ornaments of the Gothic style. Mr. Gayfere's restorations of the front of Westminster Hall, and of Henry the Seventh's Chapel, might excite the envy of the most cunning freemason of the elder day. And the science which raised the Waterloo-bridge would enable the architect to groin the loftiest quire. In such of our English Gothic buildings as were erected after the age of Edward I. the drawing of the sculptures is often rude and clumsy; but it is a strange mistake to suppose that when the architect copies the Gothic style, it is also necessary to copy the imperfections resulting from want of skill in a peculiar branch of art. He is under no obligations to reproduce ugliness. Let him take all forms which are beautiful, and reject all such as are unpleasing. In the Gothic of France the human figure is often treated with remarkable purity of design; and there is no reason whatever why the statue in a Gothic tabernacle should not have as much elegance as if it were placed in a Roman niche. The costume of the middle ages may be treated with the utmost elegance. The monumental statues now erecting by Mr. Westmacott, for Lord Grosvenor, point out the method in which *real* classical taste—that is to say, the taste which seeks propriety—may be applied to the Gothic style. If a costume, *not being that of real life*, is to be borrowed for our heroic statues, the ancient English state robes have at least as good claims as the Roman mantle, to which they bear a near affinity: and the open crown of Edward the Confessor, encircled by the mystic fleur-de-lis, of which the prototype appears on the monuments of the Pharaohs, would deck the brows of the monarch with full as much grace as the laurel wreaths of the Cæsars. With regard to the subordinate decorations, it may be remarked that painted glass is usually executed upon an erroneous principle. When large plates are used, as by the artists of the Eginton school, they destroy the effect which it is intended they should produce. This art partakes as much of the nature of mosaic as of painting, and it never succeeds except when, as in the excellent productions of the sixteenth century, the figures are formed of pieces adapted to the outline, the lead being lost in the shadows.

A few words must be said respecting sculpture. We will not call sculpture a cognate art, because it is really inseparable from architecture. We may lament that in the present age, the professors of the two arts are so completely divorced in practice. They were not disjoined in the good days of Italy, and we have sufficient genius in England to tempt us to wish for their re-union. In historical and monumental scupture a very questionable taste has been fostered by an ill-directed study of the remains of antiquity. Symbolical representations were employed by the ancients, who always understood their work, with a thorough propriety of invention and of conception. Symbolical figures form as definite a mode of conveying ideas as the letters of the alphabet: when combined they form a word and impart a notion. But the symbols of the classical age are grounded upon a creed wholly foreign to us, and which has reached us only in disjointed fragments. The alphabet has gone out of use, and the language is a dead language; and in its place we mock the ancients by substituting *allegorical* representations, that is to say, by hewing metaphors in stone, vague, strained, and bombastical, affording no satisfaction to the vulgar.

Artists imagine that they ennoble their work by borrowing ancient costume and attributes; much in the same way as a country schoolmaster keeps up his dignity by making a speech in Latin to the young squire on his birth-day. By these anachronisms, however, they emulate the absurdities of the barbarous ages. In the productions, as well

ripturæ divinæ, quæ ventum et pluviam repellunt: id est, nociva prohibent' et, dum claritatem veri solis, id est, Dei, in ecclesiam, id est in corda fidelium transmittunt, inhabitantes illuminant. Hæ intus latiores sunt quia mysticus sensus amplior est, et præcedit literalem .... Per cancellos vero, qui sunt ante fenestras, prophetas vel alios doctores obscuros intelligimus ecclesiæ militantes, in quibus ob duo charitatis præcepta, quandoque duæ columnæ duplicantur, secundum quod Apostoli bini ad prædicandum mittuntur ......'

Rationale Divinorum Officiorum, l. i. c. 1. The mention of the weathercock contradicts a common notion, that it replaced the cross after the Reformation; and proves the antiquity of the custom.

literary as graphical, of the *Gothic* era, there is a constant and ludicrous confusion of costume, both physical and moral. Joshua stalks in plate armour; the daughter of Herodias dances and tumbles on her head; the temple of Jerusalem is built with the belfry of a cathedral. No inconsistency was perceived. Guillaume de Lorris describes the church of St. Venus; Parson Cupid mounts the pulpit and preaches a sermon, and the choristers and canons chaunt anthems and psalms. Absurdities like these, arose from ignorance and bad taste; they cannot be condemned too strongly. But let us be impartial, if we can. Perhaps information and *classical taste*, as it is called in common parlance, produce equivalent absurdities. Our artists often violate propriety with as much boldness as the much reviled Gothic artists. They disguise their contemporaries in the costume of Greece and Rome. They people the aisles of the church with the lifeless mythology of Olympus. An incessant war is thus waged against reason and propriety.—Do they not forget the great object of their art?—The object of art is to satisfy the reason. Skill may be displayed in the carving of the statue; the limbs may be moulded with faultless accuracy; they may emulate Grecian symmetry: but more, much more than such qualities, is wanting. Unless the sculptor labours to meet the ideas of those who range at the opposite extremes of mental cultivation, he is not imbued with the true spirit of his art, he is a mere workman still. He must satisfy those men who are his friends and companions, the lovers of his art, by the spirit of poetry which he infuses into the representation of nature. He must idealize the countenance, the attitude, the garb, so as to breathe into the figure a spirit of gracefulness beyond the triteness of common life. This is no easy task, and the statue must prove that the artist has overcome the difficulty without destroying the illusion which it is essentially necessary that the art should produce. If we may so express ourselves, he should sculpture in a style analogous to blank verse, avoiding the prose of conversation, and the rhyme of French tragedy. But having effected this end, he must, nevertheless continue perfectly significant to the unimpassioned, uninstructed spectator, who asks for nothing but the representation of the common form; to him who is merely seeking for the memorial of the King, the Matron, the Commander, whose memory he loves, or whose fame he admires. Works of art are peculiarly addressed to such spectators. A public monument is a book opened for the perusal of the multitude; unless it declares its meaning fully, plainly, and sensibly, the main use is lost. This principle is so self-evident that it is almost unnecessary to discuss it. And yet how many grand statues, groups and cenotaphs have been cast, chiselled, modelled, and manufactured, in which this plain and first intention is wholly lost!

We may here be allowed to relate a true story, which in itself, as well as in its consequences, affords a volume of instruction. Some years ago a sculptor, whose genius may justly be a subject of national exultation, happened to be present at Guildhall when Nelson's monument was first exposed to view. A child who stood before him, was exceedingly attentive from the moment when the canvass began to fall before the marble. The boy looked anxiously at the statues as they appeared. When they were completely unveiled, he could not possibly conceive that the obscure medallion on the lap of Britannia contained the likeness of the naval hero: so he cried out in a tone of mixed inquiry and of disappointment, whilst he pointed at Oceanus,—"Father, is *that* Lord Nelson?"—The sea god, the most prominent figure of the group, naturally seemed to be the personage in whose honour it was erected; but how could the bearded naked giant be the British admiral? The Guildhall cenotaph is of miserable workmanship, but the just censure conveyed by the exclamation of the child, was not lost upon Chauntrey, who was then at the beginning of the career in which he has since bounded forward. And his productions, which will hereafter form an æra in the history of English art, prove how successfully real genius can discard conventional aids.

Moderate artists resort to graphic allegory for the same reason that poetical allegory has been favoured by poetasters. It is protected by the harmless graces of mediocrity. Affording a convenient help to poverty of invention, it inspires a decorous kind of traditionary respect. We are accustomed to it, and, without much inquiry, its use seems to be sanctioned by the example of a few great men who have employed such representations with success in particular instances, not reducible to general rules. Michael Angelo may be allowed to place Day and Night on the sepulchre. War and Peace, as they are engrafted by Westmacott on the Wellington vase, add to the significancy of the trophy. Sin and Death are embodied by Milton. Yet precedents like these forbid imitation, except by the equals of the mighty masters. We have partly confessed this truth by abandoning all heathen mythology and allegory in literature. Neither Mars nor Bellona are invoked in rhyme to aid the slaughter; and Hymen and his altar, and Cupid and his bow, are never seen in colours except upon the Valentine. Allegory has been wholly repudiated by the poet and the painter, and in process of time the sculptor will follow their example. But, unfortunately, in all branches of the fine arts, bad taste and pedantry retain an inveterate hold. Books which are not worth reading soon cease to be read; but works of art which are not worth seeing do not easily cease to be seen. Versifiers outlive their trash; whilst the productions born in the Grub-street of art, continue, in spite of their recognized worthlessness, to exercise some gentle influence over some docile imitator. As long as they continue to be a part of our common stock of visible objects, they pervert the taste of the artist as well as of the crowd. The eye easily acquires bad habits: bad examples haunt the imagination of the artist, and influence him when he thinks he is a free agent. Every glaring picture, or ranting statue, is sure to become the fruitful prototype of an hundred affiliated deformities.

We have hitherto spoken only of ecclesiastical buildings. Public monuments of another description must now be considered. At the conclusion of the war the legislature considered the propriety of erecting some memorial which might perpetuate the memory of the events of the mighty conflict. Various plans for naval and military monuments were designed, but no one has yet been adopted, because the money voted by parliament has never been raised. * * *

As similar causes in the physical world always produce similar effects, it may appear reasonable to suppose that the form of a beautiful specimen of architecture, which has afforded a very pleasurable sensation to the spectator, will always retain that power. An exact copy of a pleasing original, when repeated or created anew, may be anticipated to produce the same degree of gratification as it did in its original place. However, when the architect acts upon these premises he is usually disappointed. There are cases, unquestionably, when satisfactory results will follow from such imitations; but a slight consideration of the nature of architecture will convince us that they are of rare occurrence, and that any close or servile imitation of a supposed "perfect model" must usually prove a complete failure.

Architecture produces its effect upon the mind quite as much as upon the eye. Its forms are understood by the intellect, not merely painted upon the retina. The pleasures which it excites arise from complicated sources; they spring from the thoughts which we bestow upon the object, and not merely from the contemplation of the form. This assertion may be easily exemplified. A building which we *know* to be constructed of Canada deals and cast iron pipes, daubed with "lithic paint" or "patent mastick," will never please us as much as if it were raised of freestone. The lines may have the same elegance, but we cannot disjoin the ideas of grandeur and of durability; and the notion of the instability and slightness of the flimsey edifice derogates from its consequence. Besides which, when we look at a building, we are gratified by considering the labour and skill of its construction. We like to see the firm and regular courses of well-squared stone, the shaft compacted with the capital, the wedge stones balancing each other in the arch; but when the materials pretend to perform a part which does not belong to their nature, then we are offended by the deception, at least we receive but a very small proportion of the pleasure which their *forms* would have given if executed in the genuine substance. From the centre of the pit the actress *looks* as fine as the lady in the boxes; but we do not *think* that she is equally well dressed, because we are aware that instead of diamonds, gold, and silk, she is tricked out with glass, tinsel, and gauze, with things that assume to be that which they are not, with *tromperie*. Every deception in architecture becomes a blemish which the mind does not pardon. Windows, which exclude the light; doors which cannot be opened; twisted columns which could not stand beneath their superstructure; columns bearing nothing; passages leading to nothing; are imperfections which are obvious to the most inattentive or uneducated observer. They are deformities, because they are of no use; otherwise the idle imposts or columns, which please when properly applied, would have as much inherent beauty—so far as beauty depends upon form—in one situation as in another. But if we cease to derive satisfaction from the parts of a building on account of their false bearing to the whole, can we be better satisfied when the entire building, the "perfect model," is a falsehood? Every structure raised by the hand of man, derives its entire value from the feelings of the human heart. The hearth gives sanctity to the dwelling; the throne, to the palace; the altar to the temple. But if we erect dwellings, palaces, or temples, which never can be used by human kind, the walls will rise in cheerless and desolate mockery. A perfect modern model of the most perfect Doric temple, if not applied to some purpose beyond mere ornament, would excite no other feelings than those of labour in vain. No person of common sense ever was satisfied with a temple in a garden; we know it is built merely for a show, and as a show we undervalue and despise it.

It may be asked in what manner we are to commemorate national victories. Certainly not by what are called "monuments," not by pillars, arches, temples, having no assignable use, and built merely as "examples." All these are what are vulgarly called "follies," and deserve no more respect than the tower on Shooter's Hill. The ancients never raised *monuments;* they never "realized examples," they never built for display alone; and it was from its connection with actual life that every ancient work of art acquired its vitality.

In copying any Grecian temple, however beautiful, and calling it a Christian church, we depart still more widely from the practice of the ancients. They never imagined that a restoration of a building which did not belong to them was productive of "perfect beauty." In fact, such an epithet, as applied to any building, must be erroneous. Architecture is not an imitation of nature. All the forms of architecture are conventional; it is therefore an art of which the objects do not admit of abstract perfection. Buildings are capable of as many varieties of perfection as of destination; each may be perfect in its kind, if it is perfectly suited to its end. But therefore it follows as a necessary consequence, that it is impossible to transfer its merit to an "example," erected for another purpose, amongst other people, and in another climate; the more the imitation is "correct," the more is its application falsified by its original character.

Any system of encouragement for the arts which inculcates, that perfection is to be attained by compelling the artist to "faithful imitations," is the bane of all talent. The ancient architects never "copied" or "restored" the structures of the stranger. They knew better. Let us attend to the lessons given by those who have attained the highest station in the art. It was from the banks of the Nine that the gifted Greeks received their art and knowledge; but they instantly surpassed the preceptors who taught them the basis of the art, to which their taste and talent, adapting it to their own purposes, gave a beauty, unknown before. Grecian genius refused to reconstruct exact *imitations* of the majestic temples of Egypt in honour of the Hellenic deities. They did not place their gods in the adyts of Isis and Osiris.—The acanthus twined around the capital which had been shaded by the branches of the date tree; new elegance was given to the spirals of the volute; beams of olive crossed the cell instead of the transverse blocks of massy granite. Relieved from the superincumbent weight, the entire frame of the structure sprang up more lightly. The columns diminished in diameter; the architrave ceased to retain a useless solidity; acroteria ranged upon the roof, unknown in the land where the rain of heaven does not fall. The sculptured pediments terminated the required covering and decked the front: and the heavy magnificence of Thebes was lost in the graceful splendour of the Athenian Parthenon.

Whether inherited from their Tuscan ancestors or discovered by their own science, the Romans possessed the art of turning the arch. They had a full perception of the beauties of Grecian architecture then existing in unimpaired perfection. They justly appreciated its excellence, but they never built copies or "examples" of Grecian buildings. Following the faith of Greece, they bore away the statues of her gods; but they did not enshrine their Jupiter within the Doric columns of Athens; they did not enter the Forum beneath the Propylea, nor did they copy the Parthenon upon the proud Capitoline. The art which they had learnt, they put in practice with good sense and prudence. Possessed of a new power, of which their teachers were ignorant, they applied it with boldness. The huge dome of the Pantheon swelled behind the Corinthian portico; fretted vaults took their span over the triumphal train; arch rose upon arch in the eternal amphitheatre; and though the relationship was not disowned, still every feature of Grecian architecture received a new character in imperial Rome.

Amidst the ruins of Rome the great Italian architects formed their taste. They studied the relics of ancient grandeur with all the diligence of enthusiasm; they measured the proportions, and drew the details, and modelled the members. But when their artists were employed by the piety or magnificence of the age, they never "restored" the "examples" by which they were surrounded, and which were the subjects of their habitual study—No! they turned them to a better use. Crude imitation was disdained by this energetic and intelligent race. They felt and understood the beauties of the ancient style; and causing the elements to enter into another combination, a new style was created, which, considered in relation to its intention and employment, possesses transcendent excellence. Retaining the same affinity to the Roman style which the latter bears to the Grecian, it has all the merit of invention, and all the beauty of propriety; and the Pantheon, high in mid air, was expanded into a cathedral worthy of the supremacy assumed by the pontiff, who claimed to be the primate of the world.

It was thus that the greatest impulse was given to national genius in those countries where architecture became an inventive, intellectual art. The architects did not linger in contemplation of their predecessors; former generations had advanced, and they proceeded. No style or structure was held up as a perfect model, or propounded as a test. It was their desire to excel by the mixed exercise of judgment and invention. Selecting from the skill of past ages the ideas best suited to the present, they felt that it was their calling to adapt their art to the wants and feelings of society. It was thus that their structures acquired the charm that we would vainly attempt to impart to cold and corpse-like restorations. Original design will never be fostered if artists are taught to defend themselves by precedents. Those who seek to distinguish themselves by the practice of this, the finest of the fine arts, should not lose the benefit derived from experience. The noble writer who is at once the warmest and most learned admirer of Grecian architecture, will best instruct them how to profit by the contemplation of its excellence. "These models should be imitated not with the timid and servile hand of a copyist; but their beauties should be transferred to our soil, preserving at the same time a due regard to the changes of customs and manners, to the difference of our climate, and to the condition of modern society. In this case it would not be so much the details of the edifice itself, however perfect, which ought to engross the attention of the artist, but he should strive rather to possess himself of the spirit and genius by which it was originally planned aud directed, and to acquire those just principles of taste which are capable of general application." The British architects of the present day are equally distinguished by their genius and their industry; no climate, however remote, has escaped their researches; no toils or dangers are shunned when information and knowledge are to be obtained. The progress of all the mechanical arts has given unexampled means of execution; and the roused spirit of the country will soon furnish them with sufficient employment. Thinking as the ancients would have done, they will not *copy* antiquity, but they will emulate and share its lasting glory.

We might have terminated this article by making some remarks upon the churches and other buildings which are now constructing in our modern Babylon. It is hardly necessary to observe that the greater part of these edifices do not please us, and that we consider them as liable to censures and objections. But upon consideration we found that we could not dare to criticise. "Taste"—we dislike the word, but we can find no other—proceeds upon principles which are so uncertain that mere theorists like ourselves must not be allowed to trifle with the reputation of professional men, whose bread depends upon their exertions. We are therefore silent where a loose or hasty observation of ours might inflict a lasting injury; and whatever affection we may feel towards the "pointed style," we will never allow our love for lancet arches to become the means of wounding the feelings of the architect who has the misfortune to be equally enamoured with entablatures.

When the fine arts really exert a profitable influence, they act by increasing those sources of reasonable pleasure by which the mind is neither degraded, nor enfeebled, nor depraved. That the love of the fine arts may be made to produce a most beneficial effect, cannot be doubted; for there can be no greater source of good, both to the individual and to the species, than the multiplication of such gratifications as are attainable without diminishing the happiness of our fellow-creatures. But when the fine arts are allowed in any manner to become the subjects of rancour or detraction, then the honour which they possess is lost. The productions of Phidias or of Raphael become despicable if they tend to increase the causes of contention. Unfortunately we are furnished with too many reasons for mutual hostility arising out of important matters. Whether this warfare might not be easily diminished it is not our business to inquire; but at all events let us avoid imitating children—let us not quarrel and fight about our gaudes and toys.

EXCAVATIONS ON THE LONDON AND BIRMINGHAM RAILWAY.

SIR,—In the last number of your Journal I observed an extract from Roscoe's history of the London and Birmingham Railway, giving an account of a new method of working excavations, the invention of Mr. Joseph Thornton, one of the contractors, which is mentioned as having been first tried under my direction. I shall be obliged by your stating in your next number, that the engineer of the works at that time was Mr. Edward Dinn, and that when I succeeded him, I found the process in full operation. Your obedient servant,

ROBERT B. DOCKRAY.

Birmingham, June 21, 1839.

BUNNETT AND CORPE'S PATENT CONCENTRIC STEAM ENGINE.

The following tables, deduced from accurate Experiments, made with a view of ascertaining the relative advantages of the application of power, by "Bunnett and Corpe's" Patent Concentric Steam Engine, in comparison with the present Locomotive and other Engines, shows the amount of force necessary to move a crank (having a nine-inch throw) through one complete revolution:—

Fig. 1. shows the position of the connecting-rod, as applied direct from the circular piston-rod in Bunnett and Corpe's Patent Concentric Engine. *a*, *b*, are points between which the end of connecting-rod reciprocates.
c, *d*, are points between which the piston reciprocates.
e, is the position of the end of connecting-rod, when the crank is at an angle of 45 degrees.
f, is the position of the piston.

Fig. 1.

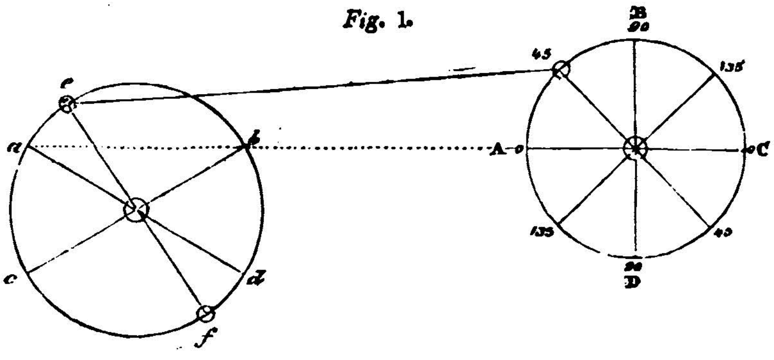
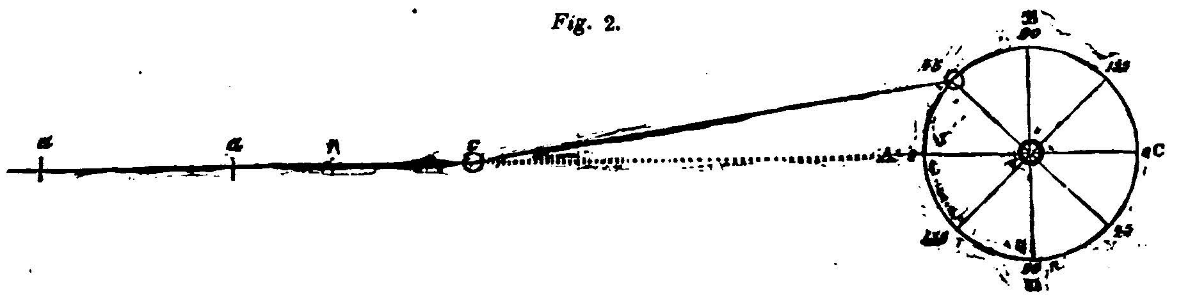


Fig. 2. shows the position of the connecting-rod, as applied from the present horizontal cylinders.
a, *a*, are guides through which the piston-rod is worked freely; forming its parallel motion.
b, represents the connecting-rod, when the crank is at an angle of 45 degrees.
c, end of connecting-rod attached to the piston-rod by a joint, working freely.

Fig. 2.



No. 1.—From A to B.

In this Experiment, a 10 lbs. Weight was suspended at the end of the throw of the Crank, commencing at 5 degrees above its dead centre at A, and continued to B.

Degrees	Concentric Engine	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
5	69.	146.	77.
10	43.	77.	34.
15	33.25	50.	17.75
20	25.25	39.5	14.25
25	21.5	30.25	8.75
30	18.5	25.75	7.25
35	15.25	21.	5.75
40	14.5	18.	3.5
45	12.5	15.75	3.25
50	11.25	13.5	2.25
55	9.5	12.	2.5
60	8.25	10.	1.75
65	6.5	8.75	2.25
70	4.75	7.5	2.75
75	3.	5.87	2.87
80	1.25	4.25	3.
85	.75	3.5	2.75
90	.25	1.87	1.62
	298.25	490.5	192.25

No. 2.—From B to C.

In this Experiment, the Weight was passed over a Pulley, and attached to the throw of the Crank; the Pulley was shifted continually, so as to render the acting force uniform in the various positions of the Crank.

Degrees	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
95	10.62	15.25	4.63
100	9.62	13.5	3.87
105	9.12	14.5	5.37
110	8.5	14.75	6.25
115	8.	14.75	6.75
120	7.	15.	8.
125	6.25	15.12	8.87
130	5.26	14.5	9.25
135	4.75	13.25	8.5
140	3.5	13.5	10.
145	2.87	14.	11.12
150	3.	17.87	14.87
155	4.5	24.75	20.25
160	6.25	32.	25.75
165	8.	38.	30.
170	13.25	58.	44.75
175	30.	114.	84.
180	dead centre.		
	140.5	442.75	302.25

No. 3.—From C to D.

In this Experiment, the Weight was also passed over a Pulley, which was shifted frequently, as in No. 2 Experiment.

Degrees	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
5	70.	160.	90.
10	32.	76.5	44.5
15	21.25	39.	18.75
20	18.	29.	11.
25	14.5	24.	9.5
30	13.	20.75	7.75
35	11.5	18.75	7.25
40	11.5	17.75	6.25
45	11.	16.25	5.25
50	12.5	16.	3.5
55	13.	14.75	1.75
60	13.25	14.75	1.5
65	13.	15.75	2.75
70	13.	14.5	1.5
75	12.5	14.5	2.
80	13.	14.	1.
85	12.75	13.75	1.
90	12.25	13.	.75
	318.	533.	215.

No. 4.—From D to A.

In this Experiment, the Weight was suspended from the throw, as in No. 1 Experiment.

Degrees	Concentric Engine.	Horizontal Cylinder.	Difference.
	lbs.	lbs.	lbs.
95	2.	3.5	1.5
100	3.	4.5	1.5
105	4.	6.25	2.25
110	4.75	7.5	2.75
115	5.5	9.12	3.62
120	6.37	11.	4.62
125	6.62	12.75	6.12
130	7.	15.	8.
135	7.25	18.	10.75
140	8.	20.	12.
145	8.75	24.	15.25
150	10.	28.75	18.75
155	11.	35.25	24.25
160	14.	49.5	35.5
165	19.	70.	51.
170	28.75	105.	76.25
175	63.	160.	97.
180	dead centre.		
	209.	580.12	371.12

	Concentric Engine.	Horizontal Cylinder.	Difference.
The gross amount of weights on the whole revolution of the Crank . .	lbs. 965.75	lbs. 2046.37	lbs. 1080.62

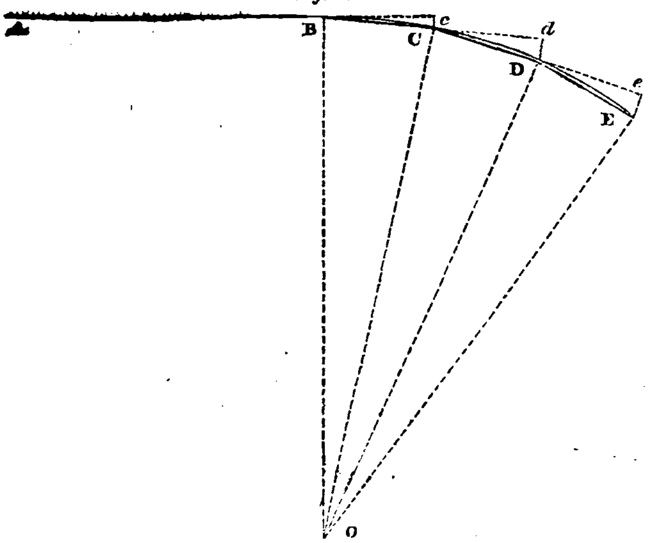
CURVES ON RAILWAYS.

SIR—Observing in your journal several papers on the subject of setting out curves, I beg to communicate to you a method differing in some respects from any there described. It has been adopted with great success on ground of the most difficult nature, both on account of the irregularities of the surface, and the buildings and other obstacles to surveying operations with which it was encumbered.

I am, your's respectfully,

May 8th, 1839. M.

Fig. 1.

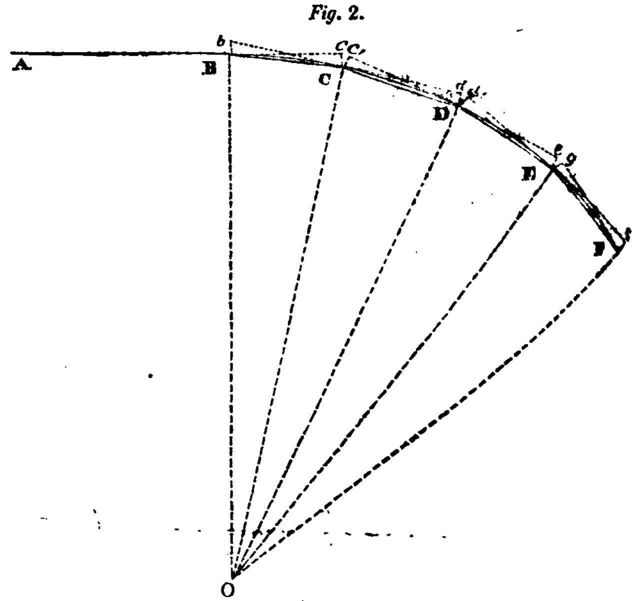


The method which has been usually adopted for setting out curves is as follows. (See Figure 1.) Let AB be the straight line, a tangent to the curve, B its termination, and C, D, E, &c., equidistant points in the curve of given radius BO, O being its centre; produce AB to c, and draw Cc at right angles to Bc; produce BC to d, making Cd= CD=BC, and join dD. Join OB, OC, OD. The angle dCO=the angles BOC and CBO, (Euclid I. 32,) and the angle OCD=CBO $\therefore$ the angle dCD=the angle BOC=the angle COD, for BC=CD, by hyp. then, by similar triangles COD, dCD; OC : CD : : CD : $d\mathrm{D}=\frac{\mathrm{CD}^2}{\mathrm{OC}}$. In order to obtain C the first point in the curve, calculate BC the sine and cC, at right angles (by construction) to BC, the versed sine of the angle BOC. If the chord BC is small in comparison with the radius BO, Cc may be considered, at least for all practical purposes, = half $d\mathrm{D}=\frac{1}{2}\frac{\mathrm{CD}^2}{\mathrm{CO}}$, and B$c$=BC. The above is a simple, and with proper care an accurate, method of ranging a curve where the ground is clear from obstructions; it has been usual to take BC=one chain, but it is much better to take 2, 3 or 4 chains where the nature of the ground will permit, as the errors arising from the difficulty of setting up ranging rods and measuring offsets with precision will be thereby much diminished.

Where the ground to be ranged over is much encumbered by trees, fences, buildings, &c., the above method is liable to objections, as it is necessary that the chords BC, CD, DE, &c., should be equal; for no very simple formula can be obtained for the value of dD when Cd or CD is not equal to BC. The following method is free from this defect, and in other respects have found it answer the required purpose in a most satisfactory manner.

Produce the straight line AB (Figure 2) to c any convenient distance, for instance, 2, 2½, 3, 4, &c., chains, and making BC the sine of the angle BOC to radius BO, calculate Cc the versed sine. This gives the first point C in the curve. Set off Bb' = cC, in a direction as nearly as can be guessed at right angles to b'C, then b'C will be a tangent to the curve at C; produce b'C to d, any convenient distance as before, and making Cd the sine, calculate dD the versed sine, which gives another point D; set off Cc' = dD at right angles, or as nearly as may be to c'D, and c'D will be a tangent to the curve at D, and so on. Of course the length of the tangents Bc, c'D, d'E, &c., will be made the same until some peculiarity in the nature of the ground renders it necessary to alter them, and after the obstruction has been passed it will be well to recur to the same length of tangent. In practice I have found two chains the most advantageous length for curves varying from 50 to 100 chains in radius; for curves of larger radius and on favourable ground, probably 4 chains would be better. The principle of the above method is, that the curve is ranged by means of continual tangents; it would occupy too much space to describe in detail the various methods of making the necessary calculations, and facilitating operations in the field work, as well as the mode of finding the intermediate points, when it is required to put in a stake at the end of every chain, or half chain; these and many other points will readily suggest themselves to any person at all conversant with mathematical subjects.

Fig. 2.



This method affords advantages in terminating or changing the radius of the curve at any required place, or reversing the curve (commonly called making an S curve) much greater than any plan I have hitherto seen described.

With regard to reverse or S curves, I consider it of great importance to insert a straight line at their junction, on account of the necessity of elevating the outer rail of a curve above the inner one. This may be easily effected by interposing a short piece of straight line, and wherever it is possible to do so, it should by no means be neglected.

THE MARQUIS OF TWEEDDALE'S DRAIN TILE MACHINE.

This machine will make 10,000 drain-tiles a-day, one man and two boys to attend it, and 20,000 of flat tiles for the drain-tile to lie upon; but if the tiles are broad for roofing, it will make 12,000 a-day. These draining tiles are 15 inches long, so that three machines would make in one season (of thirty weeks) as many tiles as would lay a drain from London to York. Now a man and two assistants will only make 1,000 drain-tiles in a day, and these only one foot long, which is 1,000 feet per day. While the machine with the same number of persons will make 12,500 feet per day; so that if the drain be laid at the distance of twenty-five feet, it will make in one day sufficient tiles for six acres. The advantages are—1st, the tile is much stronger from being compressed, and less pervious to water—it is not only compressed, but it is smoothed over, which gives it a surface as though it were glazed. They are capable of being made from a much stiffer clay than usual, and in nine cases out of ten the clay may be used directly on being dug, if passed through the crushers, being much drier. Clay unfit for bricks and tiles by the common method is available by the machinery. The expense of draining will be paid in three years, but not unfrequently in one.—*Farmer's Magazine.*

LOWTHER ARCADE.

In an article by our correspondent Ralph Redivivus on the Lowther Arcade, we find that he has inadvertently fallen into an error in attributing the designs to a Mr. Turner. We received a contradiction of this from a gentleman of that name in March last, but as we were desirous of ascertaining whether we had attributed this to the wrong person, we were induced to delay the contradiction; we have now much pleasure in announcing that Mr. Witherden Young is the architect. A letter from him unfortunately miscarried, as the reason that a longer delay has occurred than we should have wished in doing justice to a gentleman who so highly merits the esteem of the profession. We beg to assure Mr. Young of our sincere regret that any misunderstanding should have occurred, and of our wish on all occasions to do justice to himself and the profession.

MOMENTUM OF FALLING BODIES.

Sir,—As the following remarks on the momentum of falling bodies are I believe of importance, and connected with the communications of C. E. C. and B. on the subject, you will oblige me by giving them a place in your journal.

The questions for consideration are, the effect of a moving power on the resistance offered to a pile while driving, and the comparative effects of a weight acting simply as such on a pile, and when striking it with velocity. These effects are best measured by the depths penetrated under the same circumstances.

It is demonstrated by writers on dynamics, that the effect of a moving power in overcoming an uniform resistance is as the square of the velocity, and Smeaton in his "Experimental examination of the quantity and proportion of mechanic power," has shown "that the quantities of mechanic power to be expended are as the squares of the velocities to be generated, and *vice versa*. If, therefore, the resistance to be overcome was uniform, the force of a ram or monkey would be as the square of the velocity into the weight, or as v^2b. But the resistance offered by a pile when driving, is made up of the resistance to penetration and the resistance of friction; the first of which, in homogenous substances, is nearly uniform, and the second increases as the pile is driven, and in a ratio nearly to the depth penetrated. Put a = the velocity that would be destroyed in one second by the resistance to penetration, x = the depth penetrated, and mx = the velocity that would be destroyed in one second by the friction at the depth x: we then have (Simpson's Fluxions, art. 218, vol. 1,) $(a+mx)\,dx=v\,dv$, and by integrating and solving the resulting quadratic, we get $x=\sqrt{\frac{v^2}{m}+\frac{a^2}{m^2}}-\frac{a}{m}$ for the depth penetrated with the velocity v, and therefore the resistance under the assumed circumstances will be as this quantity in which a and m are known quantities, to be determined by experiment from the substance penetrated and the nature of the pile. If we suppose a to be very small compared with mx, as would be the case with a rough pile in a bog when it had penetrated to some depth, we get $x=\sqrt{\frac{v^2}{m}}$ or, *the effect of a stroke is proportional to the velocity when the resistance increases as the depth.*

Without entering farther into the nature of the resistances to be overcome in pile-driving, it appears that the force of the stroke will be as the velocity when the resistance increases as the depth; as the square of the velocity when the resistance is uniform; and as some other function of the velocity when the resistance does not follow these laws. It also appears from the equation $x=\sqrt{\frac{v^2}{m}+\frac{a^2}{m^2}}-\frac{a}{m}$ that the effect increases in a greater ratio than the velocity, but as in all practical cases, the velocity of the ram will be greater than that the superstructure can ever be supposed to have, the advantage will be in favour of practice, and therefore practically we may suppose the force to be as the velocity. The nature and mass of the pile will have considerable influence on the force of the stroke. If the pile is of straight-grained fir, it will be driven farther by the stroke than one of beech or oak, and if shod and capped with iron, the effect will be considerably increased from a greater degree of elasticity, as the effect would be decreased if shod and capped with cork or any other yielding substance. Also, if bv represents the quantity of motion in the ram, and p the mass of the pile, $\frac{bv}{b+p}$ will be the joint velocity after the stroke, which, as I have before remarked, being less than v, will make the effect less.

With respect to the effects of a body in the state of rest upon a pile, and when striking it, I am of opinion that in most cases there is a disparity in the forces, for as the weight produces no effect, how are we to compare them? A weight is compared to a weight by its own standard; and a moving force to a moving force by a different standard; but when we commence comparing both, we find the consideration attended with no small difficulty. In the spring balance used by B, (Journal, vol. II, no. 16, p. 18,) a weight on the spring keeps it steadily o a point that the same weight, moving with a velocity of ⅜ foot per second, would attain when its motion was destroyed; but in the case of a weight pressing on a pile, if it is not such as to cause penetration, I do not see how it can be compared with a moving force that does, and if it does penetrate, the forces are best measured by the depth; but after a few strokes of a monkey, or after the first, the effect of the weight resting on the pile becomes nothing.

The object in bridge building is to give firmness to the superstructure by strengthening the foundations. For this purpose it will be best to suppose the incumbent weight moving with a velocity of one or two feet per second, and to compare this force with the entire force used in driving the piles. Example:—Suppose an abutment measuring $30\times20\times10$, each foot weighing 1½ cwt., supported on 150 piles, each pile being driven with a monkey weighing 6 cwt., falling from a height of 16 feet. Here the force of the piles $=32\times150\times6=$ 28,800. The weight of the abutment $=30\times20\times10\times1\frac{1}{2}=9000$ cwt. $\frac{28{,}800}{9{,}000}=3\frac{1}{5}$, which shews the foundations are able to bear the force of the abutment moving with a velocity of more than three feet per second. The equation $m=b+\theta bv$, given by your correspondent B, appears to me not to hold good for falling bodies, and certainly cannot apply to the example taken from "Hutton's Course," for, evidently b *is not* similar to θbv, and therefore the equation $b+\theta bv$ cannot obtain. The fact of the matter is this, that in falling bodies, after the force θbv is expended, b then acts by its weight, and very little consideration will shew that both cannot be added together. The ingenious method invented by Sir Christopher Wren for determining the effects of collision by suspending the bodies with threads of equal lengths, show the truth of Hutton's formulæ $\frac{Bv}{B+b}$ and $\frac{Bv+bv}{B+b}$, and the experiments of Smeaton for finding the mechanical power lost after the stroke, prove the same thing.

The experiments made by B prove the effects of a moving power on his spring balance to be $\frac{3bv}{2}$ nearly, but until the case is shewn to be analogous to pile-driving, it would be incorrect to use the result. Galileo and Mersennus found the squares of the weights started from the ground in a balance to be as the heights fallen; and Gravesande, in his Natural Philosophy, by altering the apparatus, found results as the square of the velocity; therefore, in applying experiments of this kind, it is quite necessary that the resistance in both cases be equal and similar.

B changes the equation $m=b+\frac{3bv}{2}$ into $m=b+\overline{\frac{3b}{2}\sqrt{32s}}$; it should be $m=b+\overline{\frac{3b}{2}\sqrt{64s}}$, for $v=\sqrt{64s}$. The results, therefore, of the examples he has given should be $200+\overline{\frac{600}{2}\sqrt{64\times25}}=12{,}200$, not 8,685, and $100{,}000+\overline{\frac{300{,}000}{2}\sqrt{64\times{\cdot}01}}=220{,}000$, not 184,000. By discarding the factor b, the results would be 12,000 and 120,000, which are nearer the truth.

I am, sir,
Your's obediently,
John Neville.

Limerick,
24th May, 1839.

"ASPECTS AND PROSPECTS."

Sir,—Instead of the epithet "judicious," I think that of "ingenious" might very well have been applied to Repton's remarks given in your February number; since they certainly are of that ingeniously perplexing kind which tend to make people fancy objections and inconveniences where none were before thought of. I at least am so far from agreeing with him that aspect is of more importance than almost any thing else, that I consider it to be a matter of comparatively little or no moment. In fact every aspect has something to recommend it, and also something that may be alleged against it as a defect.

According to Repton's theory, "an aspect due north is apt to be gloomy, because no sunshine ever cheers a room so placed." Now as regards the exterior, such an aspect is certainly not at all to be recommended for that of the principal architectural front, because it will never catch the sun, except its evening rays in summer time, consequently will not show itself to the same advantage as when set off by strong light and shade. But so far from the rooms themselves being necessarily gloomy, they will in summer time be far more agreeable than those more exposed to the sun. A room facing the north and looking out upon a pleasure ground or landscape lighted up by a brilliant sun, enjoys a most cheering and animated picture, so placed, be it observed, as to be viewed with the greatest effect. Whether such room be in itself gloomy or not, will depend upon the architect, upon its design, fitting up, and furniture. It may be of more than ordinarily cheerful character, while another facing the south, shall be quite the reverse. I am of opinion therefore that Repton either has not sufficiently explained himself, or else does not himself understand what constitutes gloominess in the appearance of a room.

He objects to an aspect due east, "because there the sun only shines (he means shines only) when we are a-bed;" which, however, depends upon the time people choose to rise, whether before ten o'clock in the forenoon, or after. A no better due west aspect is admired by him, for that we are assured "is intolerable from the excess of sun dazzling the eye during the greater part of the day." Rooms so situated, must of course be habitable only in the depth of winter or in cloudy weather. It seldom happens that the sun is complained of as being an exceedingly unwelcome guest; but whenever he is so, we can very easily prevent his intrusion into our rooms, by means of blinds and muslin curtains, which, if intended for any purpose at all, are intended to shut him out. The objection alleged against an aspect full west is deserving of consideration, because it would follow that in front so turned the windows ought to be fewer, that is, the piers much wider between them than if the aspect were east or north, a circumstance I believe wholly disregarded by architects, certainly not attended to in street building.

The very worst aspect of all, we are assured, is a south-west, because more exposed than any other to driving rains. In corroboration of this we are told of a heavy storm of wind and rain which pelted against the windows at Organ Hall, while from those on the other side of the house, the view appeared perfectly clear. This driving of rain against the windows, Mr. R. considers highly disagreeable; yet if most other persons agree with him in such dislike, my own taste must be singularly perverse or capricious, for I know of nothing that conveys so intense an idea of indoor comfort and security, than the rattling of wind and rain against the glass which defies their attacks. It is one of those enjoyments for which a Sybarite might be allowed to sigh.

I will not pursue Repton's remarks any further, except to say that after all they amount to very little if any thing, to nothing more than that, of the four aspects of a house having rooms facing all of them, three will be bad, unless the south-east, instead of due south, be chosen for one of them, in which case however, one of the aspects must be the very worst, namely, the so much reprobated south-west. I should therefore say that the safest and best rule is, whenever there is any particular prospect afforded by the situation, to be determined chiefly by that, and to take care that it shall be commanded by the principal sitting rooms, let the aspect thus given to them be what it may; should that not be the most advantageous, there would still be other aspects for other rooms, where prospect might be dispensed with.

C.

ON BLASTING ROCKS.

Sir,—Having seen in your Journal of May last two very interesting accounts of blasting rocks by the aid of galvanism, on plans lately introduced by Colonel Pasley and Mr. Roberts, grounded on the principle of bringing to an intense red heat a fine iron, steel, or platinum wire, as originally proposed by Dr. Hare, of Philadelphia, I am tempted to trouble you with a few remarks on the advantages stated by Mr. Roberts to be derived by leaving a column of atmospheric air above and below the charge of powder, as also the increase of power which is obtained by doing away with the necessity of a vent hole.

If then, in accordance with Mr. Robin's experiments, we suppose that the flame of gunpowder has a temperatute not exceeding that of iron heated to its most extreme degree of red heart, it will expand the air which it penetrates, in the ratio to its former bulk of 4 to 1, or induce an increase of pressure of nearly 60lbs on the square inch; this on the hypothesis of this rate of temperature must be a maximum for the coolness of the surface on which it acts, as also the inferior temperature of the air must reduce that of the flame somewhat below that of the above standard. Mr. Robins likewise determines that his experiments for the force of gunpowder when inclosed on all sides, as exerting a pressure of 14,750lbs. on the square inch. If we suppose that this is expanded in the ratio of 3 to 1, by leaving a volume of air, equal to the cubic content of the powder, above and below the charge, also that the square surface acted on is increased in the same ratio, we will have in accordance with the law of the elasticity, being inversely as the volume, a pressure of 4,917lbs. on the square inch, one-third less than if the powder had been inclosed on all sides, but acting over three times the surface, and hence, as deduced from the statical law of virtual velocities producing the same virtual effect; to which, then, if we add the increase of 60lbs., by the expansion of the air, we procure an addition of power of 1-82nd part of that which we had if no air at all had been employed. From this it may be deduced that the larger the proportion of air, the greater will be the addition of power, but this, I am of opinion, will be in a great degree counterbalanced by the greater extent of cooling surface, and consequent smaller degree of elasticity of the atmospheric column. With regard to the loss of power by vent holes, it is obvious that it will be proportional to the quantity of fluid which escapes by such apertures, and this will be equal to the velocity of the fluid multiplied by the area of the aperture. In order to determine this velocity, the best method is, perhaps, to find the height of a homogeneous column, of the same fluid capable of producing the same pressure as that to which the fluid is subjected, for then the fluid would rush into a vacuum with the velocity a heavy body would acquire by falling through the height of the homogeneous column. If, however, the fluid rushes into atmospheric air, instead of a vacuum, the velocity will be that which a heavy body will acquire, by falling through the difference between the heights of homogeneous columns of the fluids of greatest elastic force equivalent to the pressures.

Thus, if as Mr. Robins states, the elasticity of fired gunpowder is equal to a pressure of 14,750 on the square inch, and the height of a column of the same fluid capable of producing this pressure is h, putting h' equal to the height of a column of the same fluid capable of exerting a pressure the same as that of atmospheric air, viz., 15lbs. nearly on the square inch, the velocity per second, through the vent hole into air will be determined by the formula $v = 8\sqrt{h - h'}$. These heights may be procured as follows:—Gunpowder has very much the same density as water, and is supposed to occupy a volume of 1,000 less than its generated gas, when this latter exerts a pressure of 14,750lbs. on the square inch. Now, the height of a column of water at 60° temperature, capable of producing a pressure of 1lb. on the square inch, is 2·31 feet, but the gas of gunpowder having one thousand times the volume of its generating matter, and consequently equally more voluminous than water, must, in order to produce the same pressure, have a height of $2{\cdot}31 \times 1{,}000$, or 2,310 feet to produce 14,750lbs. on the square inch, the requisite height will be $2{,}310 \times 14{,}750$, or $34{,}072{,}500$ feet $= h$; to exert 15lbs. on the square inch the height will be 34,650 feet $= h'$. Hence from the formula $v = 8\sqrt{h - h'} = 8\sqrt{34{,}072{,}500 - 34{,}650} =$ in round numbers to 46,700 feet per second. Now, if we suppose the vent hole to be 1-16th of an inch square, its area will be $\frac{1}{256}$ of a square inch, or $\frac{1}{86{,}864}$ of a square foot, hence the quantity of the fluid escaping per second will be $46{,}700 \frac{1}{36{,}864}$ or $1\frac{1}{3}$ cubic feet nearly. Thus then we see the great loss of power which vent holes cause, unless the action of the powder is inconceivably rapid, and account for the whole force at times escaping by these apertures, when the power is over matched by the resistance, a fact which frequently happens. It is to the entire obviation of this loss, as well as the more rapid ignition of the charge, that I am disposed to allow the increase of power, and consequent saving of gunpowder which will be caused by the use of the galvanic battery in all mining and blasting operations, which advantages, coupled with the perfect immunity from all danger which the apparatus causes, are, I believe, sufficient to bring it into speedy and universal use.

The addition of power by using a column of air is so small as hardly to be taken into account, and there is no case in which I can conceive it to be with any great advantage employed.

Very faithfully yours,

June 21, 1839. J. J.

BRITISH MUSEUM.

(From the Times.)

In the temporary building attached to the fifth room of the British Museum, which contains the casts from the metopes of the Temple of Jupiter Selinus in Sicily, and of which an account was given in this paper some time since, one was omitted; viz., the fifth, the execution and design of which are equal, if not superior, to the others. It represents a combat between a warrior and an Amazon or a divinity not known. The warrior is represented in a kneeling posture, yielding to superior force; the body, which is bent, is entirely covered with the leathern armour called "*spolas.*" Two guards to represent metal are adapted to protect the shoulders, and a belt of peculiar shape crosses over the left shoulder-guard, and passes down the right thigh. Straps, called "*mitra,*" are joined to the "*spolas*" at the waist, and underneath is seen the tunic drawn tight by the position of the leg; the scabbard of the sword is suspended by the thong, "*telemon,*" crossing the breast. The large round shield is placed behind the warrior for a relief to the figure, and part of the helmet is seen. The female figure has the stiff tunic and *peplus* in parallel folds, the earliest representation of drapery; she resembles in some degree Minerva, whose exploits are sculptured on part of the metopes. Within the same apartment, placed under glass cases, in proportions of half an inch to a foot, are four models of what are vulgarly called Trevethy stones. As the monuments of which these are the exact representations are by antiquaries supposed to be among the most ancient remains of human labour now existing in our island, a brief account of them may not be unacceptable to the general visitor of the Museum, as there is none to be found in the published synopsis.

These structures are in general found at the tops of hills, or if on the plain at the highest part, probably because they should be visible at a distance; stones placed upright, and standing at regular distances, are sometimes placed around them. The cromlech (the name by which they have been for ages known) consists of one large stone placed on three supporters; this is done probably because it is easier to place a superincumbent weight on three than on four or five, because in the latter case all the supporters of the weight must be brought to bear equally on all, and this is not requisite when there are but three; accordingly, the covering stones are never found horizontal, the weight subsiding where the lowest support is found. These monuments are also frequently called quoits, from the upper stone resembling the ancient discus. What nation or religion they belonged to it is difficult to say; they are met with in Sweden, Denmark, Norway, France, and the islands of the Mediterranean, but more especially in the Celtic kingdoms of the North of Europe. If they can be attributed to the Druidical priests, they must have been among the earliest of their works, as the simplicity both of the plan and form declare them to have been the work of men far less advanced in knowledge of architecture than the founders of the gigantic structures of Stonehenge. The Irish historians say, that Jeguinas, King of Ireland, the author of idolatry in that country, died in the year of the world 3034, in the plain of Magh Steadch'd, while sacrificing there to "Crom Creaich." It is not likely that they could have been used as altars, for sacrifice, as it is difficult to get atop of them, and more difficult to make a fire large enough to burn a victim without scorching the officiating priest; Crum Quoit Cromlech is so shaped that no one could stand on it to tend the fire or oversee the victim. As, therefore, they are not likely to have been designed for altars, they were probably erected for sepulchral monuments, as the sarcophagus of the Greeks, and the altar-tombs of the present day, are but a more regular cromlech. In general they are situated in the neighbourhood of barrows, and some of them, by the way in which the stones are placed, closing in the sides, are called "Kist-va-en," and would serve, as was the first and common usage of mankind, to defend the body therein deposited from exposure to the weather or the attacks of beasts of prey. Rowland derives the name from the Hebrew "Corem Cruaich," a devoted or consecrated stone. According to Wormius they were sometimes called "aræ," or altars. He supposes they were first altars and afterwards tombs; and there is an account of one in Denmark, in which King Harold was interred. The great similarity which prevails in the manner of their erection, seems to prove that the use to which they were devoted must have been the same both in Britain and in Denmark. In Wales they are known by the name of "Calne Arthin," Arthur's Quoits; and by some antiquaries, the name is supposed to be derived from the Armoric "crum," crooked, or having a top stone.

Chun quoit, or cromlech, one of the models in this room, stands about 500 yards to the south-west of Chun Castle, in the parish of Movah, Cornwall; the covering stone is 12½ feet long, and 11 wide; it is supported on three stones pitched on an edge, which, with the fourth one, form a pretty regular kist-en-vaen; the top of the quoit is convex, and the monument is surrounded with a low barrow, or heap of funeral stones. Layon Quoit, another of which the perfect representation is here shown, is near Penzance; the area described by the supporters of this is 70 feet, but it does not stand, as is generally the case, east and west, but north and south, as does also a similar monument in Denmark, mentioned as the tomb of Heraldus by Wormius; to this of Layon there is no kist-va-en, nor any area marked out by side stones; the quoit which is more than 47 feet in girth, is 19 long, and its thickness in the middle of the eastern edge is 16 inches, and at each end not quite so much, but at the western edge it is two feet; the chief supporters do not stand at right angels, with the front line, as in the others, having been forced from its position by the weight of the superincumbent quoit; its height is such that a man on horseback can stand under it. Some years since it was dug under to the depth of eight feet, and a cavity was found in the original earth in the shape of a grave, which had been rifled of its contents; it stands on a bank not more than two feet higher than the soil. At the south end are many upright stones, among which human bones, and those of horses and deer have been found, and a rod made of clay baked red; those stones might have been the Kibla, the sacred place of assembly for sacrificing to the manes of the dead.

The means by which these immense masses have been placed on the supporting stones it is difficult to conjecture; a people, the perfection of whose architecture is shown in such rude structures as those, cannot be supposed to have been acquainted with mechanical power sufficient to have effected it; the plan which Mr. Rowland, in his *Mona Antiqua*, conjectures to have been made use of to place the transverse stones at Stonehenge was probably the way in which it was done. The powers of the lever and the plane being some of the first things understood by mankind, it is easy to conceive that they were made use of to erect these prodigious monuments; where a small mound was found it was shaped into an inclined plane, or a small agger or mount of solid earth was found, flatted and levelled at the top, up the sloping sides of which the stone intended to be placed as the covering of the cromlech was moved by the help of levers and rollers, and when adjusted on the upright stones previously erected, the earth of the mount or artificial agger being cut away, the fabric was complete. It must have been by this means that the rocking stones poised so nicely that the smallest touch puts them in motion, which are found in Cornwall and in Anglesea, were in all probability adjusted. The other two models in this room are one of a cromlech at Duffuin, in South Wales, and one which has a very perfect and double kist-va-en in Anglesea, near Plas Newydd.

In the courtyard of the Museum is an object which excites much attention from the visitors, and of which no further account is to be obtained than that it was presented by the late Lord Egremont. It is an ancient vessel or canoe, which was discovered near Petworth, in Sussex, at the village of North Stoke, on the left bank of the river Aran, three miles from Arundel, near South Downs, in a meadow where the river takes a turn towards a creek that runs into it. This vessel was found embedded in the mud; one part was completely buried, the other part was visible about two feet under water; from time immemorial it was considered as part of the stump of an old tree, and allowed to remain there; it was used as a support for one end of a flat wooden bridge, connecting two meadows, such as are commonly employed in those situations; thus situated it afforded no impediment to the flow of water which passed in front; about 20 years ago a farmer who rented the land cut away part of it to give an easier flow to the water, and a bridge having been built higher up, it was thought proper to remove this piece of old tree, as it was supposed to be: the labourers employed finding it much larger than they had reckoned on, attached eleven horses to it, by an iron chain, and with great difficulty drew it to land. Its real form and character were then discoverable, viz., one half of the stem of a large oak cut into the shape of a boat. The toughness of its substance is shown; that, although but 4½ inches in thickness at the bottom of the vessel, when its stem, to which the chain was fixed, was drawn up the sloping bank, and elevated four feet, while the opposite end was in the water, with its load of mud, it was drawn entire to the flat surface.—The length of this vessel is 35 feet 4 inches; the depth 1 foot 10 inches; the width in the middle is 4 feet 6 inches; the thickness in the bottom, 4½ inches; the sides 5 inches to 1½; of the stem, 1 foot 8 inches; of the stern, 2 feet 2 inches. There are three bars left at the bottom, at different distances, which served to strengthen the whole, and gave a firm footing to those who worked it; there is no appearance of its having had a rudder, but there is a notch which might have been for an oar to guide it. The extreme simplicity of its construction indicates its having been the product of an early and rude condition of man; it is undoubtedly of much greater antiquity than the vessel found some few years ago in the bed of the Rother, as it has the appearance of having been hollowed out by fire. The ancient forest of Anderida, within whose precincts it was discovered, was famed for the luxuriant growth of its oaks. From a combination of circumstances, it may safely be regarded as a relic of the aboriginal Britons, wrought before, or soon after, the arrival of the Romans. We are told by Cæsar and Tacitus that the vessels with which the ancient inhabitants of our island passed into Gaul were formed of wicker, and covered with skins, or fabricated by a single tree hollowed out by fire. This vessel probably lay on the bank of the creek ready for use, and being swamped by a sudden flood of the river, might have been accidentally lost to view, for it was found turned in the direction such a flow of water would have given it: remaining thus unseen for months, it might have been forgotten by the owner, and nothing but accident would have revived the knowledge of it. Several vessels resembling this have been found in morasses in Scotland—one at Loch Kernos in 1736, seven feet long, with a seat at one end and a paddle in it; another at Kilblain, eight feet three inches long; and in 1720, several of the same kind were dug up in the marshes of the Medway; and one so well preserved as to be used as a boat some time afterwards; at Moreton Lake, in Lancashire, eight were found, each made of a single tree, and shaped like the American canoes, but this we have described by far exceeds all the others in its dimensions. Although with regard to its antiquity, there are perhaps no certain means of judging, yet its blackened condition and fibrous texture, resembling that of wood found buried in bogs, prove that it must have for many years been immersed in water.

Upon the walls of the room which contain these antiquities there are three paintings which have been lately placed—views of Stonehenge, and the cromlech at Duffuin, South Wales. They are exceedingly well executed, and give, as far as pictures can, a true representation of that gigantic Druidical, pile, but to those who may not have an opportunity of seeing the originals, nothing brings to the mind so clear a notion of their real appearance, and what they are, as the models we have described.

The Elgin marbles, broken and scattered as they appear, render to the public in general but a faint idea of the beauty and magnificence of the fabric of which they formed a part, and consequently they are stared on with wondering admiration, that such vast sums have been expended, and such spoliation should have been made, for what appears as only so many defaced and broken stones. To the antiquary and the artist and the connoisseur they are invaluable; but it may be doubted if the taste of the public has been much improved by their inspection. If a model of the Parthenon, upon such a scale as that in the University library at Oxford, or larger, were placed in the saloon, the beauty and magnificence of that celebrated temple would strike the most unlearned; the shattered fragments and headless statues would no longer be objects of false enthusiasm or ignorant contempt, and the eye having the exact representation of the original before it, the imagination, by speedily restoring the whole of the now mutilated parts, would fully appreciate their value.

AVERY'S ROTATORY STEAM-ENGINE.

The wonderful simplicity of this engine led us to feel an interest in it from the first; and those made upon its plan, with various improvements, by Mr. Ruthven of this city, have been noticed more than once in our columns. Our last notice was about a year ago. Mr. Ruthven had one then working (and has it still) in his workshop, turning several lathes, moving a tilt-hammer, and plaining machine, driving a grind-stone, &c. On Saturday, 18th May, we had the pleasure of seeing one of those engines at work in this neighbourhood, on the farm of Mr. Allan, at Pilton, and in a manner fully calculated to test its powers.

The engine is one of *six-horse power*, according to the usual method of computation. The radius of the revolving arm is two feet; the length of the two arms, of course, four feet; and they make fully 3000 revolutions in a minute. The cast iron-box in which they revolve is five feet in diameter, and about six inches wide externally; and this box, with the two revolving arms within it, actually constitutes the whole machine, except the boiler and the pump which supplies the boiler with water. The engine has neither beam, piston, parallel-motion, apparatus, crank, nor valve. It could be put with ease into a parlour book-case! The boiler is a cylinder two feet in diameter and ten feet long. There are two small cylinders of twelve inches diameter connected with it, filled with water, but no steam is formed in them. Their use is to economise fuel. They may be considered as *enlarged portions* of the pipe which conveys water to the boiler, passed through the lower and horizontal part of the flue, that the waste heat of the fire may be profitably employed in warming the water before it gets into the boiler. A polished iron cylinder, 9 inches long and 5 in diameter, is attached to the axis of the revolving arms; and a broad leather belt passing from it to a wheel, 4 feet in diameter, conveys the motion to the thrashing-mill. The motion of the arms, which constitutes the moving power, is produced by the *re-action of steam*, rushing from two apertures, about a quarter of an inch wide, in the opposite sides of the arms, and at their outer extremities. The engine is worked with a pressure of four or five atmospheres. Its price, including boiler and pump, with the belt and wheel for communicating motion to the thrashing-mill, is about £120. We are thus particular, because many will have forgot, and some will not have seen, the details we formerly gave.

We saw the fire lighted, the motion commence, and the operation of thrashing and winnowing proceed for a considerable time. The engine has been two months in Mr. Allan's possession. He has been using it every week, and has already thrashed upwards of 200 bolls of grain with it. It has given him complete satisfaction; and the following is his account of its performance:—

"Mr. Ruthven's engine thrashes from eight to ten bolls (four to five qrs.) of grain per hour, with a consumption of less than a hundred-weight of coals. It is, besides, easily kept and managed, and there is a great saving of grease. In addition to the thrashing-mill, it drives two sets of extra fanners, a humbling-machine, and two sets of elevators."

Mr. Allan informed us that it required five horses to work the same thrashing-machine, before he procured Mr. Ruthven's engine; and neither the extra fanners, elevators, nor humbling-machine, were then attached to it. With this addition, he reckons that the engine (of six computed horse-power) does the work of seven or eight horses. With the apparatus in its present state, he is able, not only to thrash, but to winnow, clean, and send off to market, fifty bolls of grain in six hours, with a great saving in manual labour. We may add, for the information of persons at a distance, that Mr. Allan is one of the most extensive and intelligent farmers in the county.—*Abridged from the Scotsman, May 29.*

CORNISH HIGH-PRESSURE, EXPANSIVE, CONDENSING STEAM-ENGINE AT CARLISLE.

On Saturday, the 25th May, the engine manufactured in Cornwall by Messrs. Harvey and Co., of Hayle, from the specifications and plans of that eminent Cornish engineer, William West, for the Carlisle Canal Company, commenced working. The directors having assembled at twelve, in a few minutes after, the engine was started by Mr. Halson, the chairman, and Mr. West, who had arrived from Cornwall for that purpose. The volume of water sent forth excited universal surprise amongst the numerous gentlemen and artizans whom curiosity had drawn to the spot, and was gratifying in the highest degree to the directors and proprietors of the company.

The engine (named the "Eden") is set up for the purpose of supplying the Carlisle Canal with water from the river Eden. The height the water has to be lifted is about fifty-six feet; the steam cylinder is sixty inches diameter; that of the pump forty-five (the largest of the kind in the kingdom); length of stroke ten feet. In less than two minutes, the huzzas of those assembled announced the water was lifted to the pump-head, whence it was poured forth in a solid, continuous, and rapid stream, at the rate of 6,624 gallons per minute; consequently, working at twelve strokes, the quantity delivered in twelve hours into the canal is 4,769,280 imperial gallons of water—equal to 765,288 cubic feet—at an expense of fuel under 5*s*.

The canal from Carlisle to the Solway Frith is about twelve miles in length. There are six locks, each about sixty-seven feet long, twenty-two feet wide, and eight feet six inches deep; and when required, such is the power of this simple, yet effective machine, that the quantity of water contained in each lock can be replaced in less than ten minutes—*i. e.*, as quick nearly as a vessel can be passed through. In the course of a month, when Harvey and West's new patent valves shall be substituted for those now in use, the work will be done better, and with considerably less friction, and the heavy blow, and consequent vibration common to all pumping-engines will (it is said) be entirely overcome.—*Abridged from the Carlisle paper.*

AMERICAN LOCOMOTIVE ENGINES.

It will be recollected that a contract had been entered into between the Birmingham and Gloucester Railway Company and Mr. Norris, of Philadelphia, U.S., for the supply of locomotive for the Gloucester Railway. The contract was conditionally made, on the first engine manufactured by Mr. N. performing certain work agreed upon. As much interest has been felt in this country with reference to the contract, and as some doubts were entertained as to the correctness of the representations made respecting these engines, we have pleasure in giving the following particulars as to the engine sent over to this country by Mr. Norris, and the work it has actually performed on the Grand Junction Railway, in conformity with the agreement to which we have alluded. "The England" weighs about eight tons, without water or fuel; she is built much lower and smaller than the engines commonly in use here, and has six wheels, the driving pair being four feet in diameter. The cylinders are ten and a half inches in diameter, and are enclosed in copper cases to prevent radiation—stroke eighteen inches. The machinery is of the simplest construction, and consists of a much smaller number of parts than we have been accustomed to see. The cylinders are placed on the outside of the framework, which allows the advantage of a straight axle; and the general appearance of the engine more nearly resembles that of the old "Rocket" engine than of any other with which we are acquainted. The engine is got up in a most superior style, and is finished, even to the minutest particular, in a very beautiful and workmanlike manner; every part having been executed with perfect accuracy, by means of self-acting machinery. As a proof, indeed, of the mathematical correctness of the work, we may mention that the steam-tight joints are formed simply by the bringing into contact of metallic surfaces; the workmanship of which is so true, as entirely to supersede the necessity of packing of any kind. The boiler is similar to those used in engines manufactured in this country, but it contains only seventy-eight tubes, instead of from 100 to 140, the number commonly used in those on our railways; and the consumption of fuel, compared with the work performed, is, we understand, very small. The task undertaken to be performed by "The England" was to run from Birmingham to Warrington, fourteen journeys each way, carrying 100 tons in the gross, and performing the distance, eighty miles, at the rate of twenty miles per hour, which the engine has accomplished considerably within the specified time of four hours; the average time having been about 3 hours 50 min., or the actual running time, without stoppages, from 3 h. 9 min. to 3 h. 19 min. On one occasion, it is stated that the engine brought into Birmingham the enormous load of 126 tons, drawing it up the inclined planes without any assistance; and on no occasion has it failed to perform the required duty, nor has even the least derangement of any part of the machinery taken place. It should also be mentioned, that the various parts were never put together until its arrival in this country, when they were first fitted at Liverpool, the day previous to making a trip; nor has a tool been applied to the engine since she was first set up. We understand the conditional order to Mr. Norris for ten engines, of similar capability, has been confirmed.—*Midland Counties Herald.*

REVIEWS.

The Suburban Gardener and Villa Companion; comprising the choice of a Suburban or Villa Residence, &c. &c. By J. C. Loudon, F.L.S. H.S., &c. Illustrated by numerous engravings. 8vo. London, Longman, Orme, & Co., 1838.

By no means does its title—we do not mean the title-page, but the mere name—do justice to this work, it being so partial as to exclude the idea of there being any thing, except, perhaps, quite incidentally, connected with architecture; whereas the last mentioned subject forms no inconsiderable portion of the volume. Indeed we hardly know of any single work which contains so much relative to domestic architecture, taking the term in its widest sense, comprehending every thing that relates to private residences, fittings-up and furniture not excluded, besides a vast variety of other matters, respecting which books by architects themselves do not afford any instruction or information whatever. So far from being made up out of other books, the volume—and it extends to 750 closely printed octavo pages—contains a great deal of matter that has hardly ever been touched upon before, notwithstanding that it is in itself highly important; besides which, it is communicated in a very agreeable style, familiar and intelligent, without the slightest tinge of pedantry on the one hand, and equally free from all twaddle on the other. It may very fairly be described as a book for the many, at least for all who are in easy circumstances, and who can afford to study the comforts and the luxuries of *home* in the true English meaning of the term. To descant upon the moral influence of home, would be here rather out of its place, yet we may be allowed just to remark *en passant*, that those who have a taste, or cultivate one, for order and elegance in the objects which surround them, are, *cæteris paribus*, if not actually more moral and intellectual, more in the way of becoming so than those who attach no importance to what does not afford any direct gratification either to sensuality or to vanity.

To proceed, however, to give some specimens of the work—for hardly could we attempt any analysis, except by copying the list of contents, which alone would occupy a great deal of room—we will quote the following, if only on account of the ingenious and pleasing suggestion at its commencement:—

For houses that have a garret, a sort of green-house may be established there, by forming glass windows in the roof. An enthusiast amateur might, indeed, have the roof of his house entirely of glass, and train vines or creepers under it; which might be planted in the ground, and their stems brought up against the outside wall, and covered with a wooden case. In such roofs, the panes of glass should not be more than 2½ in. or 3 in. wide, or plate glass should be used, in order to prevent breakage from hail. The most fitting suburban residences for having green-houses are such as are either quite detached, or in pairs; which last-mentioned houses, in the neighbourhood of London, are called double detached houses. In cases of this kind, whether the houses are of the fourth rate or the first rate, they may always have a plant-house of some kind attached to them. One of the most ordinary modes of connecting a green-house with a small house is by placing it against the gable end; it being understood that this gable end fronts the south, the south-east, or the south-west: though, even if it fronts the direct west or direct east, such a green-house will answer for many kinds of green-house plants; and for all kinds whatever, with an extra-allowance of fire heat during winter. For double cottages or houses, where the gable ends front the south-east and north-west, a green-house may be placed against each; but where the one gable fronts the south and the other the north, then the one green-house should be placed on the east side of the house, and the other on the west side. In single houses, the green-house may be placed in a great variety of ways, and may be of many forms, as will be seen hereafter, according to the arrangement of the ground plan, and the style of elevation, of the house. In whatever manner a green-house, or plant-house of any description, is attached to a house, means ought always to be provided for warming, ventilating, and watering the plant-house, altogether independently of the dwelling-house; for few things are more disagreeable and unwholesome to human beings, as well as injurious to furniture and the walls of the room, than the close damp effluvia from the earth, water, and plants of a conservatory. For this reason, the plants grown in conservatories immediately attached to drawing-rooms should be such as are natives of very dry climates, (for example, the Cape of Good Hope, Australia, &c.) and, consequently, require very little water; and the gardener should contrive to give his waterings either late in the evenings, or very early in the mornings, when there is no chance of the conservatory being in use by the family. Previously to the hour when it is expected the family will walk in the conservatory, it ought to be thoroughly ventilated, so as to carry off the damp; and the surface of the ground ought never to be kept very moist, in order to produce as little evaporation from it as possible.

We do not exactly agree with the predilection expressed by Mr. Loudon for the square or cube as the best form for a house. Allowing it may deserve all that is said in its favour, it does not exactly follow that it ought invariably to be adopted to the exclusion of every other, particularly where other considerations ought to be attended to, besides those of mere economy. Far more do we approve of what is said on the subject of views:—

Variety in the views obtained from the house, and from the different walks conducted through the grounds, is one of the grand desiderata in every place laid out in the modern style, whether its extent may be large or small. With respect to the views from the house, the first thing to be attended to is, the disposition of the rooms, so that their windows may look in different directions. Unless this has been studied by the architect, it will be impossible, even in the finest situation, to produce much variety in the views. Suppose a house placed on a slope, commanding an extensive prospect; if all the rooms looked towards that prospect, all of them would have good views, but these views would not be varied; whereas if, from one side of the house, the windows of one room (say the drawing-room) looked out on a level flower-garden; and if, on another side, those of the dining-room looked up the slope; while, on a third side, those of the library, or breakfast-room, commanded the distant prospect; there would be three distinct characters of view. Now, in very small places (say of a quarter of an acre, or even less, in extent), this varied disposition of the rooms, or, rather, of the manner of lighting them, ought never to be lost sight of; because, altogether independently of distance, or of any object beyond the boundary fence, the views may be rendered of different characters by the different kinds of trees and shrubs planted, by their different disposition, by a difference of form in the ground, and by a difference in the architectural ornaments, or by the absence of architectural ornaments altogether. Even a difference in the form and size of the window, or the absence or presence of a balcony or veranda, will altogether alter the character of the scenery. Wherever, therefore, a house stands isolated, and has a clear space of a few yards on each side of it, it may always have at least four different characters of view, independently of the effect produced by balconies, verandas, or other changes in the windows or foreground. Hence, also, in limited plots of ground, whatever is their shape, greater variety of view will be produced by placing the house nearer one end, or nearer one side, than in the centre. In the latter case, it is impossible to get depth of view from any side, and thus a great source of beauty is lost. A deep view includes a greater number of objects, and, consequently, admits of a greater variety of effect of light and shade; it increases our ideas of extent, and, by concealing more from the eye than can be done in a confined view, it gives a greater exercise to the imagination. Add to this, that, in a small place, depth of view is not expected; and, consequently, when it does occur, its effect is the more striking, by the surprise it occasions, as well as by its contrast with the other views, which must necessarily be very limited.

We could wish to continue this extract by quoting also the description and remarks introduced in illustration of it, but unless we could likewise give the plan of the house and garden, the rest would not be very well understood. We must, however, hasten to conclude our article, which perhaps we cannot better do than by extracting the following general observations:—

It has often struck us with surprise, that the proprietors of the finest residences in England, noblemen and gentlemen of high education and refined taste in other things, possessing collections of the finest pictures, and whose eyes must consequently be familiar with all that is noble and beautiful in landscape, should yet commit the laying out of their grounds to their gardeners; or, at all events, permit them to make alterations and additions in whatever relates to flower-beds, flowering shrubs, and rockwork; forgetting that the life of the gardener has been devoted to the study of the culture of plants, and not to that of the composition of forms, and their effect in landscape scenery. Hence it is that many of the most beautiful places in England are at this moment disfigured by flower-beds, either placed where there ought to be none, or put down of such shapes, and in such a manner, as neither to form a whole among themselves, nor with the other objects near them. How rarely do we find pieces of rockwork, or rocky cascades, in England, which a man who had profited by the study of pictures could take pleasure in looking at? It is clear to us, that the possessors of pictures in general derive very little benefit from them, as regards the improvement of their taste in landscape. How few landed proprietors can, like the late Sir Uvedale Price, and the present William Wells, Esq., of Redleaf, transfuse the spirit of the finest landscape into the artificial scenery which they create in their grounds? Many country gentlemen are in the habit of having artists at their houses, to take portraits, views, &c.; and these being, in many instances, the guests of the family for weeks together, we often wonder how it happens that they do not point out the grosser errors of want of connexion and unity of expression, with which they must so frequently be shocked in passing through flower-beds and pleasure-grounds; but we suppose that gentlemen do not think of asking the opinion of a landscape-painter on any point connected with gardening; forgetting that the composition of forms is the business of the landscape-painter, and that his eye has been educated by a long course of study and observation, so that he can detect what is right or wrong at a single glance. There are some proprietors who have studied the subject themselves, or who fortunately knowing their own ignorance of it, have had the wisdom to consult such artists as Gilpin, Nesfield, &c.; and we only wish that those who do without such aid could see their places as they are seen by men of real taste.

We are aware that what we have said ourselves, and what we have quoted, goes a very little way indeed towards affording much idea of a volume consisting of between 700 and 800 closely printed pages, and illustrated with from 300 to 400 woodcuts; but we can recommend it in general terms as one exceedingly interesting and useful to those who have either suburban or country residences; and also to those who are concerned either in architecture or in gardening.

FOREIGN MONTHLY REVIEW.

The second number of this new periodical contains an article entitled "Modern French Architectural Decoration," at the head of which is placed Thiollet and Roux's "*Nouveau Recueil de Menuiserie et Decorations Interieures.*" Perhaps the best way of recommending this paper to the attention of our readers will be to give some extracts from it, by way of sample.

Granting that it may, in some respects, be a subordinate part of their practice, we must be allowed to assert that decoration is a very important one of their art, and that the study of it, internal as well as external, ought to enter into every architect's education. Many may, perhaps, be of opinion, that it is one of those things which may very properly be deferred, until after the usual elementary course of training has been gone through; we, nevertheless, are disposed to hold that it is the safer course to cultivate a refined taste as early as possible, lest, in the interim, a bad taste, never afterwards, perhaps, to be eradicated, should spring up of its own accord. For want of duly cultivating an acquaintance with interior decoration, in all its manifold and complex ramifications, it seldom happens that, if accidentally called upon to furnish ideas for any thing of the kind, our architects have any better resources than what they find in some analogous exterior parts. Undoubtedly it is not every one who, in the course of his professional employment, may have occasion to exercise his talent this way; but even then it would not be a whit more useless to him than many things to which he directs his attention; and certainly the subject we are speaking of comes far more within the province of an architect, than some of the studies so fantastically insisted upon by Vitruvius as indispensable to the education of one.

How far a knowledge of it may be useful or not must, in a great degree, depend upon the peculiar walk in his profession, which an architect takes up; a man whose practice lies chiefly in building bridges, or prisons and poor-houses, can, of course, shift very well without it; while it is, on the contrary, of almost paramount importance to those who are called upon to erect or alter residences for the opulent and luxurious; at all events, if they, instead of applying to it themselves, choose to commit that department of design to decorators and others of that class, it is very unreasonable, on the part of the profession, to affect to hold a contemptuous opinion of such persons and their taste, when they might rescue their art from the baleful influence of such taste, by taking that department of it, as far as design is concerned, into their own hands. There is room, however, for suspecting that few of their own body would do very much better, for the simple reason that such branch of design forms no part either of their professional education or their after-studies: of colours, as applicable to their art, on which so much depends in this comparatively trifling branch of it, if so they choose to consider it, they know scarcely any thing.

In these remarks there is but too much truth; and among those which we afterwards meet with there is also much that merits to be considered.

How much depends upon colour alone is obvious enough from the fact, that the same design will appear altogether different, according as it happens to be differently coloured. Nevertheless, the choice of colours, and the arrangement of them, are generally left to the chapter of accidents. The architect's eye is not trained to colouring, as connected with embellishment; on the contrary, his attention is exclusively confined to models that afford scarcely any thing that is immediately applicable to interior embellishment, unless it be in a few particular cases. His books furnish him with no ideas on the subject; since what they offer, connected with it, rarely amounts to more than an occasional section, exhibiting only one wall of each apartment, while even that little is exhibited without colour, and without any of those accessories which there must be in the rooms themselves. As mere sections, we do not blame drawings of that class; all that we mean to observe is, that their deficiencies ought to be supplied by others. Yet even works, which are professedly intended to be studies of decoration, generally leave us quite in the dark as to one very material point, for very seldom, indeed, does it happen that they are *illuminated;* in regard to colour, therefore, they afford no information.

We must not be too liberal of our extracts, for were we to copy from it as much as we could wish, we might as well transfer the whole article entire to our own pages, which would be being more liberal towards our readers, than just towards the publisher of the Foreign Monthly. We must therefore pass over some other descriptions of, and remarks on, several of the modern Parisian shops, and confine ourselves to what is said of the mode in which the interior of many of them are decorated.

If less striking on the score of mere novelty, the specimens of interior decorations in shops are more successful: in fact, they exhibit more of taste than of decided novelty, except as regards the actual application, all partaking, more or less, of the style of painting in vogue at Pompeii. Milletot's, the confectioner's shop, plates 49 and 50, is an exceedingly pleasing example of this mode of embellishment; tasteful in design and rich in effect, although the colours employed are little more than browns and greys upon a white ground. Plate 66, a linendraper's shop, No. 29, Place de la Bourse, is, although very different from the preceding, another agreeable subject. The Café Gaulois, Rue Poissonnière, is a more ambitious display of the Pompeian style; but, as that plate is uncoloured, it is impossible to form any idea of that upon which the effect mainly depends. For purposes where mere general effect is required, this mode of decoration may very eligibly be adopted; but it is not very favourable to other species of art, because it excludes framed pictures, with which it would very ill agree, even were spaces for their reception provided for before-hand in the design; while it is hardly to be wished that subject pictures should be made to combine with it, by being similarly painted on the walls themselves, because it is our opinion that, were such practice to be brought into vogue, it would tend to deteriorate art by giving currency to a flimsy, meretricious style—a specious, shewy mannerism —and nothing more. We are now taking into view the consequences, supposing it were to become the fashion among those who occupy not family mansions but rented houses, to encourage such pictorial embellishment on the walls of their rooms. As such paintings could not be removed, and could scarcely have value as available property, it is hardly to be supposed that real talent would ever be employed in producing them. Besides, a superior collection of pictures may be formed by degrees; but, in this case, an entire series would have to be paid for at once, and, if not of first-rate quality, of such quality, at least, as to stand the test of critical examination as works of art, and would be no better, perhaps some degrees worse, than the same surface decorated with simply ornamental figures; if merely for the reason that it would have more pretension, yet be unable to support it.

Of purely decorative painting, applied to the walls and ceilings of rooms, examples are here furnished from a ball and billiard-room, executed, at Paris, for Baron Rothschild, in 1820, by Picot and Gosse. The ceiling of the second-mentioned apartment, in the style of the baths of Titus, is rich, yet chaste and harmonious, and many of the other parts, taken by themselves, show much taste, yet how far the tout-ensemble may be satisfactory, can only be guessed at; even allowing it to be so, it is questionable whether it is one that can safely be recommended for general purposes. It is certainly one that calls for much previous consideration and foresight as to its results. It is one that may be carried too far, and which is liable to great abuse, unless it be put under the check of correct artistical judgment and feeling. Still we could wish to see it encouraged to a certain degree in this country, were it only because our architects would then, almost of necessity, be led to bestow more attention than they at present do on what they ought to understand; and, if properly taken up, it would tend greatly to widen the scope afforded to design.

Theory, Practice, and Architecture of Bridges. The Theory by James Hann of King's College, *and the Practical and Architectural Treatises by* William Hosking, F.S.A., &c. Part 1, 2, 3. London, John Weale, 1839.

The three parts before us are devoted to a miscellaneous collection of well engraved plates of several bridges of importance, which have been erected in this country; in addition to what we have before noticed, there are eight plates of the Hutcheson Bridge at Glasgow, which exhibit not only the construction, but also the progress of the work, the setting of the centres, building the foundations, and the implements employed. There are several good examples of Iron Bridges, constructed by the Butterley Company, and various bridges of stone and timber.

In the letter-press we have a translation of Gauthey's Treatise on Bridges; but notwithstanding that this treatise has been held in high repute by many scientific men, we cannot for our part concede to it such a prominent position. We consider the formulæ to be generally complicated, and not at all calculated to benefit the practical bridge builder. The translator has fallen into a few errors in the translation; the word *pile* has been introduced in several places for the word *pier*, and there are some others which the scrutinizing eye of the profession will discover.

The two papers on the theory of Bridges, by Professor Ham, and on the theory of the arch, by Professor Moseley, are well written and of deep research; it would have been better if the two papers had been blended and intrusted to one author, for they in some measure interfere with each other, and are likely to confuse the student; notwithstanding, they are well deserving of an attentive perusal, and we shall give an extract from the paper by Professor Moseley, to enable our readers to form an opinion of the work for themselves.

* * As the simplest case of a section of variable inclination, let its plane be supposed always to pass through the same horizontal axis. This case includes that of the circular arch under its most general form, and to this case my further researches have been limited.

I have supposed certain forces to be applied to one extremity of a structure thus intersected, and resting by its other extremity upon an immoveable base. As for instance a semi-arch, fig. 2, resting by its extremity B upon its abutments, and supported by a given force P, applied to the key-stone AD, instead of the pressure of an opposite semi-arch. On this hypothesis the equation to the line of resistance may be completely determined in respect to an arch of equal voussoirs subjected to any variety of loading. With a view to this general determination I have first supposed the loading to be collected over a single point X of the semi-arch; and on this hypothesis I have found the equation to the line of pressure in terms, of the inclination of the joint AD of the key-stone (that is, of the line CD) to the vertical, the angle ACB of the segment of the arch, the common depth AD of voussoirs the point of application, and the magnitude of the force P and the weight X. This determination evidently includes the cases of the loaded Gothic and segmental arches; and were the magnitude and point of application of the force P known, it would constitute a complete determination of the equilibrium of the structure.

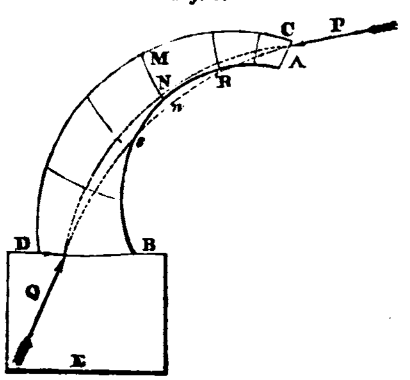
But unfortunately, in the actual case of the arch, this pressure upon the key is an unknown thing. We neither know its point of application nor its amount.

It is the pressure of the opposite semi-arch, or rather it is the resultant of an infinity of pressures exerted by the opposite semi-arch upon an infinity of points, by which that semi-arch is in contact with the face AD of the key; and the amount of this resultant, and whether it pass through the middle of the key-stone or its extremities, are necessary, but, up to this period of the investigation, *unknown* elements of the theory. Some other principle of mechanical action manifestly enters into the conditions of the equilibrium, and claims a place at this period of the discussion.

That other principle is this, that of all the pressures which can be applied to the key, different in their points of application and amount, but all consistent with the equilibrium of the semi-arch, that which it actually sustains by the pressure of the opposite semi-arch is the *least*. This condition of minimum pressure at the key supplies mathematically all that is required for the complete determination of that pressure, and perfects the theory.

The demonstration of it is easy. The pressure which an opposite semi-arch would produce upon the side AC of the key-stone, fig. 2, is equal to the tendency of that semi-arch to revolve forwards upon the inferior edges of one or more of its voussoirs. Now this tendency to motion is evidently equal to the least force which would support this opposite semi-arch; supposing the semi-arches, therefore, to be equal in every respect, and equally loaded, it is equal to the least force which would support the semi-arch ABDC.

Fig. 1.



Suppose the mass ABDC, fig. 1, to be acted upon by any number of force among which is the force Q being the resultant of certain resistances, supplied by different points in a surface BD, common to the intersected mass and to an immoveable obstacle BE.

Now it is clear that under these circumstances we may vary the force P, both as to its amount, direction, and point of application, without disturbing the equilibrium, provided only the form and direction of the line of resistance continue to satisfy the conditions imposed by the equilibrium of the system.

These have been shown to be the following,—that it no where *cut* the surface of the mass, except at P, and within the space BD, and that it no where cut any section MN of the mass, or the common surface BD of the mass and obstacle, at an angle with the perpendicular to that surface, greater than the limiting angle of resistance.

Thus, varying the force P, we may destroy the equilibrium, either, first, by causing the line of resistance to take a direction without the limits prescribed by the resistance of any section MN through which it passes, that is, without the cone of resistance at the point where it intersects that surface; or, secondly, by causing the point Q to fall *without* the surface BD, in which case no *resistance* can be opposed to the resultant force acting in that point; or, thirdly, the point Q lying within the surface BD, we may destroy the equilibrium by causing the line of resistance to cut the surface of the mass somewhere between that point and P.

Let us suppose the limits of the variation of P within which the first two conditions are satisfied, to be known; and varying it, within those limits, let us consider what may be its *least* and *greatest* values so as to satisfy the third condition.

Let P act at a given point in AC and in a given direction. It is evident that by diminishing it under these circumstances, the line of resistance will be made continually to assume more nearly that direction which it would have, if P were entirely removed.

Provided then, that if P *were* thus removed, the line of resistance would cut the surface, that is, provided the force P be necessary to the equilibrium; it follows that by diminishing it, we may vary the direction and curvature of the line of resistance until we at length make it *touch* some point or other in the surface of the mass.

And this is the limit; for if the diminution be carried further, it will *cut* the surface, and the equilibrium will be destroyed. It appears then that under the circumstances supposed, when P, acting at a given point and in a given direction, is the least possible, the line of resistance *touches the interior surface or intrados of the mass*.

In the same manner it may be shown, that when it is the greatest possible, the line of pressure touches the exterior surface or extrados of the mass.

I have here supposed the direction and point of application of P in AC to be given; but by varying this direction and point of application, the contact of the line of resistance with the intrados of the arch may be made to take place in an infinite variety of different points, and each such variety supplies a new value of P. Among these, therefore, it remains to seek the *absolute* maximum and minimum values of that force.

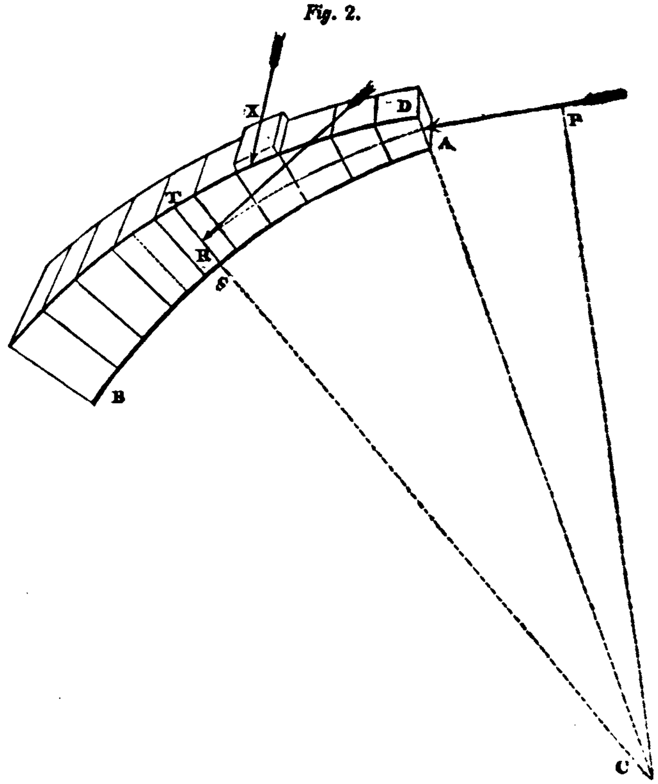
In respect to the direction of the force P, or its inclination to AC, it is at once apparent that the least value of that force is obtained, whatever be its point of application, when it is *perpendicular* to AC.

There remain then two conditions to which P is to be subjected, and which involve its condition of a minimum. The *first* is, that its amount shall be such as will give to the line of resistance a point of contact with the intrados. The *second*, that its point of application in the key-stone AC shall be such as to give it the least value which it can receive, subject to the first condition.

I have determined the value of P subject to these conditions in a paper read before the Cambridge Philosophical Society in May 1837, and published in the 6th volume of their Transactions. The equations involving that value admit of a complete solution, and determine it for every form and dimension of the broken or Gothic arch, and the complete segment, and for every circumstance of its loading.

The condition however that the resultant pressure upon the key-stone is subject in respect to the *position* of its point of application on the key-stone to the condition of a minimum, is dependent upon hypothetical qualities of the masonry. It supposes an unyielding material for the arch-stones, and a mathematical adjustment of their surfaces. These have no existence in practice. On the striking of the centres the arch invariably sinks at the crown, its voussoirs there slightly opening at their lower edges, and pressing upon one another exclusively by their upper edges. Practically the line of resistance then, in an arch of *uncemented* stones, *touches the extrados* at the crown; so that only the first of the two conditions of the minimum stated above actually contains: that: namely, which gives to the line of resistance a contact with the intrados of the arch. This condition being assumed, all consideration of the yielding quality of the material of the arch and its abutments is *eliminated*. It will thus be discussed in what remains of this paper.

Fig. 2.



To simplify the analytical discussion of the question, I have hitherto assumed the load upon the semi-arch to be placed over a single point of it X, fig. 2. I now imagine it to be distributed in any way over the extrados, but symmetrically in respect to the two opposite semi-arches. The centre of gravity of this load on each semi-arch being determined, it is evident that the *horizontal thrust* P on the key-stone of the arch will be the same if the whole load upon it be imagined to be collected in these two centres of gravity. I determine then the horizontal thrust P on this hypothesis of a concentrated loading: this determination being made, the data necessary to the analytical discussion of the question are *complete*, all the forces acting upon a mass ASTD of the arch and its loading intercepted between the crown and any inclined position CT of the radius are given, and the equation to the true line of resistance under any given circumstances of loading is determinable in terms of the radius vector CR and the angle ACS. The equation determining the value of P is unfortunately one of a high order, involving circular functions of complicated forms; and the solution of it otherwise than by approximation is perhaps to be despaired of. The small value of the ratio of the depth AD of the voussoirs, in the majority of practical cases, to the radius CA of the arch in terms of which ratio the value of P is expressed, suggests a developement of the value of P in a series of terms ascending by powers of this ratio. To effect this developement I have called to my aid the theorem of Lagrange, using two terms only of that theorem, and not therefore extending the approximation beyond the first power of the ratio. It might perhaps be expedient in some cases to extend it to the second; beyond this limit no practical enquiry need however be carried.

The line of resistance being fully determined, the *point* Q, fig. 1, where the resultant pressure of the whole semi-arch intersects, the supporting surface BD of the abutment becomes known, and also the *direction* of this resultant pressure. Now all the circumstances which determine the equilibrium of an abutment, subject at a given point to a given insistent pressure, I have before discussed, and I have determined its line of resistance under these circumstances: that line of resistance evidently unites with that of the arch at this point—this line of pressure is therefore completely known, and the conditions of the equilibrium of the piers or other abutments of the arch, and of the arch itself, are determined. * *

The theory of the equilibrium of the groin and that of the dome are precisely analogous to the theory of the arch.

In the former a mass springs from a small abutment, spreading itself out symmetrically with regard to a vertical plane passing through the centre of its abutment. The groin is in fact nothing more than an arch, whose voussoirs vary as well in breadth as in depth. The centres of gravity of the different elementary voussoirs of this mass lie all in its plane of symmetry. Its line of resistance is therefore in that plane, and its theory is embraced in that which has been already laid down.

Four groins commonly spring from one abutment; each *opposite* pair being addorsed, and each *adjacent* pair uniting their margins. They thus lend one another mutual support, partake in the properties of a dome, and form a continued covering.

The groined arch is of all arches the most stable; and could materials be found of sufficient strength to form its abutments and the parts about its springing, I am inclined to think that it might be safely built of any required degree of flatness, and that spaces of enormous dimensions might readily be covered by it.

It is remarkable that modern builders, whilst they have erected the common arch on a scale of magnitude nearly approaching perhaps the limits to which it can be safely carried, have been remarkably timid in the use of the groin.

In part 3 is the commencement of a paper on the Construction of Bridges, by Mr. Hughes, of a more practical nature, and it is evidently written by one who is completely master of the subject. This paper commences by describing the various methods of forming foundations for bridges, piers, &c.; but we shall defer making any extracts or further comments, until after the appearance of another part.

Upon the whole the work is undoubtedly the cheapest publication of the day, when we consider its valuable contents; but it would have t een far better had the work been published in such a form as to avoid bhe necessity of folding the plates; probably this might have enhanced the cost of the work, notwithstanding, it is our opinion that the work would have given greater satisfaction to the profession even at an increased price. We undertand that it is the intention of Mr. Weale to publish another edition so as to avoid this inconvenience; if so, we feel assured that the work will meet with that support which it so richly deserves.

Studies and Examples of the Modern School of English Architecture. The Traveller's Club. By Charles Barry, Architect; Illustrated with Drawings by Mr. Hewitt, and Engraved by Mr. J. H. Le Keux. Accompanied by an Essay on the present state of Architectural Study, and the Revival of the Italian Style. By W. H. Leeds. London: Weale. 1839.

English Architecture has been treated by many pseudo-critics with a contempt which a due consideration of its works would have prevented from being applied to it. This neglect has arisen, perhaps, more from the apathy of its professors in asserting their own rank, than from any inferiority of theirs in the production of works of merit. Abroad, every café, cassino, town-pump, and police-station is fully registered, and receives due honour; but here "Landscape Annuals," or similar *ad captandum* publications, are too often the records of our most ingenious monuments.

We need not feel astonished at the reproach of being a nation of shopkeepers, when it seems to be our national habit to obscure what even ourselves recognise as the highest source of glory. Domesticity we may pride ourselves upon—it may be a virtue to seek no enjoyment beyond our own fire-sides—but why, in the name of common sense, are we to keep our churches as closely confined at home as our daughters, or hedge in our palaces with the same care as our fruit trees. A spirit of hoarding seems to have possessed us, and content with possessing treasures, we have felt no wish to communicate them to our neighbours, or to allow them a participation, which is an increase instead of a diminution of our own honour. Where are our finest buildings? Not in the most frequented streets, or suspicious strangers might run away with them; not exposed to the public gaze, or they might become as dishonoured as a prostitute; but in some dirty unknown nook there is concealed a monument, which foreign nations would make pilgrimages to visit. The same feeling seems to prevent us from publishing them, as if to give a detailed architectural drawing would be as dangerous a communication to our enemies, as the secret of a new rocket or the plan of a fortification.

Let us rouse ourselves from this lethargy; let not inferior nations usurp our glory; but let us force Paris and her comonopolists to admit us to the same circle of honour. We have already done much towards bringing out the old buildings, but as much and more remains to be done, and that at once. The opening of the Monument, St. Bride's, and St. Martin's, are worthy acts, and would be esteemed exertions of a healthy disposition, did not other acts point out the lingering of the old leaven. What could be more disgusting than sacrificing St. Paul's to a toy-shop, hiding St. Paul's School in a corner, and demolishing St. Saviour's? while the half-penny farthing policy in not pulling down the corner of Lombard-street, will leave the Royal Exchange as a monument of our stupidity to all posterity. Why is not St. Paul's in some degree cleared; St. Michael's, Cornhill, thrown open; and St. Giles's, the tomb of Milton, new fronted?

It is not that we do not possess architectural riches, but that we neglect them, and allow others to arrogate over us a superiority which our own feelings of dignity should induce us to repel. Did we take as much pains as our neighbours in talking of what we have, many of their idle boasts would be repressed, and instead of being treated as a nation of barbarians, we should threaten their supremacy.

If we look either to the past or the present, we see nothing abroad which is to prevent us from claiming a high position in the scale of architectural merit. Our great works in the perpendicular style can compete with the flamboyant, the Moorish, or any other continental medieval style; and in the works of Wren we have some counterpoise for the later periods. France, like ourselves, has been going through a course of the cast-off styles of Europe, and, amid little that is great, she has learned from us what is pure. In Italy the medieval styles have been defaced, the simple supplanted by the corrupt, and architecture degenerated from Francia di Giorgio and Baldassare Peruzzi has been consigned to the meretricious designs of Palladio and his successors; the Dome of Milan has been disfigured and St. Peter's stands a childless giant. Spain, deserted by the energy of the Goths, and the refined taste of the Moors, relies for its modern fame upon buildings which have all the tawdry arrogance of the Castilian, and all his want of soul, which, where they exhibit nature, seek it in the beggar or the monk. Germany, as great in her claims as in the sprawling extent of her edifices, as wide-spreading as Berlin, and as empty, mistakes nakedness for simplicity, and adaptation for originality. She does in architecture what she does in other branches of the art—seeks the simple in the rude, and looks for elegance in uncouthness. To deny the merits of our rivals would be absurd; but to be blind to faults so glaring, would indeed leave us without a motive for exertion.

Our deficiency arises from architecture being treated as an effort of the hand, and not of the mind, the prey of the draftsman and the stone-mason, and its qualification a barber's-shop apprenticeship, instead of being considered as an elevated and inspired branch of art. To restore it, it must be treated like the other arts—it must be cultivated not in details, but in principles; not by a private soldier in the melée, but by a general, who inspects the mass. We have made Greek architecture an affair of columns and friezes—we have forgotten its adaptation to climate, and we have stripped it of its ornaments and its colours—and need we be astonished if we have a skeleton instead of a living being, or that we have starved a style which we have disclimated and unclad? The principles of Gothic composition stare us in the face, and we cannot see them, while we waste, in the research of detail, the power of creating that very detail. Architecture must be made popular and artistical—it must have a band of admirers as cultivated as its professors, and we may then hope, that originality may be encouraged, instead of compilation bearing sway. Of old, it was considered a matter of pride to call in to the assistance of the architect the most distinguished professors of other arts; and to Michael Angelo, Raphael, and Rubens, we owe many ingenious works. The principles of art are general, but their application special, for it is the same law of proportion which determines the grouping and massing of a building as of a picture; the same law which regulates the light and shade; the same laws of contour; and it is the appreciation of these general laws which makes the artist, and not a mere knowledge of the handling. The versification of Mickle, Hode, Broome, or Rowe, equalled perhaps that of Pope or Dryden; yet, although all are translators, the latter only have fame as poets. The grouping of the Laocoon or of Canova's tomb of the Pope, in St. Peter's, is guided by the very same rules which mark out the majestic front of York Minster, or the minor façade of King's College Chapel. The same objections to breaking up a picture into isolated figures refer with equal force to the distribution of the members of a palace, or the details of a club-house. If, too, Greek architecture be carried out here as at Munich, or the Moorish or early Italian styles be introduced, the architect must study with the painter the same principles of combination, and possess the genius of colour as well as form. The public are the parties to be pleased, they are those who command, and those who applaud, and unless they be instructed, the architect must be contented with the invidious honours of a clique, or find his best meant efforts received with the contempt of ignorance. It lies upon the architect to give this impulse—it is from him that must come the instruction, and then we may see the same progress in his branch as in the other styles of art. It is by the activity of the painters that the public have become qualified judges of their productions—tha. art has advanced, and pictorial exhibitions are crowded, while the architectural room is left to the solitary cavillings of the profession, and the contemptible productions of unapplauded exertion. Public competitions will do much, and they are the more necessary, as even the judges, according to the observation of Mr. Leeds, must see the works exhibited, before they are able to compare them and select. The architects must, however, shake off their lethargy, read "Stuart's Athens" less, think more, write and speak more, and, above all, act with greater energy and more effect. No time is more propitious than the present—the public is alive to art; they have claimed it as their inheritance, and sources of instruction now exist, which, to the previous generation, were unknown. The purest models of Greece have been disclosed, their polychromy illustrated, the Gothic and Moorish styles described, the Renaissance is in vogue, and a number of works have rendered the Italian styles accessible to us in all their beauties.

Much of the mischief has doubtless arisen from the absurd restrictions imposed by the professors of the art, from their want of a liberal construction of their studies, and by their confining the artist within bounds, which to the ancients were unknown. Nothing is worse than this cramping down to conventional rules, which gives, like a University education, the prize not to genius, but to memory. To animate the student, and direct his future progress, proper works should exist, not of ancient or modern edifices merely, but of our own productions, so that foreigners might learn that we could rival them, and Englishmen that we had not been neglectful of our duty. The proper body to have executed this task would have been the Institute of British Architects, but they want either the confidence or the means to give this plan effect. To Mr. Weale, therefore, are the English public indebted for attempting to form a work worthy of the subject; and to his public spirit will they owe what has too long been left neglected. That the attempt is hazardous, experience has too often proved; and we therefore call upon the profession, as they are capable of appreciating such a work, to set the example to the public in its support.

To Mr. Leeds has been confided the task of superintending this work, and we know no man who, in the merit of his previous works, the soundness and liberality of his judgment, or extent of learning and information, is better qualified for conducting such an arduous work. In the last edition of "The Public Buildings of London," Mr. Leeds has earned his qualification; and equally in translations from foreign languages, and in commentaries on other works, he has proved himself, without pretension, to be one of the best architectural critics of the day. Did his success depend on his ability, or on the spirited exertions of Mr. Weale, we should not hesitate to pronounce it as certain, but it is on the profession that we must again call to show that they merit the efforts which are made on their behalf.

Before we read Mr. Leeds' Essay, we thought that a better choice might be made for the commencement of such a work; but by him we have been convinced, that both from novelty and purity of style, and individual merit, no work could have been better selected to interest the public than the "Traveller's Club." The author briefly enumerates the causes which now impede architecture, and then, after a survey of the Greek and Gothic styles, enters into an able disquisition on the various styles of Italian, and particularly as they relate to the subject now before us; and it is but truth to say, that the "Traveller's Club" comes out of his hand with new beauties added, and all its perfections enhanced. From the works of an able and attractive writer like Mr. Leeds, it is difficult to select any thing without an embarrassment of choice, but we have culled for our readers the following extract:—

To attain even such degree of familiarity with the subject,—which is after all but very limited and superficial in comparison with the drier practical knowledge indispensable to the professional man,—to attain even this, will be thought no inconsiderable labour,—a task little short of irksome. On the contrary, it is one which would be found to be replete with great interest and amusement, provided, indeed, a person has any capacity for it at all, and would take it up rationally, as he would any other pursuit to which his taste might incline him. The chief obstacle in the way of its being done is that no system of study accommodated to such purpose has hitherto been laid down; so far from it that an *hysteron-proteron* is committed at the very outset; that is, according to vulgar phrase, the cart is put before the horse, and the beginning made at the wrong end; for instead of commencing with generalities and proceeding onwards to specialities and minutiæ, the latter are brought forward before the student has any clear notion whatever of the subject in its leading bearings; which is not very much unlike finishing up a single figure or object in a picture before any other part of it has begun to be put in: a method suitable enough for a youth put into an architect's office, where he must learn his elements piece-meal, but as unfit for persons in general,—as tedious and as repulsive as it would be to drudge through all the minutiæ of a grammar in studying a foreign language, before any insight had been obtained into its general structure and character.

It is true, the mass even of the educated are at present totally ignorant of architecture; yet, barring the prejudice which deters people from making the attempt, there is nothing which would prevent those who have a turn for studies from becoming as proficient in all that relates to the *æsthetic* part of architecture as the most accomplished architect himself. Or if this view of the matter be denied,—if no diligence, no study, no enthusiasm of feeling can ever place the amateur on the level of the professional man with regard to taste,—the disastrous alternative is that it matters not how soon we abandon all idea of advancing architecture as a fine art, seeing that it would be all to no purpose, no advantage whatever—no accession of enjoyment resulting from it to the public.

Whatever views to the contrary may be held by some among the profession, certain we are that no real friend, either to the profession or to the art, will advocate the principle of mystifying that branch of architecture with which all ought, if possible, to be conversant. No doubt shallow smatterers, superficial dabblers, half-educated pretenders, ought to be exterminated; not, however, by interdicting them from meddling with what they do not understand, but by encouraging them to proceed, and not to rest content with stopping short at the threshold, where, as they are well aware, they are at least one step in advance of the rest of the public, and therefore give themselves airs accordingly.

It is not the least evil attendant upon the present insulated condition of architectural study and knowledge, in consequence of their being confined almost exclusively to the profession, that architects themselves do not take that enlightened view of their art which they ought. As far, indeed, as the claiming for it almost paramount importance goes, they cannot be charged with undervaluing it in the slightest degree; but that sort of overrating it is altogether a different matter from endeavouring to ennoble it, and from exerting themselves to make it manifest the powers ascribed to it. In their attention to the means,—laudable enough in itself,—professional men overlook, or if they do not overlook, apparently disregard, or are indifferent to the end,—that is, to what ought to be the end proposed,—admitting that the work puts forth any pretensions on the score of art. They are urged on by little or no stimulus from without their own pale; and it might sometimes be imagined that they presume rather too much on the ignorance of all the rest of the world.

Another disadvantage is, that for their judges they can look scarcely to any except their professional brethren, perhaps rivals, whose praises will hardly ever be very enthusiastic, and who will seldom be disposed to approve individually of what is either contrary to their own practice, or calculated to render manifest their own inferiority. Certain it is that the most promising talent in a young aspirant is seldom cordially hailed, or in any way assisted onwards by those around him in the profession; neither does that of the more advanced architect receive their applause until he has terminated or is about to terminate his career; his contemporaries punctiliously waiting till he shall first have said his *valete*. All this need excite no wonder: it would be more wonderful, every thing considered, were it otherwise. Still it would be better were there some counterpoise to it; which can be obtained only by there being, out of the pale of the profession, a sufficiently numerous body competent to judge of merit and talent, and to discriminate between those and the opposite qualities. Then, and hardly till then, will talent have generally a chance of developing itself and making its way, without being dependent, as it now is, almost entirely upon those fortunate casualties which enable it to surmount the obstacles that else might have impeded its course for ever.

That the work is brought out with skill and taste, the name of Mr. Weale is a sufficient guarantee, and we can thus relieve ourselves from a task of eulogy, which we hope our readers will perform instead of ourselves. It is sufficient that Messrs. Hewitt and Le Keux have performed their task; and we leave to the profession to give it their good wishes as strongly as we do ourselves.

On Steam-Boilers and Steam-Engines. By Josiah Parkes, M. Inst. C. E. *Part I., Vol. 3. Transactions of the Institution of Civil Engineers.* London: Weale. 1839.

It has long been a desideratum, that some person or persons, well qualified for the task, should undertake an investigation of the different systems of generating steam, and of the various circumstances by which its production is accelerated or retarded, with the view of ascertaining the form of steam generator and treatment of fuel best adapted to promote *durability* in the former, and *economy* in the latter. On the first appearance of the work under review, we entertained great hopes that it would supply this deficiency, but were much disappointed; for on perusing it carefully, we found it so full of theoretical errors and fallacious arguments, as to render it unfit to serve as a guide, either in the construction of boilers, or in the management of the fires under them, except in a general way, which is now little needed, as the principles advocated by Mr. Parkes are already extensively acknowledged and put in practice, especially by the Cornish engineers.

The author proposes, in this paper, "to investigate and compare the peculiar properties of various kinds of steam-boilers, as exemplified in their practice; to show their points of agreement and disagreement; to exhibit their respective merits and demerits as evaporative vessels; to point out some general laws which may contribute to give greater uniformity to the results of evaporation from any assigned heated surface of boiler, and enable the employer of a boiler not only to ascertain if he is using his fuel economically or wastefully, but to apply a remedy, should he find his practice imperfect."

In our opinion, the proposed end has not been attained in the work before us; nevertheless, the table of experiments, which we presume to be correct, cannot but be very instructive, and may, with the addition of other experiments, form a basis from which a more successful analyst may deduce the general laws which Mr. Parkes endeavoured to discover. We have now to show the grounds on which we base the opinion we have just expressed; for which purpose we shall follow the reasoning contained in the paper as concisely as possible, and, therefore, confine ourselves principally to the leading points of the argument, supporting our remarks by quotations from the work itself.

Part I.

"On the qualities of steam boilers, and on the influence exercised over evaporation, by their proportions and practical management."

This part commences with a kind of introduction, in which the author enumerates the subjects treated in the sequel, and mentions, among others, the influence of *time* in producing the relative degrees of economy, which he reserves for a separate examination at the end of the paper, giving the following vague definition of *time*, as he intends it to be here understood:—

"By *time*, I mean the relative periods of the duration of a given amount of heat about the boilers, and about equal areas of their surface."

The rate of combustion, one of the elements of *time*, as defined by our author, is considered by him as one of the circumstances which have the greatest influence on the evaporative economy of a boiler; but, if we perfectly comprehend, as we believe we do, the meaning attached by the author to that expression, viz., the quantity of fuel burned under one boiler in a given time, this is not a matter of choice, but must depend on the required rate of evaporation; and slow combustion, in the same sense, must be, not a cause, but a sign of economy effected by some other means. It should be distinctly understood that we have made use of the term *slow combustion*, in the sense in which we conceive it to be employed by the author, namely, as signifying a comparatively small quantity of fuel burned under one boiler in a given time: but we would rather have that expression convey the idea, that the quantity of fuel burned in a given time is small in proportion to the quantity contained in the furnace. The rapidity of combustion, in this sense, must obviously be regulated, in some measure, by the nature of the fuel; for the more bituminous varieties of coal, if submitted to a comparatively moderate heat, suffer distillation, and a great proportion passes unburned through the boiler in the form of smoke. In one instance, in Lancashire, Mr. Parkes tells us, the coal he attempted to burn, on his plan of thick fires, on extensive grates, with slow combustion, contained so much tar as to run in streams through the bars, and catch fire in the ash-pit. Thus the limit of *slow combustion*, properly so called, or rather, the *most advantageous rate of combustion*, is determined by the nature of the fuel used.

At the head of the observations on each class of boilers are placed certain quantities, considered by the author as forming the principal points of contrast and comparison between them. These are:—the time in which one pound of coal is burned under one boiler; the weight of coal burned on each square foot of grate per hour; the weight of water evaporated by one square foot of heated surface per hour from 212°; and the weight of water evaporated by 1lb of coal from 212°. These quantities are called by the author *exponents*, as he considers them to be "indicative or *exponential* of the quality of the boiler, and of the effects of the practice upon it." Mr. Parkes is probably not aware that these terms are already appropriated in mathematics to a very different signification.

The first of these circumstances can evidently have no influence on the economy of a boiler; for, supposing two boilers to be equally economical, the weight of coal burned under each in a given time is necessarily proportional to the quantity of water evaporated in that time.

The second circumstance affects the results in two ways.—*Firstly*, a larger grate is generally accompanied by a larger surface to receive the radiated heat, which moderates the action of the latter on the surface, and thus adds to its durability.—*Secondly*, the thickness of the stratum of fuel, and the weight burned in a given time, being the same, the combustion must proceed more slowly in that furnace which has a larger area of grate, and therefore, contains a greater quantity of fuel at one time. The economy effected by this means may be explained thus:—

It is a matter of every-day experience in common life that, below a certain limit, the more atmospheric air is admitted in a given time to a given quantity of fuel in a state of incandescence, the more rapidly the latter will be consumed; there is also, no doubt, that the air which has passed through the fuel into the flue of a boiler, of the ordinary construction, contains still a large proportion of uncombined oxygen, some part of which might still be employed in effecting the combustion of an additional quantity of fuel, if properly applied. Suppose, for example, a square foot of grate covered with a stratum of coal 6 inches in thickness, and supplied with such a quantity of atmospheric air, that 5lbs of coal shall be burned in an hour; it is clear, that if a second stratum of coal of the same thickness as the first be added, it will in a short time be heated to incandescence, and as all the air which has passed through the lower stratum comes in contact with the upper one, a portion of the latter will burn by combining with some of the free oxygen remaining in it, and thus a greater quantity of fuel will be burned per hour on the square foot of grate, when the stratum is 12 inches, than when it is only 6 inches thick, the supply of air being the same. To reduce the consumption of coal, in the second case to the same as in the first, it will therefore be necessary to diminish the supply of air, the consequence of which will be that a smaller quantity of heated air will pass up the chimney; and since the principal loss of effect is to be attributed to the abstraction of heat by the air which passes up the chimney, the gain, or rather saving of heat effected by means of thick fires will be proportional to the diminution of draught, the air being supposed to arrive at the foot of the chimney, at the same temperature, under all circumstances, which is probably the case, when the heated or evaporating surface is the same.

The experiments made by Mr. Parkes on the summit of the chimney, and mentioned by him in a former paper (Trans. Inst. C. E., Vol. II., page 167), are in accordance with these views as far as we are more acquainted with the particulars; but, unfortunately, we are neither informed of the temperature of the air in the chimney, nor of the volume of air passing through the furnace, nor of the temperature of the flues, these points having probably not been ascertained. We only know that the air arrived at the top of the chimney on the old plan at such a temperature, that the water in an open copper vessel exposed to the current was constantly in ebullition, while on the new plan its temperature rarely exceeded 180°. Whatever the actual difference of temperature of the hot air may have been, it must be referred to two distinct causes: *first*, to the difference in the rate of combustion, less air being required to burn the same quantity of coal; so that if all other circumstances had been the same, and the air had therefore arrived at the foot of the chimney at the same temperature as on the old plan, nevertheless, the quantity of heated air impinging against the vessel of water being diminished, the same effect could not be produced upon the water, as when a greater quantity of hot air impinged against the vessel. Besides which, the air ascending the chimney with less velocity, had more time to cool, and therefore, lost more of its temperature before arriving at the top of the chimney, where the vessel of water was placed. *Secondly*, to the addition of another boiler; for the evaporating surface was thus so much augmented as to abstract a much greater amount of heat from the air during its passage over it, which therefore arrived at the foot of the chimney with a lower temperature. In the last mentioned work, page 169, Mr. Parkes states that he found that 75lbs of coke, produced from 100lbs of coal, evaporated as much water as 100lbs of the self-same coal. This observation, if correct, corroborates our views explained above; for the combustion of the gases contained in the coal could not have taken place without evolving some heat, the whole of which must consequently have been employed in raising the temperature of an extra quantity of air over and above that which was necessary to burn the gases distilled from the coal.

The third circumstance is certainly an important cause, and the fourth is the evidence and measure of the evaporative economy.

The observations on the three kinds of boiler, the Cornish, the waggon and the locomotive, tend to show that they rank, according to their respective merits, in the order in which they stand, the Cornish being greatly superior to the two others.

With respect to the actual economy of the Cornish boiler, we cannot but concur in Mr. Parkes' opinion, though we should explain it differently. Instead of saying that the slow rate of combustion "*involves the necessity* of employing a very extensive surface, or proportion of boiler to evaporation," we should say, that a more extensive evaporating surface absorbs more caloric from the gases and vapours before they arrive at the chimney, and thus *admits of* a slower rate of combustion. We are not informed of the thickness of coal on the grate in any of the experiments referred to; but if we suppose it to have been the same in all, the rate of combustion will be inversely as the area of the grate, and directly as the quantity of fuel burned per hour; or directly as the quantity burned per hour on each square foot of grate. But if the thickness of the layer of coal is not the same, the rate of combustion is directly as the quantity of coal burned per hour on each square foot of grate, and inversely as the thickness of the stratum of coal on the grate. Mr. Parkes states in the note at the foot of page 22, that he found thickness of fuel far more economical than an *excessive* extent of grate surface, thus pointing out the economical effect of a circumstance, which he has nevertheless not included in what he calls the *exponents*.

In that part of his paper in which he treats of the waggon boiler, the author professes, on his own behalf and that of the profession generally, absolute ignorance of the rate at which heat is transmissible through metal of varying thickness, as well as the rate at which it is absorbable by water at different temperatures (see page 13). If this admission is well founded, it is much to be regretted that so important a part of the investigation should have been omitted in his experiments, and that he should not have delayed the publication of his paper until he could have resolved the difficulty. We are inclined to think that he will find, should he be disposed to pursue the inquiry, that the rate at which heat is transmissible is very nearly directly as the difference between the temperatures of the gases in the flue, and of the water in the boiler, and inversely as the thickness of the plate. Unfortunately Mr. Parkes has left us entirely in the dark as to the temperature of the gases in the flues, so that we cannot with any degree of certainty institute a comparison of the evaporative results with regard to that circumstance; but if we suppose the mean temperature in the flues to be 800°, while that of the water is in the one case 300°, and in the other only 220°, the thickness of the plate in the former case being double that in the latter, we shall find the transmission of heat through equal areas of plate to be in the ratio $\frac{500}{2}$ to 580, or as 25 is to 58; or, the transmission would be equal if the surfaces were as 58 to 25. Now it appears that the Cornish engineers allow 7 times as much surface as the general waggon boiler practice for the vaporization of equal weights of water in equal times, or in the proportion of 175 to 25, which is 3 times as much as would be necessary, under the conditions assumed above, to evaporate the same quantity of water. The mean difference of temperature should therefore be reduced to one-third, or 467°. The consequence must be, that the heated air will reach the chimney, with an excess of temperature over that of the water in the boiler less by at least two-thirds than in the waggon boiler; and, the same quantity of heated air having thus a greater effect, less fuel will be burned to produce only the same effect, as we have already explained. It must be remembered that the evaporation will not be increased in the ratio of the heated surface when an equal quantity of coal is burned, the increasing evaporation diminishing the temperature of the hot air, for which reason the plate with which it comes afterwards in contact will not be heated to so high a temperature, and will therefore not evaporate so much water as an equal area of the other parts of the plate, whose temperature is more elevated.

Compared to the Warwick boiler, the Cornish has only 275 times as much heated surface as would evaporate the same quantity of water, the temperature of the plate being the same; and if we take into consideration that its temperature in the Cornish must have been on an average much lower than in the Warwick, in consequence of the greater extent of surface in proportion to the fuel burned, the saving will not appear so disproportioned to the increased area as Mr. Parkes seems to think by the following expression in page 13: "We must not conclude that it requires 7 times as great a surface exposed to heat *under like circumstances*, to realise an additional product of only 22 per cent. from fuel." It should also be remembered that the surface is here considered with reference to the fuel consumed instead of the water evaporated, which would have been the fairest comparison. But we certainly cannot, under any circumstances, expect the saving of fuel to be proportional, or nearly so, to the increased surface for transmitting the heat.

We cannot agree with the author, that the gain of 41½ per cent. in the effect of fuel is "miserably small, compared with the strides made in the economy of steam," nor is it at all necessary to conclude, from this *inconsiderable* economy, "that our methods of generating heat and steam, and of constructing evaporative vessels, have attained the utmost perfection which the strict laws of nature and the limited ingenuity of man forbid us from passing."

We now come to the most important part of the paper, where the author discusses the various circumstances which affect the results obtained in the different boilers, and compares them numerically. It is intituled

"An investigation of the relative time during which the products of combustion, from equal weights of fuel, continue in operation on equal areas of the surface of the boilers; with an estimate of the quantity and intensity of heat applied to them."

We shall discuss the several propositions of this investigation *seriatim*, and endeavour to show whether they are based on sound principles or not. The chapter commences with the following words:—

"The structure of the parts, and the mode of setting a boiler, occasion the heat applied to it to travel greater or less distances, and to pass over very unequal extents of surface, in equal or unequal* times. The distances travelled I shall consider as determined by the length of the circuit which the heat is compelled to traverse from the grate till it quits the boiler. The time in which it performs the circuit is the period of the duration of a particle of heat about the boiler, and is the first question to be considered.

"The rate of combustion, or the time in which a pound of fuel is burned, seems to me to be the best practical measure of the velocity of the products of that combustion about a boiler. The mind readily apprehends, that if a pound of coal be consumed under one boiler, in half the time that it is consumed under another, the velocity of the current must be twice as rapid in the one case as in the other; but if the velocity be expressed in feet per minute, or miles per hour, no information is conveyed of an appreciable or practical nature; nor does that expression reach the source or origin of the current, vis, the rate of combustion."

We must protest against this mode of estimating the velocity of the products of combustion, as affording no measure whatever of that velocity in boilers of various dimensions, or in which different systems of firing are followed. Suppose, for example, two boilers, with grates in the ratio of 1 : 2, the section of the flue, in the same ratio, but its length the same in both, and let all the arrangements be such that the same quantity of air shall pass through, and the same weight of fuel be burned on one square foot of grate in each; then, according to the above rule, the velocity of the current of the products of combustion should be as 1 : 2, while, in reality, it would evidently be equal in both boilers. As another illustration, let equal weights of fuel be burned in the same time, under two boilers, similar in every respect; but let the stratum of fuel be twice as thick on one grate as on the other; we have already shown that, with the same draught, more fuel would be burned in a given time on the former than on the latter, and that therefore the draught must be checked by means of the damper, in order to confine the consumption to an equality with the other; it is then clear that in this case the velocity of the current in the boiler where the thick fire is used must be considerably less than in the other. But by the above rule it would be found to be equal in both; therefore, the *rate of combustion, or time in which a pound of fuel is burnt*, cannot be adopted as the measure even of the *relative* "velocity of the products of combustion about a boiler."

The author considers the value of *time*, as an element influencing evaporative results, to be referable to,—

"1st. To the rate of combustion.

"2nd. To the distance passed over by the products of combustion before they quit the boiler.

"3rd. To the time in which the heat traverses the boilers.

"4th. To the period of the duration of the heat about equal areas of surface.

"It is necessrry to state that the rate of combustion now spoken of, is not the rate reckoned on the square foot of grate, but the consumption of fuel in an unit of time under one boiler of each class."

We have already proved that this rate of combustion has not the remotest relation to evaporative economy.

"Proposition 1. The velocities of the current of heated matter through each boiler, will be to one another directly as the rates of combustion, an inversely as the time in which equal weights of fuel are burned."

This propositition, being in suhstance the same as what precedes, calls for no further notice.

* The words *or unequal* must have crept in through inadvertence, for they canno possibly have any signification in the way they are used.

"Proposition 2. The distances passed over by the heat before it quits the boiler, are to each other directly as the circuits of the boilers: thus the

"Locomotive is to the Cornish as 7 to 155·00, or 1 to 22·142, &c.

"Proposition 3. The times in which the surface of the several boilers is traversed by the heat, will be to each other, as the products of the ratios of the velocities of the current, or rates of combustion, multiplied into the ratios of the lengths or circuits travelled: thus the

"Locomotive is to the Cornish as 6·835 × 22·142 = 151·34 to 1, &c."

Before commenting on this proposition, it is necessary to correct two errors in it which render it rather difficult to understand. It should be expressed thus:—The times in which the surface of the several boilers is traversed by the heat, will be to each other *inversely as the velocities of the current, and directly as the lengths or circuits travelled:* thus the

Locomotive is to the Cornish as $\frac{1}{6\cdot835} : \frac{22\cdot142}{1}$, or 1 : 151·34, &c.

Having brought the proposition and its example to what Mr. Parkes intended to convey, we have only to refer to what has already been said on the subject of the velocity of the current, to prove that the numbers thus found in nowise represent the difference in the periods occupied by "*the passage of a particle of heat from the grate, till it quits the boilers,*" as Mr. Parkes expresses himself.

The next question which he considers is, "the relative time occupied by the heat from equal weights of fuel in *giving out its caloric to equal portions of surface;*" and he solves it in Propositions 4 and 5, by means of the velocity of the current, incorrectly found by Proposition 1, which therefore vitiates the solution of the present question. Thus, then, the numbers found by this method cannot "be properly termed the *relative periods of caloric action*, arising out of the structure and practice of each class of boiler." But since the truth of the results is attempted to be confirmed by another process, it is necessary to examine what that process is, and whether it can be admitted as a demonstration or not. The proof runs thus:—

"It is the same thing to burn, as in the Cornish boiler, one pound of coal in 44·08 seconds, and apply the heat to 961·66 square feet of boiler, as to burn 44 08lbs in one second of time, and apply the heat to 44·08 times as great a surface. We should thus find that 42389 square feet would be the area corresponding with that increased rate of combustion for the Cornish boiler. In like manner, 2157 square feet would be the equivalent surface for a rate of combustion in the locomotive increased by 6·45 times. The quotient of 42389 ÷ 2157 is 19·64 as above."

Before we can discuss the strictness of this proof, it is necessary to correct an error (probably in the printing), which will be obvious to every reader, on considering a moment. Instead of 44·08lbs, it should be 1lb in one second of time.

The number 19·64 had been previously found by multiplying 6·835 by 2·874; but the former of these was found by dividing 44·08 by 6·45, and the latter by dividing 961·66 by 334·56; thus:—

$$\frac{44\cdot08}{6\cdot45} \times \frac{961\cdot66}{334\cdot56} = 19\cdot64.$$

In the proof it was found by multiplying 961·66 by 44·08, and dividing the product by that of 334·56 by 6·45; thus:—

$$\frac{961\cdot66 \times 44\cdot08}{334\cdot56 \times 6\cdot45} = 19\cdot64.$$

These two equations, being identical, cannot serve to corroborate each other, but would necessarily furnish the same result, however absurd the grounds from which they were deduced.

We have now come to the conclusion of the investigation of the influence of *time* on the *economy* of heat, from which it appears that the word *time* may as well be eliminated, as neither the absolute nor relative periods of the "*duration of the heat about the boilers,*" nor "*about equal areas of the entire surface,*" has been ascertained, the only point arrived at being the ratio of the evaporating surface to the fuel burned, which may be taken at once from Table I., column 21.

The remaining part of the paper is taken up with an investigation of the *relative quantity*, and the *relative intensity* of heat given off to those portions of the boilers which are exposed to the direct action, or radiating caloric of the fire, as having an especial bearing on the *durability* of the boilers.

Propositions 6, 7, and 8 are used to ascertain the relative quantities of heat supplied (by radiation) to equal areas of those portions of the various boilers which are exposed to radiating heat. In the latter there is an error similar to those already mentioned, which does not, however, affect the numbers, as it only exists in the statement of the proposition, and is not followed in the application.

By the following paragraph, which we quote from page 41, it would seem that Mr. Parkes has quite original ideas of heat, since he makes a distinction between the quantity of heat radiated upon a given area of surface in a given time and its intensity, as if the latter were not determined by, and proportional to the former.

"The *quantity* of heat supplied to any boiler would not affect the material of which it is composed any the more, whether that quantity or volume were greater or less, provided its *temperature* or intensity remained the same. This intensity varies greatly in the different boilers. We have seen that on the locomotive 6·835 times more heat is generated in equal periods than on the Cornish grate; but the grate of the locomotive has only 7 feet area, whilst that of the Cornish has 23·66 feet; and we know that nearly 7 times as much fuel cannot be burned in equal times off a grate less by two-thirds than another grate, without the accelerated combustion being accompanied by a very considerable elevation of temperature in the products of combustion. The *intensity* of that combustion must, therefore, be found, before its intensity of action on the surfaces exposed to it can be ascertained."

Here the quantity of fuel burned has been improperly compared with the area of the grate, instead of the area of the surface exposed to the radiated heat; for, the greater the surface which receives a given quantity of radiated heat, the less is the intensity of the action of the latter on the surface. For this reason proposition 10 will be of no value, and proposition 11 false as a general theorem, though possibly true in some few particular instances; namely, where the areas of the grates are equal. These two propositions require the same corrections as most of the others. The last should be:

Prop. 11. The relative intensity of calorific action on the surfaces exposed to radiated heat, will be directly as the ratios of the intensity of combustion on the several grates, and inversely as the ratios of the areas of those surfaces. Both these propositions are supported by similar proofs to that of prop. 5, quoted above, which have therefore no value.

From the 11th we learn that the author considered the heat as radiating, not from the whole surface of the fire, but from some portion of it, of equal area in all boilers, which we cannot possibly admit.

In conclusion we observe, that it is only the theoretical portion of Mr. Parkes' paper to which we object, not calling in question the authenticity of the facts therein stated; and we repeat, that we approve highly of large evaporating surfaces, and a slow rate of combustion, the mode of firing being suited to the variety of fuel used. But we firmly believe, that if any one should deviate from the proportions and practice experimented on, and determine those which would suit his purpose by Mr. Parkes' rules, he would find himself very much mistaken on submitting his boiler to the test of experience.

The Encyclopædia of Ornament. By H. Shaw, F.S.A. Imp. 4to. Parts I to 13.

Conformably with the title it bears, this publication is intended to furnish specimens and decorative detail in various architectural styles, and will therefore be far more comprehensive, and contain a greater variety of studies than any English work of a similar kind, which we are acquainted with. Indeed we hardly know of any similar collection that has been published in this country; the best subjects of this class being to be met with only in plates of details in larger architectural works; while what are professed by Books of Ornaments have been, for the most part, productions of a very inferior grade—bad as patterns, and altogether worthless as studies. We will not, however, term these plates unrivalled, simply because those in Mr. Shaw's "Specimens of Ancient Furniture," and other publications, would render such epithet incorrect, except as applied to his works collectively, and not to this individual one singly. So far the author's name is a sufficient guarantee for the superior execution of the plates; nor does this "Encyclopædia" need much recommendation from us to those who are acquainted with the same artist's former publications. Neither is it necessary to insist, at much length, on the extreme importance of characteristic and well-finished, if not particularly rich, detail in every style of architecture. It would be idle to inquire whether it be of greater importance than the larger masses and features of a building, it being enough to say that it is equally indispensable. Mere embellishment, or correctness and beauty in subordinate parts, will not excuse defects in the general design, any more than beauty of finish or careful execution of the accessories in a picture will atone for bad drawing or bad composition in a picture; but then, on the other hand, whatever be its merits as to general outline and proportions, a building will always cause more or less disappointment, unless the true spirit of the style adopted be attended to, and kept up in all the component parts. It will do well enough to look at by moonlight, or through a mist, but nothing more. Most desirable is it, therefore, that the student should train himself by times to detail, by acquiring familiarity with varieties of it, not only in different style, but in one and the same style.

It is in consequence of the neglect of this apparently very subordinate, not to say trifling, branch of design, that there is so much poverty—or, if not absolute poverty, common-place mannerism, and obvious want of study with regard to finish, in the majority of our buildings. The greater the stock of ideas any one has laid in by accumulating studies, from which he may learn the diversities of any one or more styles, all the greater will his resources be; and instead of merely following certain copies or patterns, he will be able to imitate his models freely, selecting their beauties and rejecting their blemishes, adapting and recombining as the particular purpose may best suggest. Among the subjects here represented, some consist of strictly architectural details, such as capitals, corbels, &c., but the greater number are entirely pieces of ornament from various buildings; carvings in stone or wood, enriched panels of doors, or similar compartments on walls, stained glass, painted tiles, inlaid metal work, drapery and hangings, jewellery and goldsmiths' work, and even patterns of lace-work; which last-mentioned, being composed of geometrical figures and devices, will, with more or less alteration, be found exceedingly applicable to floors, whether adapted for pavements or carpets. The same may be observed with respect to some of the patterns of stained glass; and even the specimen of drapery from a picture by Cima da Conegliano, which, with very little, if any alteration, will be found to supply both patterns and colours for carpeting, paper-hangings, floor-cloths, and similar purposes of decoration; while those for buhl and inlaid work may be derived from the plate of ornaments by Hans Holbein. Hardly can too high praise be bestowed on this work of Mr. Shaw's, which ought to find numerous purchasers, as it recommends itself not only for the library of the antiquary and the studio of the artist, but likewise for the table of the drawing-room and the boudoir.

Report on the Improvement of the River Dee, and Port and Harbour of Chester. By Sir John Rennie, Chester. Evans: 1837. *Reply to Mr. John Scott Russell's Letter.* By Mercator. Chester: 1839.

In our last we gave a general outline of the plan proposed by Sir John Rennie, for the improvement of the Dee; and although we consider it susceptible of some alterations, we feel bound to declare its unequivocal superiority over the dredging plan suggested by Mr. Russell. On the relative merits of these two propositions, a long paper-war has been going on at Chester; and the two pamphlets, the titles of which are at the head of this article, form but a small portion of the mass of papers devoted to the subject.

One prominent feature strikes the most unobservant spectator of the position of Chester, and that is the large area now occupied by the tidal waters of the Dee. That this area is the cause of the mischief, and that its proportions are too large, it needs but a small portion of the faculties of reasoning and comparison to assure us; and it does strike us as extraordinary, that both Sir John Rennie and Mr. Russell should entertain such erroneous views as to its necessity. Sir John, instead of recommending the reduction of this waste, on the contrary, says, that "as the preservation of the sectional area of all channels depends on the quality of the water passing through them, it may reasonably be inferred that the channels below Flint and Parkgate have suffered, to a certain extent, in consequence of the abstraction of the large quantity of tidal water by the embankment of 4000 acres above-mentioned from the estuary, and over which the tide used formerly to flow, although the new channel between Flint and Chester may be said to have been improved." Now the cause of this deficiency of depth does not arise so much from the previous embankment, as it does from the embankment not having been carried out.

Mr. Russell, however, who has exhibited so much research on tidal action, mistakes the position still more wrongly; for, with all his knowledge of the operations of the sea, he actually proposes dredging. The plain explanation of dredging is this, that, like paying off an accumulated and annual debt, you must first get rid of all the arrears, and then maintain such a force as will counteract the annual operation. The same cause which produced the silt is ever in activity, and unless a constant force be maintained to resist its invasions, it necessarily follows that it will again accumulate. It is very true that this can be done, and so can tunnels be run through quicksands, or a breakwater be erected from Dover to Calais. Every thing is practicable when the means exist; but it is certainly a serious question, whether a merely palliative measure should be adopted, or whether the difficulty should not be at once removed. Temporising on Mr. Russell's plan is out of the question, as for all useful purposes it is a practical impossibility. The dredging on the Clyde, his strongest case, has occupied eighty-three years, and cost £800,000. The position of the Dee, however, is totally different; and even admitting that the works be executed in a much shorter time, it must still be remembered that there is an accumulation of interest, so as practically to increase the cost; and that every year that Chester waits, she is insuring the superiority of her rivals over her. Two measures only remain, one of which is to alter the course of the river, and the other is to make an independent channel. The former of these two is the cheaper, and the more profitable, from the quantity of land recovered; but it is an operation little understood, and which involves an expenditure of time—the most valuable consideration to the inhabitants of Chester. Under these circumstances, one only method remains—that of Sir John Rennie to form a ship-canal, the expenses of which can be calculated, and the period of its formation ascertained, and which will have the additional advantage of leaving the river free, as the scene of future operations. If, as suggested in the "Chester Courant," a railway be placed on the banks for towing vessels, Chester will have advantages such as are possessed by no port on the coast, and enjoy at once the benefits of an inland position, and a ready access to the sea. We should further recommend, that in case of a junction with the River Dee Company, that the plan of recovering the estuary from the sea should be kept in sight, and on the completion of the canal, looked on as a means of reimbursing the expenses.

Sir John thus describes the River Dee Company's operations:—

At length the plan was brought to a considerable degree of utility, and a fine canal formed and guarded by vast banks, in which the river is confined for the space of ten miles, along which ships of 350 tons burthen may be safely brought up to the quays.

The last work of any importance was the extension of the Rubble Embankment from near Connah's Quay to about half a mile lower down, which took place about fifteen years ago. Since then, I understand, little has been done, except placing a few jetties here and there between Chester and Flint, in order to confine the current and increase the scour. The Dee Company, I believe, originally agreed or rather engaged to maintain 16 feet always at high water of ordinary spring tides, at Wilcox Point, Chester. It appears, however, that they have not been able to maintain above 14 feet or 14 feet 6 inches. The total quantity of land embanked from the estuary is upwards of 4000 acres (besides a large tract of unenclosed salt grass), which is now under tillage, and is very valuable.

The effect of the works above mentioned, has, I am informed, been to increase the depth of water between Flint and Chester, and to enable larger vessels to come to Chester than previously. From thence, however, downwards towards the Point of Ayr, it does not appear that any particular improvement has taken place; on the contrary, the great flats off Bagillt and Parkgate have materially increased, and the low-water channels at these places have suffered in proportion, particularly at the latter place; for where there used to be 18 feet at low water, there is now an extensive shoal, extending almost across the estuary at low water, so that it is unfit for vessels or boats of the smallest class, whereas formerly it used to be one of the principal stations for the packets between England and Ireland. One of the chief causes of this was, no doubt, the diversion of the channel from its natural course on the Cheshire to the Flint shore. Had the channel been continued there, and proper means been taken, the depth at Parkgate would have been increased rather than have diminished. It is quite clear, however, that as far as the river is concerned, the measure was not quite so complete as it might have been; for not only is the course lengthened nearly five miles, but four most inconvenient angles or bends are produced, which added materially to the friction and consequent impediment of the scour of the waters, both tidal and fresh. But, inasmuch as the main set of the flood tide coming from the Irish Channel naturally sets on the Cheshire shore, and on the ebb takes the same channel, although in an opposite direction, and under present circumstances each of them must bend back again almost at right angles before it can enter or leave the new channel, which is on the opposite or Welsh shore: thus, a further most serious obstruction to the tidal and fresh waters is created.

From the above description of the river it is evident that the navigation is in a very defective state, and, with the exception of a very short period at the height of spring tides, vessels drawing above six or seven feet of water cannot reach Chester.

But as the tide only rises from three to four feet during neaps as far as Chester, and there is only four feet at low water in the channel, the navigation is not practicable for vessels drawing above seven feet; and, with the exception of four or five vessels of 250 tons burthen, belonging to the cheese company, who have a steam-boat to tow them up and down the river during spring tides, all the trade of Chester is transported in small crafts of about 70 tons burthen, so that in fact it has dwindled away to comparatively of little importance.

As to dredging, it is only applicable in confined positions, where it is of imperative importance to preserve a certain depth of water against the inroads of the sea, and where a large expense can be afforded for such an object. But as to applying it as a means of engineering construction, we might just as well sop up the sea, or carry out the Dutch plan of draining works below the level of the sea by scoops. If the revenues derived from the improvement should fail to be commensurate to the expense, which, however, we do not fear, at least the canal will remain in something like a working state; but in a few years the dredging must disappear, and "leave not a wreck behind." On the one side is a great expenditure of time, and a protracted and uncertain operation; and on the other, a certain result at an established and certain cost, with incomparably less waste of capital or time. In the time that Mr. Russell is dredging out the Dee, a leash of Liverpools may arise; and the manufactures have already passed far from Chester on their pilgrimage to the north, where they are invited by the cheapness of water and of labour.

Gothic Ornaments drawn and lithographed. By J. Thomas, Sculptor and Carver. London: Williams, 1839. 1st Number.

The execution of this work is exceedingly promising, but its matter is not selected with equal taste. A finial in plate 3 is very good, as also a corbel in the eighth plate, and generally the designs from the perpendicular style, are better chosen than those from the earlier styles. The specimens are generally selected from cathedrals in the West Midland district, and will prove an accession to the works on architectural detail.

The Ascot Grand Stand. Designed by W. Mullingar, Architect.

This is a drawing of the grand stand recently erected at Ascot, and is necessarily removed from the sphere of our criticism. We think the architect is, however, entitled to praise in fulfilling a public duty in the publication of his work, too often neglected in buildings of greater pretension.

Design for the Exchange Buildings proposed to be erected at Manchester. By Thomas Taylor, Architect.

This design exhibits a basement on which is raised a story of the Corinthian order, surmounted by a peristyle and dome. The principal front is broken into a portico and two wings. The portico is octastyle, the outer columns being double, and the wings consisting each of four columns placed double. The other fronts consist of a hexastyle portico and wings, on the same principle as the main front. There is a frieze, sculptured pediment, and statues on the porticos. The double columns seem to be arranged so as to be free from the objections generally entertained against that disposition. The proportions and massing of the building are good, and produce a picturesque effect.

The London, Southampton, and Portsmouth Railway Guide. Wyld, 1839.

Mr. Wyld is, as usual, first in the field, and has produced a guide at once comprehensive and cheap. It includes all the necessary information, numerous maps and wood-cuts, illustrative of the progress of a railway.

The Lecturer.

We are much pleased with the appearance of this publication, which is what it purports to be, cheap and useful. In the monthly part, for the small sum of sixpence, we have above thirty wood-cuts, and seven lectures by popular men on practical science.

Hand-book for Travellers along the London and Birminghum Railway. London: R. Groombridge.

This little work is an abridgment of Roscoe and Lecount's History of the Railway, which we have frequently noticed, and from which we have made several extracts. The traveller will, by a perusal of this guide during his flight along the line, be amused with the description of the various works as they pass by him.

The Chevalier de Pambour's new work on the theory of the steam-engine will be noticed in our next number.

Mr. Buck's work on Oblique or Skew Arches, is just published.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

THE PRESIDENT'S CONVERSATIONE.

On Saturday evening, the 1st ult., Mr. Walker, President of the Institution of Civil Engineers, held a *conversatione* at his house, No. 23, Great George Street, which was crowded with individuals eminent in their profession. Throughout the apartments there were several novel inventions or ingenious illustrations, some beautiful models of works in progress on the grand scale. The rooms were chiefly illuminated by the brilliant lamps recently invented by Parker, and which, from their combined power and economy, promise to supersede all others for the combustion of oil. They supply the world with *desiderata* hitherto deemed unattainable, viz., the means of procuring from the by Salter in paper) was much admired. Much attention was excited by a most cheap and common oils a clear and intense light, hitherto only obtained from the best! Some of those in use at Mr. Walker's last night were filled with the best sperm oil, and some with the ordinary whale oil, yet nobody could tell by the light from which it proceeded. Several beautiful plans and models of the labours of the distinguished president on railways, bridges, piers, and other public works, were visible. A model of the bridge which he is now building over the river Ouse for the Hull and Selby Railway (modelled series of drawings, upon a large scale, representing Arnold's marine chronometer, and several working models upon an equally large scale, explanatory of the details of the work and the action of the different parts. Mr. Arnold's labours, and the success with which they have been attended, are so generally known and acknowledged, that any particular notice of them is unnecessary. Another valuable work of art, in the same important department of mechanism, was produced by Mr. Vulliamy. A regulator movement, with Graham's dead-beat escapement, executed as described in Nos. 28 and 31 of the *Journal of Science*. The advantage of this construction consists in the whole of the work connected with the escapement being executed by turning instead of filing, and thus insuring greater precision and accuracy. There were also exhibited some ingenious contrivances and models by Mr. Cowper; one in particular we noticed for its simplicity, it being an apparatus to ascertain if the lines of a railway are in guage, in another part of the journal we have given a drawing of it. We must leave undescribed the ingenious mechanical inventions of Bramah and others, and devote a few words to the fine arts, with specimens of which the tables were covered. The most interesting was a folio volume of the original drawings of Webber, who accompanied Captain Cook in his voyage round the world, which has lately been purchased by the President, and now displayed, we may say for the first time, to the admiration of the public. The picturesque fidelity of these sketches (the principal part of which were taken in Otaheite) cannot be sufficiently admired. Owen Jones's rough views in Egypt, and his splendid restorations and illustrations of the Alhambra formed an instructive contrast, each faithfully accurate to the character of the scene, yet apparently the production of pencils the most different. The latter volume is, perhaps, the most gorgeous specimen of illuminated printing in existence, and bears the impress of years of patient research and devotion to art, as well as of unique talent in achieving such a work. It certainly raises our ideas of the Saracenic style of architecture for magnificence of decoration, as well as elegance of proportion, and the combination of graceful forms with brillian and harmonious colours. A bronze vase, the work of B. Cellini (the property of Mr. Deville), was justly admired for its exquisite workmanship and the delicacy of its relief. A series of academy figures from the life, in oil, by Mr. John Woods, were attractive, and the sketches of J. B. Pyne were also highly praised. Nine faithful portraits of the late Charles Matthews, in the most fanciful characters of his "Comic Annual," for which he sat to Mr. R. R. Scanlan previous to his trip to America, were recognised with pleasure by his old admirers. Some sketches of Cornish miners, "taken under ground," by the same artist, presented features of a very curious character.

The honours of the house and supper-table were done in person by the president, assisted by the secretaries, Messrs. Webster and Manby, and every body seemed to feel highly gratified by the judicious combination of social and scientific arrangements; and the select, yet abundant materials for intellectual, as well as hospitable entertainment provided by the president for his guests.

Among the numerous distinguished individuals present we recognised—

Sir John Herschel, the Earl of Shaftesbury, Sir H. Parnell, Sir John Barrow, Sir Thomas Dyke Acland, M.P., Colonel Fox, Mr. Handley, M.P., Lord Blaney, Mr. Emerson Tennant, M.P., Mr. Bramston, Mr. Dunbar, Mr. Fox Talbot, Mr. Pollock, Professor Barlow, Mr. Ewart, M.P., Captain Brandreth, Sir Stavely Clark, Mr. Milne, Mr. Chawner, Mr. Burney, Sir Charles Price, Gen. Sir Duncan Macdougall, Mr. Angerstein, M.P., Mr. Mylne, Mr. Hardwick, Mr. Philpots, Dr. Ure, Professor Wallace, Mr. Adolphus, Mr. John Wood, Mr. Jerdan, Mr. Blexie, Mr. Henderson Macdougall, Mr. Ameyet, Professor Challis, Colonel Wells, Mr. C. Fowler, Professor Willis, Colonel Pasley, Sir William Symons, Dr. Todd, Colonel Churchill, Mr. Barry, Mr. Poynter, Mr. T. Wyatt, Mr. Charles Wood, Mr. Harris, Count Lubinsky, Mr. W. Cotton, Mr. Tooke, Mr Arnold, several Prussian noblemen, with Mr. Hebeler, the Consul-General, Sir D. Wilkie, Mr. F. Hodgson, M.P., Professor Wheatstone, Professor Kierman, Mr. Wrangham, Mr. Joy, Captain Locke, Sir Charles Price, Mr. Baxendale, Dr. Bowring, Mr. Scanlan, Mr. Wood, Mr. Stone, Mr. Brickwood, the Presidents and Councils of the principal scientific societies, the Council, and about three hundred members of the Institution of Civil Engineers.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

May 27.—Edward Blore, V.P., in the Chair.

Samuel Ware, Esq., was elected an Honorary Fellow; Richard Morrison, of Dublin, was elected a Fellow; William Cleribew and Addington Artis were elected Associates.

Among the donations announced was a copy of the first part of a work on the Pyramids of Gizeh, presented by Colonel Howard Vyse; also a copy of the second part of the Architektonisches Album, presented by the Architectural Association of Berlin.

A communication from Messrs. Smith, of Darnick, was read on a failure in the Falsbope Bridge. Mr. Richardson delivered his fourth lecture on Geology—subject, the chalk formation.

June 10.—George Basevi, Jun., V.P., in the Chair.

Various donations of books and casts were laid upon the table. A paper by Mr. Donaldson was read on the church of Notre Dame du Port, at Clermont Auvergne.

Mr. Richardson delivered his fifth Geological lecture, the subject being on the Wealden formation.

June 24.—David Mocatta, Fellow, in the Chair.

A letter was read from Mr. Donaldson, acknowledging his election as fellow for life, without further contribution; also a letter from the Chevalier Gasse, of Naples, Honorary and Corresponding Member.

Amongst the donations laid upon the table was a copy of the fifth part of the "Illustrations to the Normans in Sicily," presented by H. Gally Knight, Esq., M.P.

A paper was read by the Rev. Richard Burgess on the Form and Parts of Ancient Christian Temples, commonly called Basilicas.

Mr. Richardson delivered his sixth and concluding lecture on Geology.

ARCHITECTURAL SOCIETY.

Report of the Committee, read at the Annual General Meeting held the 4th of June, 1839, at the Society's Room, No. 35, Lincoln's Inn Fields.

Gentlemen,—In making this their annual report, the committee have the pleasure of appearing before the society under circumstances which they venture to think fully justify them in congratulating the members on the very satisfactory condition of the society generally. During the past year many important subjects have been brought under consideration. In the early part of it, a proposition was made for the junction of this society with the Institute of British Architects. The proposition itself originated with this society, which is the best evidence of their inclination to make a common cause for common objects. The negotiation, however, the committee regret to say, failed, in consequence of its being ascertained that the Institute had bound themselves by bye-laws of so exclusive a nature, rendered imperative by the charter, that, in the opinion of counsel, they could not be relaxed; these bye-laws prevented this society from securing any control over the disposition of the funds and property which they were called upon to give up, and were otherwise objectionable. Upon a full and careful consideration of the whole matter, this society therefore negatived the propositions; they are not aware, however, that they have been losers by this determination, for though some of their members left them and joined the Institute, the number is not so great as has been stated, and the secession has been more than filled up by the accession of other members, amongst whom they are happy to reckon some of the most respectable senior members of the profession. This discussion, however, they are happy to state, has been most useful in its results, because the Institute has been thereby led to create a class of student members in connexion with their society. This class they had previously entirely overlooked, though it is obvious that one of the best and most certain means of raising the profession of architecture to its fair place amongst the fine arts of this country, is by encouraging and educating the junior members.

The next subject to which they think it necessary to refer, is one of entire congratulation in the acceptance of the office of president by Mr. Tite: to this gentleman the committee feel bound to tender their best thanks for the devotion of a considerable portion of his valuable time, for a liberal donation, and for the present of some valuable and costly books.

The committee have also to state that the donations to the society have been on the increase during the present session; not merely has the library and museum been extended, but the funds of the society have also been much benefitted, and the committee are happy to state, that although they have this session had to meet many extra heavy expences, the funds are at the present time in a very satisfactory state. It is not necessary to introduce a balance sheet of the accounts in the present report, but any of the members who may wish to inquire more particularly into this subject, may receive any information they require on application to the treasurer, Mr. George Mair.

The introduction of lectures at the evening meetings forms a new feature in the proceedings of the society, and the committee feel that it is a measure which has met with the approbation of the members generally; with this conviction the committee have it in contemplation to make similar arrangements for the ensuing season, and by so doing they hope greatly to extend the advantages the society previously offered.

The prizes for this year have been adjudged by the society as follows: viz.

To Mr. George Adam Burn, of George Place, Hammersmith, student member, for the best essay on the Ionic order.

To Mr. George B. Williams, Penny Fields, Poplar, for the best measured drawing of St. Mark's Chapel, South Audley Street.

The only remaining subject that the committee think it necessary to advert to, is with reference to the student members, and they have to regret that they have not availed themselves of all the advantages this society offers. In consequence of this circumstance they have been obliged to withhold two of the prizes usually given; viz. that for original design, and that given by the treasurer for sketching from subjects proposed at each meeting.

One of the main objects for which the Architectural Society was founded, was for the purpose of affording facilities of study, as well for its student members, as for mutual intercourse among themselves; and in giving the students those facilities, the society has endeavoured to offer every inducement in its power, not merely to excite study, but to create emulation, and to call forth latent talent amongst its junior members.

The committee feel it their duty to call attention to these circumstances, knowing of themselves the benefits that are to be derived from a proper participation in the opportunities of study thus offered.

It now only remains for the committee to express the thanks of the society to the visitors who have honoured them with their company at their several meetings, and also to the gentlemen connected with the press, to whom they feel indebted for the kind manner in which they have been pleased to notice their proceedings.

In conclusion, gentlemen, the committee trust that the ensuing session may be as generally successful as the past, and that they may be able to procure, with increased satisfaction to themselves, increased motives for your attendance at their meetings.

They beg to assure you it will be their study to carry out the objects for which the society was formed, and they hope in so doing not only to deserve, but to receive, your approbation and support.

William Tite,
President.

ROYAL SOCIETY.

April 25.—The Marquis of Northampton, President, in the chair.

Robert Rigg, Esq., and Professor Sylvester, of University College, were elected Fellows.

The following papers were read:—

"*On the motion of the Blood,*" by J. Carson, M.D. After referring to his paper contained in the Philosophical Transactions for 1820, relative to the influence of the elasticity of the lungs as a power contributing to the effectual expansion of the heart, and promoting the motion of the blood in the veins, the author states that his object in this paper is to explain more fully the mode in which these effects are produced, and to corroborate by additional facts and observations the arguments adduced in its support. He endeavours, from a review of the circumstances under which the veins are placed, to show the inconclusively of the objections which have been urged by various physiologists against his and the late Sir David Barry's theory of suction: namely, that the sides of a pliant vessel, when a force of suction is applied, will collapse and arrest the further transmission of fluid through that channel. The considerations which he deems adequate to give efficacy to the power of suction in the veins of a living animal are, first, the position of the veins by which, though pliant vessels, they acquire in some degree the properties of rigid tubes; secondly, the immersion of the venous blood in a medium of a specific gravity at least equal to its own; third, the constant introduction of recrementitious matter into the venous system at its capillary extremities, by which the volume of venous blood is increased, and its motion urged onwards, to the heart in distended vessels; and lastly, the gravity of the fluid itself, creating an outward pressure at all parts of the veins below the highest level of the venous system. The author illustrates his positions by the different quantities of blood which are found to flow from the divided vessels of an ox, according to the different modes in which the animal is slaughtered.

2. *Account of Experiments on Iron-built Ships, instituted for the purpose of discovering a Correction for the Deviation of the Compass produced by the Iron of the Ships*, by G. Biddell, Esq., A.M.

In this paper the problem of the deviation of a ship's compass, arising from the influence of the iron in the ship, more particularly in iron-built ships, is fully investigated; and the principles on which the correction for this depends having been determined, practical methods for neutralizing the deviating forces are deduced and illustrated by experimental application. The author states that, for the purpose of ascertaining the laws of the deviation of the compass in the iron-built steam-ship the Rainbow, four stations were selected in that vessel, about four feet above the deck, and at these the deviations of the horizontal compasses were determined in the various positions of the ship's head. All these stations were in the vertical plane, passing through the ship's keel, three being in the after part of the ship and one near the bow. Observations were also made for determining the horizontal intensity at each of these stations. The deviations of dipping needles at three of these stations were also determined, when the plane of vibration coincided with that of the ship's keel, and also when at right angles to it. After describing the particular method of observing rendered necessary by the nature of the vessel and the circumstances of her position, the author gives the disturbance of the horizontal compass at the four stations deduced from the observations. The most striking feature in these results, is the very great apparent change in the direction of the ship's head, as indicated by the compass nearest the stern, corresponding to a small real change in one particular position, the former change being 97°, whereas the latter was only 23°, and the small amount of disturbance indicated by the compass near the bow. After giving the observations for the determination of the influence of the ship on the horizontal intensity of a needle suspended at each of the stations, in four different positions of the ship's head, and the disturbances of the dipping needle at three of these stations, the author enters upon the theoretical investigation. The fundamental supposition of the theory of induced magnetism, on which Mr. Airy states his calculation to rest, is, that, by the action of terrestrial magnetism, every particle of iron is converted into a magnet, whose direction is parallel to that of the dipping needle, and whose intensity is proportional to that of terrestrial magnetism, the upper end having the property of attracting the north end of the needle, and the lower end that of repelling it. The attractive and repulsive forces of a particle on the north end of the needle, in the directions of rect-angular axes towards north, towards east, and vertically downwards, and of which the compass is taken as the origin, are first determined on this supposition in terms of the co-ordinates; and thence the true disturbing forces of the particle in these directions. The disturbing forces produced by the whole of the iron of the ship are the sums of the expressions for every particle. Expressing this summation by the letter S, and transforming the rectangular into polar co-ordinates, Mr. Airy gives to the expressions for the disturbing forces the simplifications which they admit of, on the supposition that the compass is in the vertical plane passing through the ship's keel, and that the iron is systemmetrically disposed on both sides of that plane. He thus deduces for the disturbining forces acting on the north or marked end of the needle,

$- \mathrm{I} \cos \delta\, \mathrm{M} + \mathrm{I} \cos \delta\, \mathrm{P} \cos 2\,\mathrm{A} + \mathrm{I} \sin \delta\, \mathrm{N} \cos \mathrm{A}$, toward the magnetic north;

$\mathrm{I} \cos \delta\, \mathrm{P} \sin 2\,\mathrm{A} + \mathrm{I} \sin \delta\, \mathrm{N} \sin \mathrm{A}$, towards magnetic east;

$- \mathrm{I} \sin \delta\, \mathrm{Q} + \mathrm{I} \cos \delta\, \mathrm{N} \cos \mathrm{A}$, vertically downwards:

Where I represents the intensity of terrestrial magnetism; δ the dip; A the azimuth of the ship's head; and M, N, P, Q, constants depending solely on the construction of the ship, and not changing with any variations of terrestrial localities of magnetic dip or intensity.

From the consideration of these expressions for the disturbing forces is deduced the following simple rule for the correction of a compass disturbed by the induced magnetism only of the iron in a ship.

1. Determine the position of Barlow's plate with regard to the compass, which will produce the same effect as the iron in the ship.

2. Fix Barlow's plate at the distance and depression determined by the last experiment, but in the opposite azimuth.

3. Mount another mass of iron at the same level as the compass, but on the starboard or larboard side, and determine its position so that the compass points correctly when the ship's head is N.E., S.E., S.W. or N.W.; then the compass will be correct in all positions of the ship's head and in all magnetic latitudes.

When the disturbing iron of the ship is at the same level as the compass, the correction is stated to be much more simple, it being then only necessary to introduce a single mass of iron at the starboard or larboard side, and at the same level as the compass. It is farther remarked, that if one mass of iron is placed exactly opposite another equal mass, both in azimuth and in elevation, it doubles its disturbing effect: if one mass be placed opposite the other in azimuth, but with elevation instead of depression, or *vice versâ*, it destroys that term of the disturbance which depends on sin A, and doubles that which depends on sin. 2 A. And if one mass be placed at the same level as the compass, its effects may be destroyed by placing another mass at the same level, in an azimuth differing 90° on either side. If a disturbance, from whatever cause arising, follow the law of + sin. 2 A, (changing sign in the successive quadrants, and positive when the ship's head is between N. and E.), it may be destroyed by placing a mass of iron on the starboard or larboard side at the same level as the compass; if it follow the law of + sin. 2 A, the mass of iron must be on the fore or aft side. From the consideration of the expression of the disturbing forces produced by the ship, it is farther inferred that both in the construction of the ship and in the fixing of correctors, no large mass of iron should be placed below the compass.

The expressions for the disturbing forces towards north and east, being transformed into forces towards the ship's head and towards the starboard side give

$\mathrm{I} \cos. \delta\, (-\mathrm{M} + \mathrm{P}) \cos. \mathrm{A} + \mathrm{I} \sin. \delta\, \mathrm{N}$, for the former,

and

$\mathrm{I} \cos. \delta\, (\mathrm{M} + \mathrm{P})$, for the latter.

The author next proceeds to investigate the effects which result from the combination of induced magnetism with permanent magnetism. Calling H, S, and V the new forces arising from the latter, and directed towards the ship's head, its starboard side, and vertically downwards, the whole disturbing force towards the ship's head becomes

$$\mathrm{H} + \mathrm{I} \cos. \delta\, (-\mathrm{M} + \mathrm{P}) \cos. \mathrm{A} + \mathrm{I} \sin. \delta\, \mathrm{N};$$

and the whole disturbing force towards the starboard side,

$$\mathrm{S} + \mathrm{I} \cos. \delta\, (\mathrm{M} + \mathrm{P}) \sin. \mathrm{A}.$$

The manner in which the numerical values of these quantities may be found from experiment is then pointed out, and being determined from the observations on board the Rainbow, at Station I., a comparison is made between the observed disturbances of the needles, and those which would result from the action of the ship as a permanent magnet. From this comparison it appears that almost the whole disturbance is accounted for by the permanent magnetism, and that the residual part follows with sufficient approximation the law of changing signs at the successive quadrants. For the complete verification of the theory it remained only to effect an actual correction of the compass. This was done by placing below the compass, in a position determined by the previously-ascertained numerical values, a large bar magnet to neutralize the effects of the permanent magnetism of the ship, and a roll of soft iron on one side of the compass to counteract the disturbance arising from induced magnetism. That this correction was effective appears from the very small amount of uncorrected disturbance then observed in the compass. The observations of the compasses at Stations II., III., IV., are similarly discussed: the disturbing force arising from the permanent magnetism of the ship being in like manner determined, a comparison is instituted between the observed and computed disturbance of the compass; and the results of this comparison, with the exception of the observations at Station IV., are found to be in perfect accordance with the theory. Attempts are made to correct the compasses at these stations in the same manner as at Station I., but owing to the imperfection of the compasses they did not succeed so perfectly. The observations made with the dipping needle are next discussed, and the values of the constants are deduced from them. The general agreement of those determined from the observations when the needle vibrated in the direction of the ship's keel, with those deduced from the observations when the needle vibrated transversely, is pointed out, and is considered an additional proof of the general correctness of the theory. Observations on the disturbance of the compass in the iron-built sailing-ship Ironsides are next described. These are similar to those in the Rainbow, but not so extensive; and they are discussed on the same principles. From this discussion it is considered that the theory is in perfect accordance with the facts observed in the deviations and intensities observed. The correction of one compass was effected by a tentative process, which the author considers likely to be of the highest value in the correction of the compasses of iron-ships in general. The ship's head being placed exactly north, as ascertained by a shore compass, a magnet was placed upon the beam from which the compass was suspended, with the direction of its length exactly transverse to the ship's keel: it was moved upon the beam to various distances till the compass pointed correctly, and then it was fixed. Then the ship's head was placed equally east, and another magnet with its length parallel to the ship's keel, was placed upon the same beam, and moved to different distances till the compass pointed correctly, and then it was fixed. The correction for induced magnetism was neglected, but there would have been no difficulty in adjusting it by the same process, placing the vessel's head in azimuth 45° or 135° or 225° or 315°. In conclusion, Mr. Airy makes the following remarks:—The deviations of the compass at four stations in the Rainbow, and at two stations in the Ironsides, are caused by two modifications of magnetic power; the one being the independent magnetism of the ship, which retains, in all positions of the ship, the same magnitude and the same direction relatively to the ship; the other being the induced magnetism, of which the force varies in magnitude and direction when the ship's position is changed. In the instances mentioned, the effect of the former force was found greatly to exceed that of the latter. It appears that experiments and observations similar to those applied in the above cases are sufficient to obtain with accuracy the constants on which at any one place the ship's action on the horizontal needle depends, namely—

$$\frac{\mathrm{H}}{\mathrm{I} \cos \delta} + \tan \delta\, \mathrm{N}, \frac{\mathrm{S}}{\mathrm{I} \cos \delta}, \mathrm{M}, \text{ and } \mathrm{P};$$

and that by placing a magnet so that its action shall take place in a direction opposite to that which the investigations show to be the direction of the ship's independent magnetic action, and at such a distance that its effect is equal to that of the ship's independent magnetism, and by counteracting the effect of the induced magnetism by means of the induced magnetism of another mass, according to rules which are given, the compass may be made to point exactly as if it were free from disturbance. It appears also, that by an easy tentative method, the compass may now be corrected without the labour of any numerical investigations or any experiments except those of merely making the trials. Although the uniformity of the induced magnetism under similar circumstances is to be presumed, yet the invariability of the independent magnetism during the course of many years is by no means certain. These statements suggest the following as rules which it is desirable to observe in the present infancy of iron-ship building. It appears desirable that—1. Every iron sea-going ship should be examined by a competent person for the accurate determination of the four constants above mentioned for each of the compasses of the ship, and a careful record of these determinations should be preserved as a magnetic register of the ship. 2. The same person should be employed to examine the vessel at different times, with the view of ascertaining whether either of the constants changes in the course of time. 3. In the case of vessels going to different magnetic latitudes, the same person should make arrangements for the examination of the compasses in other places with a view to the determination of the constant N. 4. The same person should examine and register the general construction of the ship, the position and circumstances of her building, &c., with a view to ascertain how far the values of the magnetic constants depend on these circumstances, and in particular to ascertain their connexion with the value of the prejudicial constant M. 5. The same person should see to the proper application of the corrections and the proper measures for preserving the permanency of their magnetism. The most remarkable result in a scientific view from the experiments detailed in the present paper is, the great intensity of the permanent magnetism of the malleable iron of which the ship is composed.

THE NELSON TESTIMONIAL.

The committee appointed to superintend and to carry out this object, assembled on Saturday, 22nd ultimo, at the Thatched-house Tavern, St. James's-street. Amongst the members of that body who were present we observed the Duke of Wellington, the Marquis of Lansdowne, the Earl of Cadogan, the Earl of Minto, Viscount Melville, Lord Burghersh, Lord Bridport, Lord Colborne, Lord Ingestrie, Lord C. Fitzroy, Sir G. Cockburn, Sir T. Cochrane, Sir G. Seymour, Sir W. Beatty, Sir J. Shaw, Sir G. Murray, Sir J. Barrow, Sir W. Parker, Sir P. Laurie, Admiral Digby, Colonel Fox, Lieutenant-General Sir J. Macdonald, Sir G. A. Westphal, Captain Beaufort, Captain Badcock, Mr. S. Rice, Mr. J. W. Croker, &c.

The Duke of Wellington was appointed chairman of the day. His Grace having taken his seat,—

The noble CHAIRMAN said, as there appeared not to be any other business to transact, they would go at once to the ballot for the decision with regard to the choice of design. He would, however, take that opportunity of inquiring what amount of subscriptions had been received.

Sir G. COCKBURN said that at present they amounted to about £18,000.

Mr. CROKER, on the motion "That the committee do now proceed to the ballot," said he could not help thinking that prior to the commencement of that act it would be most desirable for the committee to come to some definite and distinct understanding in regard to the question of whether they were to consider themselves to be bound to carry out every detail of the design which might that day be determined on as being the best calculated to meet the views of the majority of the subscribers. (Hear, hear.) It might so happen that the design chosen was one which was impracticable in its accomplishment, either in respect to its details or on account of the want of sufficient funds. (Hear, hear.) He could not help thinking, therefore, that it would be better for the committee to pass a resolution by which they would have the power, should such a course be deemed necessary, to make any alterations or variations in the details which might be considered requisite. With that view, then, he begged to move, "That the vote of this day shall decide which design is adopted, subject, however, to such variations in the details, and such inquiries, and conditions, and securities, as to the construction and cost, as to the committee (or any sub-committee appointed to consider of, or conduct the practical execution of the monument) may subsequently repuire."

Sir G. COCKBURN seconded the motion: which having been put, was carried unanimously.

It was asked whether the powers vested in the superintending committee were understood to go so far as to enable them to take off one of Nelson's arms? He had put the question, because the committee would recollect that in several of the designs the artists had drawn the hero with two arms, when, as everybody well knew, one of them had been shot off.

There was a general reply in the affirmative to this query.

Sir G. Cockburnn and Sir P. Laurie having been appointed to act as scrutineers, the ballot was commenced.

Shortly after the close of the ballot, at four o'clock, the scrutineers made the following official notification:—

"In obedience to the resolution of the committee, we, the undersigned, have examined the votes given for the model or design to be selected for the Nelson memorial, and we declare that Mr. Railton has the majority of votes.

"G. COCKBURN, }
"P. LAURIE, } Scrutineers

"Thatched House Tavern, St. James's Street, June 22."

Mr. W. Railton's design was No. 65 on the list.

RAILWAY SOCIETY.

THE first General Meeting of the Private Members of the Railway Society was held on Thursday the 20th ultimo, at their rooms, No. 25, Great George-street, for the purpose of electing the members of the council, and of submitting to the consideration of the meeting the proposed rules of the Society, drawn up by the Members of the Committee of Management and of the House Committee. Those gentleman who are deputed as the representatives of the different Railway Companies subscribing to the Society, were also requested to attend the meeting, in order that their opinions respecting the construction of the former rules of the Society might meet with every consideration. Several of these gentlemen were present, and rendered very efficient service in assisting to frame those regulations which were afterwards sanctioned by the members present.

George Carr Glyn, Esq., having been called to the chair, proceeded to state, in a neat and concise speech, the objects of the Society, which are principally directed towards the protection of the common interests and rights of Railway Proprietors, and the establishment of a focus wherein may centre the united experience and talent of those connected with these national undertakings, whether as Directors or Engineers. Mr. Glyn concluded by stating the purpose for which the private members and delegates were that day assembled, and informed the meeting that he had great hopes of prevailing on one of the most influential personages in the kingdom, and one most deeply interested in the prosperity of railways, to become the President of the Council.

The Secretary then read a report of the proceedings of the committee of management since the formation of the society, clearly showing that a careful watch had been kept upon all proceedings in Parliament at all likely to effect railway interests, and stated that the Right Honourable the President of the Board of Trade had recognised the society as the organ through which he should in future seek for any information required on the subject of Railways. The proceedings of the House Committee were afterwards laid before the meeting, together with a very satisfactory account of the expenditure and receipts of the society; after which the proposed rules of the society were read and considered *seriatim*.

Much attention was bestowed upon this very important subject, and several alterations were made, before the final assent of the members present was given to the rules, the principal feature in which is the election of the council from among the private members of the Society for the management of everything relating strictly to the private affairs of the Society—as the election of members, the house expenditure, &c., and the formation of a committee, composed of the members of the council and the delegates from Railway Companies subscribing to the Society, for the purpose of watching over and protecting the interests of Railway Proprietors, of adopting such measures for their benefit as may appear to them expedient, and of receiving and replying to all communications, whether scientific or otherwise, which may tend to promote the advantages of Railway communication.

The private members afterwards nominated from their own body those gentlemen who were deemed most eligible as members of the council, and the meeting broke up, after having, on the proposition of Henry Bosanquet, Esq., Chairman of the Eastern Counties' Railway, passed a vote of thanks to Mr. Glyn for the very efficient manner in which he had hitherto filled the place of Chairman of the Committee of Management, and for the interest he had at all times manifested for the welfare of the "Railway Society."

ON GEOLOGY, APPLIED TO ARCHITECTURE,

Being part of a Course of Six Lectures, by G. F. RICHARDSON, Esq., of the British Museum.

Lecture the Fourth. Delivered at the Royal Institute of British Architects, Monday, May 27th, 1839. Subjects: Igneous Rocks; Volcanic; Enumeration of Building-Stones; Choice of Stone.

ON this occasion, the Lecturer proposed to show the composition of rocks, and their application to architectural purposes. England is particularly favoured in the number and varieties of rocks adapted to architecture, although not in all of those which are most valuable. This of course arises from the great variety of formations which are here compressed into the narrow boundaries of our island, ranging from the tertiary formations of Hampshire and the great Metropolis, up to the primary of Cornwall, Wales, and the North of England.

Proceeding upon the division of rocks into aqueous and igneous, we find that the igneous may be divided into two great bodies, the modern and the ancient, and these again each into three classes, all possessed by the modern, and which are also in a great degree to be found in the ancient. The first class of modern volcanic rocks is of a light white, like felspar, and is called trachite, from trachos, a Greek word, signifying rough. The second is of an iron or ferruginous red, and is called basaltic. The third class partakes of both these qualities, as greystone. The ancient volcanic rocks are some basaltic or trachitic, and are sometimes resinous or glassy. The productions of volcanoes are often called lavas, from a Swedish word signifying to run. Tufa is formed of ashes agglutinated together; piperino is supposed to be produced by the action of showers of rain upon ashes; and pumice appears to be trachite reduced to a fibrous state. No experiments are of greater interest than those imitating nature, for in them we acquire a certain standard to which to refer the results of our operations. Mr. Gregory Scott, of Edinburgh, has, as is well known, melted basalt, and produced different bodies, according to the degree of slowness with which it was allowed to cool. When cooled slowly, it became glassy; more slowly, earthy; and when most slowly of all, amorphous or shapeless. As the former rocks are called subarean, from their being produced by volcanoes in the open air, so the trappean rocks are called subaqueous, because they have been projected by volcanoes under water. Granite has been produced by intense heat under pressure, and is not, as supposed, confined to the primary series, but is to be found of much later date. Darwin has found it piercing the tertiary strata, and it may even be believed that at the base of mountains, and in the bowels of the earth, granite is being formed even at the present period. Primary rocks are supposed to be formed of the same elementary parts, but deriving their distinct character from the different degrees of heat to which they have been subjected. Thus the schistose rocks have been slightly warmed, gneiss baked, granite melted, and others, like obsidian, reduced to glass. Obsidian, I may remark, derives its name from Obsidius, who was its discoverer. The class of schistose or slaty rocks, is supposed to be muddy or sedimentary matter, which has been altered by the operation of the burning masses underneath, so as to lose its original horizontal lines of stratification, and to acquire others. All rocks above the primary, it will be observed, are deposited by water.

Proceeding to the separate enumeration of architectural rocks, the first or foundation stone is granite. [The Lecturer here referred his auditors to the map constructed by the veteran geologist Webster, prefixed to Buckland's Geology, to whom also, not only the original plan, but most of the subsequent additions are owing, and he said, so great is the labour displayed in it, that the student who should commit only that section to memory, would at any rate learn one of the most important branches of the science, viz., physical geology.] Granite is the basis upon which the whole system of rocks seems to be founded, and where it retires from the human observation, it is still supposed to bed under the other rocks. Granite has been originally a fused mass, and crystallised from a state of fusion: it is composed of mica, felspar, and quartz, and is of a granular or grainy structure, from which it derives its name, and these particles do not seem to be united by any intermediate substance. The proportions in which its integral parts unite is of every variety, as also its colour, which may be grey, red, yellow, green, or even brownish-black, which colours proceed from the mixture of schorl and hornblende. Granite is found in mountain chains, and generally presents rugged surfaces; sometimes, however, it is columnar or pillar-like, and in the Pyrenees it abounds in masses of piles on piles. It is to be found all over Europe. In England, in the North, in Cornwall, Devon, and Wales; in Scotland, in Caithness and in Aberdeen; and in Ireland, in the mountains of Armagh and Wicklow. In Germany it forms the Brocken and the Hartz, and it is the grand material in Switzerland and the Savoy. It is admirably adapted for all purposes of architecture, even for paving and for statuary. From its capability of receiving a fine polish, it was much used by the ancients, and most of the monolithic monuments of Egypt, or those formed of a single stone are made of this material, some of enormous dimensions, particularly one at Thebes, and another at Rome, 100 feet high. In the church of the Casan, at St. Petersburgh, are fifty of these columns, each thirty feet high.

In the same city (St. Petersburgh) also is an enormous mass of granite, used for the pedestal of the celebrated statue of Peter the Great. Granite is exceedingly liable to decomposition, from its being a compound substance; and, therefore, liable to injury, from its particles coming in contact with anything dissimilar to their particular habits. So strongly is this tendency to decay sometimes, that I recollect in the case of some granite statues brought from Egypt to the British Museum, and laid in the court-yard for a short time during the winter, that they became so affected by frost, as literally, in some cases, to split to pieces, and almost fall into powder.

Syenite derives its name from Syene, a city of Egypt, in the manner that many other rocks do; thus chalcedony, from Chalcedon, tripoli, from Tripoli, in Asia Minor, and chalk, or creta, from the island of Crete. It is composed of felspar, hornblende, quartz, and mica, and resembles granite, but is of purer grain, and contains hornblende. It is found in Scotland, in Aberdeen, and in the isle of Arran, and is valuable, because it does not suffer from moisture or from the atmosphere. It was much used by the ancients, but not so much by the moderns. Some of the finest specimens are in the castle of Heidelberg, on the Rhine, supposed to have been brought from the ancient palace of Charlemagne.

Gneiss is composed of mica, quartz, and felspar. It cleaves and works more easily than granite, but is liable to injury from the weather.

Basalt is of columnar form, generally of four or five sides, and is found abundantly in natural structures. Although of volcanic formation, it is remarkable that it is rare at Vesuvius, while it is in plenty at Etna. The Giants' Causeway, in Ireland, is one of the finest specimens, containing thirty thousand pillars of this material. It is little used by the moderns, because it is the hardest and least practicable of the rocks. Winckelman, however, observes that the choicest of the ancient statues are of this material, as if the sculptors loved to effect their triumph on that which was insuperable to other hands.

Porphyry is so named from a Greek word explaining its purple colour. It is of great variety, and is a general name for rocks containing a mineral mixture. It was used abundantly by the ancients, and at Rome are many buildings decorated with pillars supposed to have been brought from Constantinople. Such are those in the Palace of the Conservatori on the Capitol, in the Giustiniani Palace, in the Basilica of the Lateran, and in the church of Santa Maria Maggiore.

Serpentine is also neglected by the moderns, but was used by the ancients for tombs, vases, and small objects.

Lava, peperino and pumice, are confined in their uses to volcanic districts, at Herculaneum and Pompeii, which are principally built of such material. Some of the early Etruscan tombs are composed of a coarse trachite, which is supposed by some to point out the existence of an early state of society during the geological periods. Pumice is occasionally preferred, on account of the lightness of its texture.

Having thus gone through the primary, we will now proceed to the secondary rocks, in which we find slate. The quality of a good slate is, that it should cleave easily, that the lamina should be straight, and unmixed with foreign substances, and the more finely laminated it is, the larger plates will be obtained. Slate for roofs should be dense and not porous, and it is best judged, like other stones, by the sharpness of the sound. Porous slates are bad, because they swallow water. Sulpbur is a dangerous ingredient, and sometimes exists in particles so minute, as to be imperceptible. This mineral when mixed with water, produces vitriolic acid, and so promotes decomposition. To detect its presence, heat the slate with wood embers, and if it exists it will give forth a sulphureous smell. Oxide of iron mixed with slate has a sympathy for air and water, and so increases the quantity of oxide or rust. Calcareous matter is equally injurious, and may be tested by observing whether it puffs up when exposed to muriatic acid. Carbonaceous, or coaly matter may be detected by burning. With regard to its colour, yellow or black spots indicate the presence of oxide, and black that of carbonaceous matter. The best work on the qualities of slates is that of Dr. Watson, Bishop of Llandaff, called "Chemical Essays," which has a whole chapter devoted to the subject.

Limestones are of various qualities; those are best which are highly crystalised, but they are little used in modern times, on account of the cost of making. These marbles, however, afford the best materials for building. Those less crystalised are most commonly used by architects.

While upon this subject it may be well to mention the manner in which stones are arranged by the continental architects. They divide them into two classes hard and soft, *pierre dure* and *pierre tendre*. *Pierre dure* is applied to those which can only be worked by water and the plane-edged saw; and *pierre tendre* to those which can be worked by the peg-toothed saw. The qualities which are required in a stone by the French and German architects are, that it should be of a fine grain, and compact. Few stones, however, possess all the qualities required, and then it is that the architect must use his judgment in selecting the best. Thinly laminated (or leafed) limestone, like lears of leaves in a book, possesses different degrees of strength, according to its position. If placed so | on edge, it has, of course, less resistance and strength than when placed thus ——. Dark stones are generally the strongest; those which suck up water are bad; but those with brilliant points and hard are good. A very good criterion is the sound of the stone when struck with a metal instrument, when a full sound is a proof of a good stone. Those mixed with sulphur are generally hard and good, but require care in the selection. Heavy stones as denoting compactness of structure. Another serious question is the evil arising from an imperfect character of stone, from inattention to which many of our finest buildings in London are injured. The Marquis of Northampton was observing to me, that to such an extent does this devastation prevail at Oxford, that the number of colleges obliged to be refaced is extraordinary.

We are not, however, the only sufferers, our younger brethren in America making the same complaint. A friend of mine, writing to me, says, "Our Capitol, one of the finest senate-houses in the world, scarce twenty years old, is so completely spoiled, that we are obliged to keep it always fresh painted, to preserve it even from the wet. This mischief doubtless arises from mistaken motives of economy, so that the builder is tied down by his contract to purchase an inferior stone. We should not however look to cheapness but to quality, for that is always the cheapest which is the best."

Resuming our examination, we find next to slate old red sandstone, so called from its being coloured with iron and nearly approaching grauwacke. There are few of these stones good for building.

The Carbonate of Limestone is very hard, and from its weight is difficult of transport. Its hardness arises from the many grains of quartz in it, and practical men say that it cuts the saw, instead of the saw cutting the stone. Craigleith stone is of this class, and it comes from a quarry of that name, two miles from Edinburgh, where a great part of the New Town is built of it. Bramley fall stone also belongs to this division, and it is used in the Terminus of the Birmingham Railway at Euston Square.

Passing over the coal formations, we come to Magnesian Limestone, which unites rare qualities, being crystalline and hard, like the Carboniferous Limestone, and easy to be worked, like Oolite. From the magnesia in it, it is a very unproductive soil, and is so injurious to vegetation, that the lichens and other small plants which disfigure stone will not grow on it. There is some of excellent quality in Robin Hood quarry, near Gloucester, and there is reason to believe that this class of stone will come into more general use.

The New Red Sandstone extends over the island from Exeter to York, and has many quarries, but it is not very appropriate for building purposes, although formerly much used. The old builders, however, it must be remembered, took the stone nearest to hand, the bad roads being a great impediment to the removal of such a bulky material. Worcester and Chester Cathedrals are built of this stone, and have worn so badly that even in the interior the faces of the statues are undistinguishable. These defects arise from being much impregnated with oxide of iron, and also with saline particles, which it derives from its neighbourhood to the Cheshire salt-beds. The church of St. Andrew, at Liverpool, is quite black, the moisture imbibed by the salt catching the soot and dirt floating in the air.

The oolite formations are the great source of building materials, and derive their name from the Greek, *oos*, an egg, their structure being that of small eggs. The Germans call it bluntly roestone. Roach Portland-stone, it should be observed, is liable to cracks and fissures; Bath-stone is soft, but not durable; Whitby sandstone is a good specimen of oolite.

The Wealden formation affords Purbeck stone, formerly much used, some of the pavements in the old streets of London being made of it. The Purbeck marble was much used for ornamenting cathedrals. The Wealden sandstone is very crumbling, but was used in Knowle Castle, and the other castles in Kent.

Chalk firestone is composed of marl and green sand, and is much used for ovens. The cloisters of Westminster Abbey are built of it. Chalk limestone is rarely used, and is not much to be seen, except in St. Alban's Abbey. The tertiary formations are not productive in England, while in France they supply abundant materials, and are extensively employed at Paris.

The Lias formations I have passed over, but it is not durable on account of its containing pyrites. It is, however, well adapted for cements, and blue lias lime is now much used.

The French Government has decided on proposing to the Chamber of Deputies, to undertake the railroad from the capital to the Belgian frontier.

LAW PROCEEDINGS.

EXPLOSION ON BOARD THE ARCHIMEDES STEAM-BOAT.

An inquest was held on the 1st ultimo at the Unicorn at Greenwich, before Mr. Carttar, the coroner for Kent, on the body of James M'Millan, an engineer on board the Archimedes steam-vessel. The deceased was employed on board this vessel on Thursday, May 30, and it was just about to leave the East India Docks for an experimental trip, when the boiler burst, and so dreadfully scalded the deceased by the heated steam which escaped, that he died in a few minutes after his arrival at the Dreadnought hospital-ship. From the evidence adduced, it appeared that the accident was to be attributed to an undue pressure of steam, and to a faulty condition of the safety valves, which did not act properly. After examining a number of witnesses, the coroner adjourned the inquiry till Wednesday, the 5th ultimo, to give an opportunity for the attendance of scientific gentlemen, and to examine two other men who have been severely scalded, and who are now on board the Dreadnought.

At the adjourned inquest Mr. Field, the engineer, attended and gave the following evidence:—

He stated that he resided at Lambeth, and was an engineer. Was not connected with the company to which the Archimedes belonged, but had been requested to make an inspection of the boiler of that vessel. He found the boiler was of the ordinary low pressure kind, generally used by steam-vessels upon the river. Its power and strength of plate were quite sufficient. The boiler was rather large. The great objection to it was, that it was less tied together than smaller boilers would be, and therefore subject to be sooner damaged. If he had had to make a similar boiler, he should have put more stays in it. The top of the boiler had been lifted by the pressure of the steam, the crown of it had been distorted, and by that means the safety-valve had been stopped from acting, and the spindle jammed, which prevented them from acting, to which cause he attributed the accident. He did not see any steam-gauges when he made the inspection; unless, therefore, the safety-valves acted, the pressure of the steam could not be known. A good engineer might have known from the opening of the cocks, but every man could not. The top of the boiler had been lifted, but the chimney had not been moved from the place where it stood, in consequence of being attached to the flues. The engineers, in consequence of the jamming, were not able to know the strength of the steam, and that was the reason of the accident. When he made the examination he tested the valves, and found one of them loaded to the extent of 5½, and the other to 6½; that was rather higher than he should load them, but many would load them in that way. The pressure ought not to be increased, as it would be attended with danger to the safety of the boiler. There was nothing but the ordinary weight on the valves at the time he saw them. The tightest of the valves could be got at from the deck, and the other from below. A preventive to this occurrence would have been stronger staying or less pressure, but that would not have prevented it if the safety valve had been jammed, which could not have taken place unless the boiler had been thrown out of shape. The boiler, if it had been sufficiently tied so as to prevent its altering its shape, would have been of sufficient strength to work up to 5½. The thickness of the plates was quite sufficient. There were a great number of fires for so small a boiler, but they did not increase the danger at all. He should not have chosen to work a steam-vessel from London to Portsmouth without a steam gauge. If there had been a steam gauge in the present instance, it would have indicated danger—that there was something more than the ordinary pressure: the difference from an extra weight of 44lb. on one valve would increase the pressure 1¼ or 1½lb. upon the square inch. He would have been extremely timid in loading the boiler to that extent. He thought the boilers were not sufficiently strong to bear the pressure he found upon them. If the boiler had been well tied and bound, however, it would have been of sufficient strength.

After hearing the evidence of Mr. Rennie and some other witnesses, the jury returned a verdict of "Accidental Death," with a deodand of £250 on the boilers.

The Foreman said the jury did not attribute the accident to any wrong construction of the boiler,* and that, if it had not been improperly interfered with, the accident would not have occurred.

The Coroner concurred in the view of the jury. If the valves had not been improperly interfered with by some person or other, the unfortunate result might not have ensued.

THE LATE ACCIDENT ON THE EASTERN COUNTIES RAILWAY.

An inquest was held at Stratford, on Saturday, the 22d ultimo, before Mr. C. C. Lewis, the coroner for Essex, on the bodies of John Meadows, the engineer, and Charles Leitch, the stoker to the engine which met with the accident mentioned in the daily papers. It appeared by the evidence that the accident took place about a quarter before five o'clock on Friday afternoon. The train had left Mile End, and was about half a-mile from Stratford, when, on taking a course near Stent's Mill Bridge, the engineer allowed the engine to acquire such an immense velocity, that it rocked violently from side to side for some distance, and at last run off the rails. Neither the passengers nor the guards were at all injured. The jury, having heard the evidence declared their opinion that the accident had been occasioned entirely by over-speed, and by the engine man having in this respect disobeyed the express orders of the engineer in chief and officers of the company; and a verdict of "Accidental Death" was accordingly returned. The engine man was a very steady and experienced person, but he had been previously warned against driving at such great speed. Either from too great confidence in his own power, or from some other cause, he did not at the time of the unfortunate accident either shut off the steam or reverse the engine, nor did it appear that the break had been applied. The engine is but little damaged, the boiler not having burst as erroneously stated in the daily papers. Nor had there been any subsidence whatever in the rails or the embankments, that portion of the embankments where the accident occurred having been made many months, and it was in the soundest possible condition. There were from thirty to forty passengers in the train, and their entire exemption from injury is mainly attributable to the judicious plan of fastening the carriage doors, which prevented the passengers from attempting to jump out. The slight damage done to the rails was immediately repaired, and the trains continued to run in the regular succession as usual.

[From inquiries which we have made, we understand that the cause of the accident was entirely owing to the centrifugal force consequent on the amazing speed at which the engine was going. It was at the commencement of a curve on a declivity of 16 feet per mile, where the engine quitted the rails. The deaths of the unfortunate men was occasioned by their attempting to leap from the engine, one being crushed by the tender, and the other by the train of carriages.]—EDITOR.

* If this were the opinion of the jury, we do not consider they were justifiable in levying so large a deodand.—EDITOR.

MISCELLANEA.

Discovery of Valuable Marble.---We understand that a large field of fossil marble has lately been discovered on the common belonging to the manor of Great Asby, in this county, the property of John Hill, Esq., of Bankfoot, some of the most beautiful which England has hitherto produced. Two specimens of this splendid marble have aptly been named by the owner, "Tortoise-shell and chintz marbles." The first has a French white ground, interspersed with blood-red spots, and bears a strong resemblance to tortoise-shell, that at a short distance it is difficult to discriminate between the two. The second presents a light brown ground marked with a curious representation of gold filigree work, mixed with a dusky green, bright purple, and red, and has the exact appearance of the rich chintz gowns worn a century ago. There are numerous other patterns in this limestone range, extending over more than 3,000 acres, both curious and handsome. The great value of this marble consists not in variety of colours alone, but also in the fineness of its grain, which is equal to the Italian marble, and also in its great soundness; the shaken condition of variegated English marbles having in general rendered them of comparative little value. We hear that blocks of large dimensions are easily won, and when manufactured, take the most brilliant polish imaginable. We have no doubt this valuable marble, unique in its kind, will soon become a general favourite with the public, and be an important acquisition to the marble works of this country. We hear, also, with much pleasure, that a few specimens will be presented to the museum at Kendal.---*Westmoreland Gazette.*

Mill Bay Harbour and Floating Docks.--We are informed that the promoters of the Exeter and Plymouth Railway intend making Mill Bay the terminus of their line, for which purpose it is admirably situated between Plymouth and Devonport. The floating dock will hold 200 sail, exclusive of the foreign packets; and the outer harbour, which will be formed by a breakwater, from the point of Mr. Gill's quarry, will have from three to four fathoms of water at low tide, and will afford abundance of room for steamers to lay afloat, and go out of harbour at any time of tide. The great abundance of stone on the spot will render the cost of this work comparatively trifling, as the limestone excavated to form the outer harbour will go a great way in completing the breakwater.

Launch of the Lord Mayor's Barge.—On Tuesday, the 11th ultimo, the Lord Mayor and the Lady Mayoress went by water from Southwark Bridge, attended by the water-bailiff and others of the officers attached to the conservancy, to the premises of Mr. Serle, the city bargemaster, to witness the launch of the state barge, which has been for some time, by order of the Court of Aldermen, undergoing repair and modern decoration. In the front of the house which is raised in the boat are four Corinthian columns, close to each of which is a very skilfully carved griffin. The gilding all round, and particularly at the head of the vessel, which is also finely carved, has been applied with a most liberal hand, and the effect is grand in the extreme. It was admitted by those who had seen the barge launched immediately after she was built, that her appearance yesterday was far more attractive.

The Lords of the Admiralty have sent a ship of war to the south-western corner of Asia Minor, for the purpose of transporting from thence to this country a large collection of most valuable ancient sculptures and bas-reliefs, which have been described by Mr. Fellowes in his account of Asia Minor, where many towns and cities, and a remarkable and nearly perfect ancient theatre, hitherto quite unknown, have likewise been found.

Kensington.—At the beginning of the month a new Infant School-house, at Kensington, erected under the direction of Mr. G. Godwin, was opened to the children. It is designed in the Tudor style of architecture, and is built with red bricks and compo facings. The roof, a very light one, has the peculiarity of a large lantern for ventilation, and which serves, at the same time, to assist the external appearance of the building. The length of the school room is 42 feet, and the width 22 feet. The cost is said to have been under £300. There is a committee-room attached.

PROCEEDINGS OF PARLIAMENT.

House of Commons.—List of Petitions for Private Bills, and progress therein.

	Petition presented.	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour	Feb. 6.	Feb. 27.	Mar. 12.	Apr. 15.	..
Aberdeen Harbour	Feb. 8.	Mar. 15.	Apr. 15.	..	..
Ballochney Railway	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	..
Barnsley Waterworks	Feb. 21.	..	..	..	..
Bath Cemetery	Feb. 22.	..	..	..	..
Belfast Waterworks	Feb. 22.	..	..	..	..
Birmingham Canal	Feb. 20.	Mar. 15.	Apr. 12.	June 13.	..
Birmingham & Glos. Rlway.	Feb. 21.	Mar. 15.	Apr. 1.	..	..
Bp. Auckland & WeardaleRa.	Feb. 22.	Mar. 18.	Apr. 15.	..	..
Blackheath Cemetery	Feb. 22.	Mar. 18.	..	..	..
Bradford (York) Waterworks	Feb. 21.	..	..	..	..
Brighton Gas	Feb. 21.	Mar. 18.	..	May 31.	..
Brighton Cemetery	Feb. 21.	Mar. 18.	May 28.	..	..
Bristol & Gloucestershire Ra.	Feb. 21.	Mar. 7.	Mar. 19.	May 13.	..
British Museum Buildings	Feb. 22.	..	Apr. 12.	May 3.	..
Brompton New Road	Feb. 22.	Mar. 18.	Apr. 30.	..	..
Cheltenham Waterworks	Feb. 22.	Mar. 12.	Mar. 22.	..	..
Commercial (London and Blackwall) Railway	Feb. 14.	Mar. 8.	Mar. 21.	June 20.	..
Dean Forest Railway	Feb. 19.	..	..	..	..
Deptford Pier	Feb. 22.	Mar. 18.	May 28.	June 21.	..
Deptford Pier Junction Rlwy.	Feb. 22.	Mar. 20.	May 28.	..	..
Deptford Steam Ship Docks	Feb. 22.	..	..	..	..
Edinburgh, Leith, and Newhaven Railway	Feb. 19.	Mar. 11.	Mar. 27.	May 30.	..
Eyemouth Harbour	Feb. 12.	..	Apr. 8.	May 28.	..
Fraserburgh Harbour	Feb. 20.	..	Apr. 8.	Apr. 16.	..
General Cemetery	Feb. 20.	Mar. 11.	Mar. 21.	June 7.	..
Gravesend Gas	Feb. 21.	Mar. 18.	..	..	..
Great North of England Ra.	Feb. 18.	Mar. 13.	Mar. 25.	May 3.	June 14.
Great Western Railway	Feb. 14.	Mar. 4.	Mar. 13.	May 1.	June 4.
Great Central Irish Railway	Mar. 12.	..	..	..	..
Herefordshire and Gloucestershire Canal	Feb. 20.	Mar. 13.	..	..	June 4.
Herne Gas	Feb. 22.	..	..	..	..
Liverpool Docks	Feb. 21.	..	..	..	..
Liverpool Buildings	Feb. 21.	..	May 28.	..	..
Liverpool and Manchester Extension Railway	Feb. 14.	Feb. 28.	Mar. 12.	May 13.	June 14.
London and Birmingham Ra.	Feb. 8.	Feb. 22.	Mar. 6.	May 30.	June 14.
LondonBridgeApproaches,&c.	Feb. 19.	Apr. 11.	Apr. 26.	..	..
London & Croydon Railway	Feb. 19.	Mar. 18.	Apr. 8.	May 3.	June 4.
London Cemetery	Feb. 19.	Mar. 18.	..	..	..
London & Greenwich Rlway	Feb. 21.	Mar. 18.	Apr. 8.	May 3.	June 4.
London and Southampton (Guildford Branch) Rlwy.	Feb. 22.	..	..	..	..
London and Southampton (Portsmouth Branch) Ra.	Feb. 6.	Feb. 25.	Mar. 7.	May 3.	..
Manchester & BirminghamRa.	Feb. 18.	Mar. 18.	Apr. 23.	..	..
Manchester and Birmingham Extension(Stone&RugbyRa	Feb. 11.	May. 1.	May 14.	..	..
Manchester & Leeds Rlway.	Feb. 18.	Mar. 8.	Mar. 19.	May 30.	..
MaryleboneGas & CokeComp.	Feb. 22.	Mar. 18.	..	..	..
Monkland & Kirkintilloch Ra.	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	..
Necropolis (St.Panc.)Cemetry	Feb. 21.	Mar. 15.	..	..	..
Newark Gas	Feb. 14.	Feb. 28.	Mar. 11.	Apr. 18.	..
Newcastle-upon-Tyne & N. Shields (Extension) Rlwy.	Feb. 18.	Mar. 15.	..	..	..
Northern & Eastern (1) Rlwy.	Feb. 22.	Mar. 18.	Apr. 16.	June 4.	..
Northern & Eastern (2) Rlwy.	Feb. 22.	Mar. 27.	Apr. 16.	June 4.	..
North Midland Railway	Feb. 11.	Mar. 4.	Mar. 14.	May 1.	..
North Union Railway	Feb. 22.	..	..	..	..
NottinghamInclosure & Canal	Feb. 19.	Mar. 18.	..	..	..
Over Darwen Gas	Feb. 21.	..	Apr. 12.	June 3.	..
Perth Harbour & Navigation	Feb. 14.	..	..	May 2.	June 4.
Portishead Pier	Feb. 22.	..	..	..	..
Preston Gas	Feb. 6.	Feb. 20.	Mar. 6.	Mar. 19.	..
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	..
Preston and Wyre Railway, Harbour, and Dock	Feb. 21.	Mar. 18.	Apr. 12.	..	..
Redcar (No. 1) Harbour	Feb. 19.	—	—	—	—
Redcar (No. 2) Harbour	Feb. 22.	Mar. 27.	Mar. 30.	—	—
Rishworth Reservoirs	Feb. 21.	Mar. 6.	Mar. 26.	May 30.	..
Rochdale Waterworks	Feb. 7.	Feb. 21.	Mar. 6.	May 6.	..
Rochester Cemetery	Feb. 22.	Mar. 18.	..	..	..
Sawmill Ford Bridge & Road	Feb. 21.	Mar. 18.	..	June 10.	..
Slamannan Railway	Feb. 12.	Mar. 18.	Mar. 27.	May 28.	..
South Eastern Railway	Feb. 11.	..	Mar. 25.	May 15.	June 14.
S. Eastern (Deviation) Ra.	Feb. 22.	May 6.	May 30.	June 19.	..
Teignmouth Bridge	Feb. 21.	..	..	..	..
Tyne Dock	Feb. 22.	Mar. 15.	May 7.	June 13.	..
Tyne Steam Ferry	Feb. 21.	..	..	..	..
Walsall Junction Canal	Feb. 22.	..	..	..	..
West Durham Railway	Feb. 21.	Mar. 18.	Apr. 8.	May 14.	..
Westminster Improvement	Feb. 21.	..	..	..	..
Wishaw & Coltness Railway	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	..
Wyrley and Essington and Birmingham Canal	Feb. 18.	..	..	..	..

STEAM NAVIGATION.

THE BRITISH QUEEN STEAM-SHIP.

We fully expected that we should have been able to have given our own report on this vessel, but as she had not arrived in the river Thames at the time of our going to press, we are prevented doing so; however, we give a very full account of her which appeared in the *Paisley Advertiser*, at the commencement of last month. Her dimensions do not differ from what we before reported in our Journal last year:—

This splendid and powerful vessel was built, as our readers are aware, by Messrs. Curling and Young, London, for the British and American Steam Navigation Company. She was launched at Limehouse at the close of May, 1838, and arrived at Port Glasgow about the 7th of July in that year, to get in her engines, made by Mr. Robert Napier, engineer, Glasgow. By the politeness of Mr. Johnstone, resident engineer, we had an opportunity of giving this ocean queen a general overhaul on Monday last, and we shall now subjoin a few particulars regarding her. Her engineering and other fittings are in a very forward state. On the day named her heavy machinery was all on board, with the exception of the main shaft, which was expected down from Glasgow on Thursday. We gave a number of the dimensions of this vessel when she was launched, but it may not be uninteresting to repeat a few of them along with some other details.

	Feet.	Inches.
Length from figure-head to taffrail	275	0
Length of upper deck	245	0
Breadth within the paddle-boxes	40	6
Breadth over all	61	0
Depth of hold	27	0
Estimated weight of engines, boiler, and water	500	Tons.
Twenty days' consumption of coals	60	do.

She has two splendid engines aboard, of 250 horse power each, the frame work of which is in a massy Gothic style, while the working parts, for strength, beauty, and excellence of fitting, are admirable. Each engine stands on a single plate of metal, weighing 35 cwt.; four pieces of the framework weigh each 16 tons; the cylinders weigh each 12 tons; the diameter of the bore is $77\frac{1}{2}$ inches; diameter of the axle in the bushes is $16\frac{1}{2}$ inches, and the stroke of the engine is 7 feet. She has in all four boilers, any number of which can be used at one time without the others. The diameter of the paddle wheels is 31ft. 6in. The float boards, which are 9ft. 6in. long, are arranged in three distinct parts, presenting a resistance of three feet in breadth. According to her depth in the water, the revolutions of her paddle-wheels will vary from fifteen to sixteen in a minute. She is supplied with Hall's patent condensers, and thus the same water with which she fills her boilers in the Clyde will, with a little addition, serve until her arrival at New York. She has iron tanks between the timbers in the hold capable of holding 200 tons of water, all of which is accessible to the pumps, and can be thereby drawn out, and conveyed by pipes to the different berths. But over and above this she has a patent still with her, and can convert salt water into fresh for her boilers, and for the use of her passengers as may be required. The main saloon is about 50 feet long, and in the narrowest part between the side berths is nearly 20 feet in breadth; a flood of light is thrown into it from above, and the floor is covered with oil cloth, above which is laid rich soft carpeting of a beautiful description, while the sides are ornamented with historical paintings, executed on a peculiar kind of canvass, which gives them the appearance of needlework in worsted. The ladies' saloon is also fitted up with great taste, beauty and splendour, while the second cabin is scarcely inferior in accommodation, and but little in beauty to the first. The saloon furniture is furnished by Mr. Boyd, and the upholstery work by Mrs. Murray, both of Glasgow. Mr. Kerr, of Greenock, has the work of the second cabin; and all seem to be vying with each other in the production of excellent and beautiful workmanship. The berths are fitted up with every attention to convenience. The lamps are of a patent kind, which can either be used with oil or with wax candles, and move on an universal joint, which keeps the light erect, however much the vessel might pitch or roll. There are 104 beds fitted up aft, and 108 forward, with room for sixty or seventy more if required. The steward's room is fitted up with almost every conceivable convenience, and affords a passage for conveying the dinner from the gallery to the dining saloon without incommoding or being seen by the crew or passengers. The delf ware, which appears of a very excellent kind, has been made specially for the vessel, and is ornamented with a steam-ship, surrounded by the designation of the company. The silver plate is superb. She will carry thirty-two hands immediately connected with the superintendence and management of the engines, and her crew in whole, including officers, seamen, engineers, cooks, steward, &c., will amount to 85. In respect to stores and general fitting out she is admirably found, and everything is on the most improved construction. Her windlass, for example, is of Tyzick and Dobinson's patent; her stoppers of Moffatt's patent, and so on of many other patented articles. Her chain cables are of $1\frac{3}{8}$ iron, and are of the same kind as are used for 74-gun ships. Her small bower, best bower, and sheet anchor weigh respectively 32cwt. 2qrs. 18lb., 43cwt., and 47cwt. 1qr. 21lbs. No pains, no time, no expense, have been spared in obtaining perfection, and taking her all in all, we may safely say she is unequalled by any vessel afloat. Among other conveniancies for passengers we had almost forgotten one. On the deck there will be a neat erection, in which cold, warm, or shower baths may be obtained by the passengers. But the attention of the owners goes still farther than this. Even the smokers are not forgotten. Near the baths there will be (shiftable to leeward, we hope) a cigar-room, where smokers may congregate, and offer up clouds of incense to each other, till they become as smoke-dried as red herrings. The cabins of the captain, chief mate, and surgeon, are on the after part of the quarter deck, and the roof forms a shelter to the steersman. She is steered with a double wheel, similar to those used by the London East Indiamen, or line-of-battle-ships. The petty officers descend to their cabin immediately before the windlass, and the seamen get down to their berths choke below the forecastle. The rigging of the vessel is low and and snug rather than taunt; but her yards are pretty square, and, as she has studding-sail booms fitted on them she will be able, when necessary, to display a good breadth of canvass to the breeze. She will have about 300 passengers on her first trip, berths for whom are already secured. The berths on her return passage from New York were all taken up two months ago. When starting from London she will have about 1000 tons of goods. She is coppered up to 17 feet, and is expected, when loaded, to draw 18 feet aft, and 17½ feet forward. Notwithstanding the great capacity of this magnificent vessel, she does not look so large as many would expect. Probably the beauty of her mould tends to detract a little from her apparent bulk. When down to the depth aforementioned, we do not think she will much exceed in appearance a first-class frigate. Start when she will, and go where she may, she will, we think, carry with her abundant proof of that high state of perfection in the construction of nautical steam machinery to which the Clyde engineers have arrived.

Iron Ship.—The largest iron sailing ship in the world is now building in Messrs. J. Ronald and Co.'s yard, Footdee, Aberdeen. This stupendous vessel is of the following dimensions:—Length of keel, 130 feet; breadth of frame, 30 feet; depth of hold, 20 feet; length over all, 137 feet; tons register, 537. Judging from her appearance, she is a beautiful model, and will carry an immense cargo on a small draught of water. She is intended for a company in Liverpool.—*Aberdeen Herald.*

PROGRESS OF RAILWAYS.

OPENING OF THE EASTERN COUNTIES RAILWAY.

This railway was opened on Tuesday, the 18th ultimo. A large concourse of persons assembled at the temporary station, Devonshire-street. Mile-end, to witness the departure of the first train on this line of railroad. The line commences at Shoreditch, on a viaduct about twenty-one feet above the level of the ground, up to which extensive and commodious carrriage approaches will be made. At the commencement of the viaduct it is proposed to erect the London station, which will be of commensurate extent with the existing traffic. In it are several bridges, the arches of which are faced with stone, which gives them a handsome and imposing character, especially the bridge over Devonshire-street, the arch of which rises less, for the span, than we have observed on any other line of railway, the rise being less than one-tenth of the span. The whole of the arching has been effectually protected from the effects of damp by a thick coating of asphaltum. The line then passes over the Regent's Canal by an iron bridge, the general appearance of which has been much admired; two main ribs of iron of fifty-four feet span, partly on the bow suspension principle, are thrown over the canal, to which transverse girders are fixed, supporting the roadway, on which are laid longitudinal sleepers of timber receiving the rails, an ornamental railing gives a finish to the whole. Passing successively over the river Lea, Grove Road, Coborn Road, Fairfield Place, and Old Ford Lane Bridges, besides numerous other smaller archways, the railway passes over the Stratford marshes within a few feet of one of the extensive reservoirs of the East London Waterworks, crossing the river Lea by an arch of 70 ft. span, rising one-fourth only; the arch is turned in 10 half brick rings; the appearance of this bridge (as we expressed in our review of Creasy's work on bridges in which drawings of it appear), is at once light and elegant, although sufficiently massive to prevent any idea of weakness. The embankment beyond the river Lea is 25 feet in height, in the formation of which considerable difficulty occurred owing to the very unstable nature of the ground on which it was raised, it being, in fact, a mass of spongy vegetable matter to a very considerable depth. Much assistance was derived in the execution of this part of the work by the formation of a staging on rough piles in advance of the embankment, and on which the wagons were run and tipped with great rapidity; of course by this means the earth was deposited over the subsoil to any required height, and the tendency of the ground "to spew up" prevented On this part of the line there are numerous bridges over the various streams and rivers which the railway intersects, some of which are of considerable magnitude, such as the Stratford viaduct of five arches, each thirty-six feet span, Kent's Mill Bridge, of four arches, and the Abbey River Bridge, all of which are over tidal currents, besides numerous other small archways. The Stratford station is erected after the style of a plain Italian villa, fitted up with waiting-rooms, carriage-shedding, engine-house, and repairing workshops for the engines. The depth of the cutting which immediately follows this station varies from ten to twenty feet. The Ilford station, which is only now being erected, is obviously incomplete. The tunnel or bridge at the crossing of the great Essex road evinces great judgment, it is 130 feet long, with iron girders resting on the abutment walls, from flanges on their lower parts small arches in cement are turned, carrying the turnpike road above; a little beyond this are some well executed culverts formed with iron pipes 3 feet diameter. The portion of the railway now open to the public terminates at Barrack Lane, immediately adjacent to the town of Romford; the total distance is about ten miles and a-half, which the trains will accomplish in less than half an hour. The whole of the gradients are favourable. It may not be generally known that this line is laid down to a 5 feet guage, which without greatly increasing the weight of the engines, gives them great mechanical advantages which they have not failed to turn to account.

The engineer to the line is Mr. Braithwaite, to whom much praise is due for the generally efficient manner in which the works and engineering difficulties (not a few) have been executed.

The Dundee and Abroath Railway.—This railway is about fourteen miles in length, with a capital of £100,000. The greater part of the line is carried along the sea shore, through property presented by Lord Panmure to the company. This railway is remarkable for the limited works required in its construction, and they of scarcely any magnitude except at the end next Dundee, where there is a cutting about half a mile in length through different strata, composed of gravel, sand, and rock. The greatest difficulty in this place is the disintegration of the rock, or rather its slipping down upon the line, in consequence of the obliquity of its bed. Numerous instances of this sort have occurred. The greatest depth of cutting is about twenty feet. The materials prodvced by this excavation are made use of to form an embankment across the sea next the Dundee terminus. This embankment is about three-quarters of a mile long, having a slope of 1 to 1 next the sea, and 2 to 1 next the shore. The sea side is protected by a wall of rubble masonry, laid dry, carried up with a straight batter, and having a parapet upon the top. There will be altogether a quantity of about 800,000 cubic yards in this embankment, but much more is requisite to secure it against the turbulence of the sea, and to protect the weakest parts from being washed away. During its construction considerable difficulty has been experienced from the influence which the sea has had over the retaining wall, not simultaneously furnished with the embankment, but when these have been carried up together no damage has occurred. The terminus next Dundee is carried along the north quay of the new dock, from whence it is the intention to lay rails round the other side of the quays. The other terminus is near the harbour of Abroath and light station. The rails weigh 48lbs. to the yard parallel, and are secured to cast iron chairs by a small wooden wedge. The chairs rest upon stone blocks, four cubic feet each in the cutting, but upon the embankment timber sleepers are employed. The greatest inclination is 1 in 1,000. The rails are 5 feet six inches apart, with a space of six feet between the two lines. The locomotives weigh ten tons each, having 13-inch cylinders, 16-inch stroke, and upon six wheels, the driving wheels being six feet diameter. The cylinders are placed outside the fire-box, and the boilers are furnished with 105 brass tubes. The carriages are divided into 1st and 2d class, and are of peculiar construction. The former are enclosed and in the centre, the others are open and are placed on each side, and hold together thirty-four passengers.

London and Croydon Railway.—On Saturday, the 1st ultimo, this line was opened by the directors, together with deputations from the London and Brighton and the Greenwich Railway Companies. At a little after one o'clock the trains, two in number, started. The journey down was accomplished in twenty minutes. The station at New Cross is fitted up with every convenience for passengers, &c.; at the back there is a most spacious engine-house, of an octagonal shape, and is calculated to hold, exclusive of tenders, sixteen engines. The building is very lofty, and supported by massive stone pillars. The light is reflected not only from the side, but from a cupola also, the advantages of which must be apparent to all who understand the nature of these works. After leaving this station there is an incline nearly two miles in extent, the gradients of which are about 1 in 100 feet. Of the bridges (which are peculiarly constructed), and of the cuttings also, we can but speak generally, and we must add, favourably.

Brandling Junction Railway.—An experimental trip was performed on the Brandling Junction Railway on Thursday, May 30, with three beautiful locomotive engines and waggons attached, which ran with a number of passengers from the Monk Wearmouth station to Boldon, where they took in water and then returned. The experiment was in all respects most satisfactory; the railway stood the test to admiration, and the engines performed their work as steadily and smoothly as if they had been used to it. The grand opening of this promising and useful undertaking will take place on the 18th, being the anniversary of the glorious battle of Waterloo.—*Newcastle Journal.*

Birmingham and Derby Junction Railway.—On Wednesday, the 29th May, the directors of the above railway inspected the line between Derby and the junction with the London and Birmingham Railway at Hampton-in-Arden, a distance of about thirty-eight miles. The proceeded from the bridge over the river Dove, a distance of seventeen miles, towards Tamworth, with a train of passenger carriages, drawn by an engine built by Messrs. Charles Tayleure and Co., of Warrington. The line is generally and on many portions remarkably straight. The gradients are so extremely favourable that it may almost be said to be a level, and the motion, we are assured by a gentleman who accompanied the directors, was easy and smooth to a degree which they had seldom experienced on any other railway. By the simplicity of construction and stability of the bridge over the Tame and Trent, at their junction near Alrewas, over which the train passed at speed, the directors were strongly impressed. It is near this point that the intended junction with the branch of the Manchester and Birmingham Extension Line is to be effected, by which the traffic from Lancashire to Derby, Nottingham, and the eastern parts of the kingdom, will eventually be brought along the line of this railway. Though some portions of the line were not in so complete a state as to render the further passage of the train adviasble, the greater portion of the permanent way was laid, and in a few weeks the engines will be able to pass along the whole distance. Considerable progress is making in the station accommodations for the company's traffic at Derby and Burton-upon-Trent; the building of the station at the junction with the London and Birmingham line at Hampton-in-Arden will soon be completed, and no doubt exists that the line may be opened to the public, for the whole distance from Derby to the junction with the London and Birmingham Railway, in the course of the ensuing month.—*Midland Counties Herald.*

Grand Junction Railway. The rates for the carriage of merchandise on this railway were reduced on the 1st inst. The principal reductions are on goods which were formerly charged 1*s.* 6*d.* and 1*s.* 3*d.* per cwt.; the former charge having been reduced to 1*s.* 3*d.* and the latter to 1*s.* 1½*d.* per cwt. The company are now carrying throughout between Liverpool, Manchester, and London.

Manchester and Leeds Railway.—An experimental trip on this line of railway was made on Friday, 31st May, by the directors and a party of their friends, consisting altogether of about sixty gentlemen, who proceeded in a train from the station in Manchester to the entrance of the summit tunnel, about three quarters of a mile beyond Littleborough, a distance of sixteen miles from Manchester. The directors promised, in one of their earlier reports, that this portion of the line would be completed in May, 1839; and, notwithstanding many unexpected difficulties in the progress of the works, they were enabled in some measure to redeem their pledge by the above trip, made on the last day of the month, although the extent of line travelled over will not be ready for the conveyance of passengers before the beginning of July. The rails on the line are about 60 lbs. to the yard. They are laid to such a width, that, in the event of the extension lines uniting, the Leeds and Liverpool and Manchester Railways, at the Hunt's Bank Station, the same engines, carriages, or waggons may proceed forward; there will be a space of six feet between the double line of rails. There are to be three classes of carriages, which will be distinguished by numbers instead of names. Both the first and second class carriages have a wooden stage along each side the whole length of the carriage, which, besides conducing to the convenience of ladies and infirm passengers, will facilitate the collecting of tickets, and is likely also to act as an additional security against accidents arising from persons coming in contact with the steps of a starting train. It is calculated that the expence of travelling in the third class carriages, which are open and unprovided with seats, will not exceed one penny per mile. There are several heavy works on the line between Manchester and Littleborough, amongst which we may mention those at Mills Hill, as an example of the difficulties which had to be overcome in the construction of this portion of the line. At this point the railway is carried upon its loftiest embankment, and across the river Irk, by a double culvert, at a height (the rails above the surface of the water) of 65 feet. Though the length of this embankment is probably not more than a quarter of a mile, it is about the highest railway embankment in England, being an average of 40 feet, with a *maximum* height of 74 feet; yet so carefully has it been made, that we are assured it has not sunk five inches since it was completed. It consists of 319,202 cubic yards of earth, of which not less than 40,000 cubic yards were shifted in one mouth. We believe it exhibits an example of the moving in a given time, just double the quantity of earth in cubic yards, which, in parliamentary evidence, had before been deemed barely possible. Shortly after one o'clock the train reached the entrance of the summit tunnel, the present extent of the line, where the company had an opportunity of examining the stupendous works which are here being carried on, and with which they expressed themselves highly gratified. After remaining nearly two hours, the party returned to Manchester, where they arrived soon after five o'clock, much pleased with the day's excursion.—*Abridged from the Manchester Guardian.*

The York and North Midland Railway.—On Wednesday, the 29th ultimo, a portion of this important national and commercial undertaking was opened, from the terminus at this city to the junction with the Leeds and Selby Railway, near South Milford, which forms an uninterrupted railway communication between York and Leeds, and York and Selby, and the several intermediate places. The whole line is intended to be completed by the time the North Midland, the Leeds and Manchester, and the Great North of England Railways (of which it will form the connecting link) can be opened. The Fairburn and Altofts contracts, which comprise the heaviest works on the whole line, are let to be completed in the spring of 1840; and the directors state, "there is no doubt, from the well-known talents and experience of the contractors (Messrs Craven and Sons, and Mr. Stephenson), that they will carry on the works with all possible energy and skill, and complete their respective undertakings in the time stipulated by the contracts." Many of our readers will be aware that a tunnel has been formed into the city through the walls and ramparts. It appears that the directors of the York and North Midland Railway first determined to have their station for passengers outside the walls. It appearing, however, to them, as well as to the directors of the Great North of England Railway, very desirable that the two companies should have a *joint* passengers' station, which was considered to be impracticable, except within the walls, a negotiation was entered into between the parties, and satisfactorily concluded. The station will be in the garden lately occupied by Messrs. T. and J. Backhouse. By means of this railway, and the others now in progress, a direct communication will be opened next ye r from Newcastle to London; and from a highly influential meeting lately held in the former town, it is probable that very speedily the line will be carried through to Edinburgh--thus forming a complete chain of railway communication from the metropolis of England to the metropolis of Scotland. On Monday, the rails being laid throughout to the junction with the Leeds and Selby Railway, an experimental trip was taken on the afternoon of that day, when the "York and Leeds" steamer took down a train of carriages in fine style. The Lord Mayor, Sir John Simpson, Alderman Meek, and several other of the directors, were of the arty in the first-class carriages; a second and two third-class carriages were filled with respectable persons who happened to be on the line when the train started. The opening took place yesterday, for which the preparations were on the most liberal scale. A large party of ladies and gentlemen were invited to breakfast in the Guildhall, at eleven o'clock, and at half-past twelve a procession was formed to the station, preceded by a band of music. The train started at one o'clock, and proceeded to the junction, and on its return, the procession re-formed, and walked, attended by the music, to the Guildhall. At four o'clock a grand dinner was served up at the Guildhall. The city presented an animated appearance throughout the whole day, a great number of visitors from the country having arrived to witness this interesting scene. Not the slightest accident occurred on the trip.—*York Courant.*

Opening of the Aylesbury Railway.—On Monday, June 10, the town of Aylesbury was a scene of bustle and vivacity scarcely to be credited. Before six o'clock in the morning musicians accompanied by persons bearing flags, on which suitable devices were inscribed, paraded the streets, after which they proceeded in procession with the directors and their friends to the station. A little after seven o'clock a train started for the terminus at the junction between Aylesbury and the London and Birmingham line. The company having expressed themselves highly pleased with the arrangements made by the directors for the convenience of passengers, &c., returned to Aylesbury. Experimental trips were made during the entire day, and persons residing in the town and its immediate neighbourhood were conveyed gratuitously up and down the line. The railroad itself is about seven miles and a-half in length, and with the exception of the curves at either terminus it is perfectly straight. At half-past four o'clock the deputation from the London and Birmingham Railway Company arrived, and proceeded down the line in company with the Aylesbury directors. The usual formal business having been gone through, the company adjourned to dinner at the White Hart Inn.

London and Southampton Railway.—A distance of twenty miles additional of this railway was on Monday, the 12th ultimo, opened to the public, viz. twelve miles from Southampton to Winchester at the one end, and eight miles from the Winchfield and Hartley-row station to Basingstoke at the other. A party of the directors and their friends left the terminus at Nine Elms, Vauxhall, at half past eleven, and arrived at the Winchfield station at about five minutes to one, where a great crowd of the country people awaited their coming, and greeted them with several rounds of hearty cheers. After a short delay the train proceeded over the new ground to Basingstoke, while upon every height, and at every place where a view could be obtained, groups of anxious and admiring spectators were stationed to watch and applaud the progress of the engine and its bulky train upon its maiden excursion. The distance was completed in about twenty minutes. The station at Basingstoke is very prettily situated upon a long line of embankment, and commands on the left a fine view of that ancient town, with its venerable gothic church peering up in modest grandeur from amid surrounding houses; and, on the right, of the picturesque ruins of the Holy Ghost Chapel, built in the reign of Henry VIII. The town itself presented the appearance of a holiday. The party, including many ladies, spent an hour very agreeably in looking about them. At about half-past two the train started on its return to Winchfield, accomplishing the distance without the slightest accident or annoyance to mar the pleasures of the day. An elegant *dejeuner a la fourchette* was provided at a cottage in the immediate vicinity of the station, to which about sixty ladies and gentlemen sat down. At seven o'clock the party broke up, and the train finally reached Vauxhall at ten minutes past eight. The railway, as we have already mentioned, was also opened from Southampton to Winchester at the same time, leaving only eighteen miles, viz., the distance from Winchester to Basingstoke, to complete the whole undertaking. These remaining eighteen miles are performed by coaches in about two hours, so that passengers from London to Southampton can complete the whole journey within five hours.—*Times.*

Gosport Junction Railway.—Already the surveyors of the Gosport Junction Railroad, have commenced marking off the ground required for the undertaking, from Bishop's Stoke to the terminus at Spring Gardens, near Gosport, preparatory to giving notice for tenders to be sent in by the 1st July, for the performance of the works which will be required; thus evidencing, that the company as they have promised, intend in right earnest to commence and finish the above line in less than two years.—*Hampshire Telegraph.*

Great Western Railway.—The company are making rapid advances in the purchase of land in the neighbourhood of Chippenham, and will shortly have completed their line in that direction. The whole of the purchases in this vicinity are likely to be completed without the intervention of juries, the company offering an ample compensation for injuries by severance, &c.—*Bath Chronicle.* It is now arranged that the opening of the line as far as Twyford shall take place in the first week in July, near which place a temporary station-house is in progress; the number of passengers is on the increase at present, both to and from the metropolis.—*Bristol Mirror.*

Glasgow, Paisley, Kilmarnock, and Ayr Railway.—The directors have determined to open the southern end of this line, from Ayr to Irvine, in the month of July next, the permanent way being already laid for the greater part of the distance, and the progress of the work on the remaining portion being such as to ensure its completion within little more than a month from the present time. Messrs. Stark and Fulton, of Glasgow have two locomotive engines ready to deliver on the rails in the course of June, and two more are in progress of completion by Mr. Edward Bury, of Liverpool. We understand the first-class passenger carriages for the present traffic are furnished from an experienced maker at Lancaster, and may be shortly expected at Troon, and for the future supply a pattern carriage has been furnished by a first-rate London maker, and now stands at Messrs. Buchanan and Sons' coach-work in Union Street, to which all persons who intend to compete for the work will be required to adhere. The progress of the works on the different contracts along the whole line is highly satisfactory, and no doubt is entertained of the railway being in full operation by Midsummer, 1840. The circumstances of this great undertaking being completed in so short a time from the commencement of the works last summer, and being finished for the estimated capital, is highly creditable to the engineer; for we believe there is not an example of the kind in any railway hitherto made. The Tradeston contract, being the last portion of the whole, which terminates the line at the Broomielaw, at Glasgow, has been also let, and from the nature of the work to be done, there is no doubt of its being finished during the present summer' We understand Mr. Lyon (who has built the large stone bridge over the river Cart, at Paisley, in such a creditable manner) is the successful competitor for this lot. We believe the directors have it in contemplation to commemorate the opening by a grand entertainment to be given at Ayr, to which all the beauty and fashion of the West of Scotland will be invited. The beauty of the scenery in that part of Ayrshire, and the present appearances of a favourable season will, we trust, contribute, with the excellent arrangements of the authorities connected with the railway, to make this ceremonial a truly magnificent example of national taste and enterprise. "Well begun," it has been well said, "is half ended," and this has been verified in the present instance; for, from the first commencement, when the foundation stones of the two magnificent bridges over the Garnock and Irvine rivers were laid with masonic honours, on the Queen's coronation day last summer, up to the present moment, not a single circumstance of any importance has occurred to delay the works; and the shareholders may soon enjoy the agreeable sight which their patriotic exertions have so speedily combined to produce, in the completion of this great undertaking.—*Glasgow Courier.*

London and Brighton Railway.—The differences between the London and Brighton Railway Company and the owner of some property at Southwick, which had caused a temporary suspension of the works on the Shoreham branch of the railway have been settled satisfactorily; and on Monday, the 3d ultimo, the Brighton locomotive engine recommenced its labours in removing the excavated earth from the cutting westward of the tunnel under Lashmar's mill. Steady progress is made in the last-mentioned work, which, judging from the quantity of chalk brought up the shaft, and deposited on the ground above the tunnel, must be approaching to completion. The cuttings on each side of the New England Road are proceeding with rapidity, the greatest number of hands being employed that the space will admit. A bridge to connect the upper and lower portions of the road leading from Wick to the Old Shoreham road has been commenced; and a similar bridge to carry the New England Road over the railway is in course of construction. Lower down the hill, towards the Dairy, the foundations of the viaduct are already completed, as are also those of the concrete walls, which will terminate the embankments abutting on the viaduct.—*Brighton Gazette.*

North Midland Railway.—We understand that the Swinton contract on the North Midland Railway is nearly completed, and that a bridge has been constructed over the river Dearne navigation near Rotherham, which is considered a superior structure of architecture, as far as elegant workmanship and substantiality of building are concerned, and reflects the greatest credit upon Messrs. John Wilks and Co., the contractors. The whole of the line is in a state of forwardness, and will be completed by the end of October.—*Yorkshire Gazette.*

Bolton and Preston Railway.—We understand that five or six miles of hi line of railway are nearly completed at the Bolton end, and that a vast number of men are thereon employed, hands being unusually plentiful. In about three weeks the remaining portion to the meeting with the North Junction will be let. Surveyors and others have been passing over and measuring the line daily for several weeks past, particularly near Chorley, where there will be seen some cutting and tunnelling.—*Preston Observer.*

Preston and Longridge Railway.---The workmen engaged on this line of railway are progressing actively with the work at the east end. They are cutting within about forty yards of the stone quarries of Tootle Height, and preparations are making for laying the line with gravel previously to placing the rails. As the weather continues so very favourable, the line will, in all probability, be opened towards the end of this summer. The viaduct near the commencement, and the bridge at the Alst n Four-lane-ends, exhibit superior style of design and beauty, combined with strength and firmness, which proves to what perfection this kind of work is now brought.---*Preston Observer.*

Manchester and Birmingham Railway.---Congleton Viaduct.---A few days since, Mr. Buck, the head engineer to the Manchester and Birmingham Railway Company, was engaged for some time in superintending the progress of the works at Congleton, and in directing the preparatory arrangement for the foundation of the piers of the great viaduct, &c. From what passed at the meeting in Manchester last week, it appears, that the height of this glorious structure is to be redneed twenty feet, which, with the addition of thirteen feet to the viaduct at Stockport, will so far alter the line as to effect a saving to the company of about 80,000*l.*---*Staffordshire Gazette.*

Newcastle and North Shields Railway.---The Directors and a number of their friends, on Wednesday, May 22, made an experimental trip on a portion of the permanent line, with one of the splendid new engines, furnished from the manufactory of Messrs. Hawthorn of this town, called the *Hotspur*. The rails, which are laid on continuous bearings, were found perfectly substantial and satisfactory, and it was observed that the motion of the carriages on the line was exceedingly smooth and agreeable. We have before stated that the 18th of June is fixed for the general opening; by which time several railway carriages from the manufactory of Mr. Atkinson, coach-builder, will be brought into requisition in the conveyance of passengers, to whose safety and comfort every attention will be paid by the servants of the Company. We have not space this week for more than a mere statement of the dimensions of this wonderful structure. The large arches are each 116 feet span, and they consist of three ribs, each formed of deals springing from stone abutments, with timber framing above. The stone arches are 45 feet span each. The number of arches is nine, five of wood and four of stone. The total length is 920 feet, and the height up to the railway is 108 feet. The whole, as finished, has a light and exceedingly beautiful appearance.---*Newcastle Journal, May 25.*

Versailles Railway.—The first trial of the whole extent of railway by St. Cloud to Versailles was made on Thursday week. A locomotive engine ran the whole distance from the station in Paris to the Rue St. Symphorien, at Versailles. At all the points near Ville-d'Avray, Sevres, Chaville, Viroflay, and Montreuil, the inhabitants came out in crowds to witness the spectacle.

Railways in France.—A trifling improvement took place in the French funds on Monday, but a vast fall took place in the shares of the company for constructing a railroad between Paris and Versailles by the left bank of the Seine, under the impression that the loan to that company proposed by government would be refused by the Chambers. It was considered all but certain that the Chamber of Deputies would reject the proposed bill of Ministers to authorise a loan of 5,000,000f. to the company which had undertaken to construct a railroad from Paris to Versailles by the left bank of the Seine, an impression which on Tuesday produced another and serious fall in the shares of that company.

CHURCHES, PUBLIC BUILDINGS, &c.

Trentham Hall.—The stonemasons who have been so long employed in the improvements now making at the mansion of the Duke of Sutherland, under the directions of Mr. Barry, the architect for the new House of Commons, struck a fortnight ago for an advance of wages, although receiving twenty-four shillings a-week, and this, after having been kept on during the whole of the winter months at that rate of wages, the liberality of the noble duke not permitting the customary reductions to be made for short days at that season of the year. The whole of the masonry is consequently at a stand, and no new hands are permitted by the trades' union to be taken on, unless at the new rate which the society has fixed, viz., 26s. a-week. Most of the workmen, it is stated, are willing to work at the old rate of 24s. a-week, but dare not.—*Shrewsbury Chronicle.*

New Scotch Church at Liverpool.—The f undation stone of a new church and school, in connection with the Church of Scotland, was laid at Woodside, on the opposite side of the Mersey to Liverpool, on Friday, May 31, by the Rev. Dr. Cooke, of Belfast.

St. Mary's, Islington.—The third of the new churches erected in this parish, by the voluntary contributions of the inhabitants, liberally aided by the Metropolis Churches Fund, was consecrated on Tuesday, 18th ultimo, by the Lord Bishop of London, in the presence of the Lord Mayor, a numerous assemblage of the neighbouring clergy, and a crowded congregation of the parishioners. The church is situated in the New North Road; the principal front, facing the east, is a pure and elegant specimen of Gothic architecture; the arches of the windows and other details of the body of the church resemble those of Merton College, Oxford, a classic example of the 14th century, of the time of Henry IV.; upon it has been introduced a spire rising 100 feet from the pavement, upon the model of St. Mary's Church, Oxford, of the same century. The whole exhibits considerable taste and elegance, and reflects great credit upon the architects, Messrs. Inwood and Clifton. The church is capable of accommodating 1,100 persons, and the cost of the building will not exceed 3,500*l.*—*Times.*

Wetherby New Church.--The first stone of a new church, to be built at Wetherby, in the West Riding of the county of York, was laid on the 1st of April last by Quintin Rhodes, Esq., in the presence of a large assemblage. The church will be built in the Lancet style, and entirely of stone, and is intended to accommodate seven hundred and thirty persons, a large portion of the seats being free. The pew framing, pulpits, &c., is chiefly of wainscot. The body of the church is 75 feet by 44 within, besides which there is a chancel 25 feet by 12 deep. There is an ornamental porch at the south side, and a tower at the west end eleven feet and a-half square within and seventy-five feet high, exclusive of the pinnacles, which a e fifteen feet more. The east window consists of five narrow lights, with cylinders, &c., and occupies the entire width of the chancel. There is a west gallery only. The vestries are placed at the east end, on each side the chancel. Over the south porch is : n ornamental marygold window. The cost of the church was estimated at £2,500, but the contracts are considerably within that sum. The works are proceeding rapidly, and it is expected to be ready for consecration in the ensuing spring. The whole of the building is vaulted underneath for interments. The expense will be defrayed chiefly by voluntary subscriptions, with some assistance from the Church Building Society. It is designed by and is building under the superintendence of Messrs. J. B. and William Atkinson, architects, York.

Cathedral of Chartres.---The immense framework of iron, which replaces that of wood, for the roof of the Cathedral, is completely finished and raised, and nothing remains to be done but to put on the copper sheathing. Workmen are employed in restoring all the internal parts of the Cathedral that have suffered injury; and some finely sculptured woodwork is to be placed before the statue of the *Vierge Noire.* This figure is held in profound veneration throughout that part of the country.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH MAY TO 27TH JUNE, 1839.

ALEXANDER GORDON, of Fludyer-street, Westminster, engineer, for "an Improved Machine or Apparatus for employing Steam, or other elastic fluid, as a motive power."—Sealed May 30; 6 months allowed to specify.

WILLIAM ARMSTRONG, of Hawes, near Ampthill, Bedford, farmer for "Improvements in Harrows."—May 30; 6 months.

WILLIAM PALMER, of Sutton-street, Clerkenwell, manufacturer, for "Improvements in Lamps and in the Manufacture of Candles."—June 1; 6 months.

STEPHEN GEARY, of Hamilton-place, King's-cross, architect, for "certain Improvements in Paving or covering of Streets, Roads, and other ways."—June 1; 6 months.

JOSEPHINE JULIE BESNIER DE BLIGNEY, of the Commercial Hotel, Leicester-street, for "Improvements in Umbrellas and Parasols."—June 3; 6 months.

John Bradford Furnival, of Street Ashton Warwick, farmer, for "Improvements in Apparatus or Material to prevent persons sinking when in water."—June 4; 6 months.

Moses Poole, of Lincoln's-inn, Gent. for "Improvements in the Manufacture of Soap by the application of materials not hitherto used for that purpose."—June 4; 6 months.

William Bates, of Leicester, manufacturer, for "Improvements in the process of finishing Hosiery and other looped fabrics.—June 4; 6 months.

Christopher Wickles, of Guildford-street, Gent. and John Danforth Greenwood, of the Belvidere-road, manufacturer, both in Lambeth, for "Improvements in producing plain and ornamental articles and surfaces from Cements or Earths, separately or combined with other materials."—Jnne 4; 6 months.

Joshua Proctor Westhead, of Manchester, for an "Improvement or Improvements in the manufacture or construction of Stays or Corsets.—June 4; 6 months.

William Prior, of Rhoyd-street, in the borough of Lambeth, Gent. for certain "Improvements in the Carriages and Axle-trees of Wheel-carriages.—June 6; 6 months.

Arthur Parsey, of the Quadrant, Regent-street, artist, for "Improvements in obtaining Motive Power."—June 6; 6 months.

Harrison Grey Dyar, of Regent-street, Gent. and John Chisholm, of Pomeroy-street, Old Kent-road, manufacturing chemist, for "Improvements in obtaing sulphur from pyrites, or certain native sulphurets.—June 6; 6 months.

Baron Henry de Bonde, of Great Portland-street, Cavendish-square, for "Improvements in the means of rendering Magnetic Needles less prejudicially influenced by Local Attraction, which improvements are applicable to other magnetic objects for the same purpose."—June 8; 6 months.

Francois Bouillion, of Princes-street, Hanover-square, for "Improvements in the Manufacture of ornamental woven Fabrics."—June 8; 6 months.

Goldsworthy Gurney, of Bude, in the county of Cornwall, Esq. and Frederick Rixton, of Cockspur-street, Pall Mall, for "Improvements in the Apparatus for producing and distributing Light."—June 8; 6 months.

Charles Andrew Caldwell, of Audley-square, Esq. for "Improvements in Furnaces and Apparatus for appplying heat of fuel.—June 8; 6 months.

Moses Poole, of Lincoln's-inn, Gent. for "Improvements in Printing Calicoes and other Fabrics."—June 11; 6 months.

Charles Chubb, of St. Paul's Churchyard, London, and Jeremiah Chubb, of Red Lion-street, Clerkenwell, mechanist, for "Improvements in Apparatus and Machinery for preserving Books, and other Papers, Documents, and articles from Fire."—June 11; 6 months.

William Hawes, of Old Barge House, Christ Church, soap manufacturer, for "Improvements in the Manufacture of Soap, part of which Improvements are applicable to preparing Tallow for the Mauufacture of Candles."—June 12; six months.

William Graunsell, of South Lincoln, machine-maker, for "Improvements in Apparatus for Drilling Corn, Grain, Pulse, and Manure."—June 12; 6 months.

Nicholas Harvey, of Hayle, Cornwall, and William West, of St. Blazey in the same county, mechanist, for an "Improved Valve for Machines for Raising Water and other Liquids."—June 12; 2 months.

William Watson, of Temple-street, Dublin, Gent., for an "Improvement in the construction of Ships, and which improvement is also applicable to all kinds sf sea-going vessels, and also certain improvements in the construction of boats and other vessels intended to be used on canals and inland navigation."—June 12; 6 months.

William Newton, of Chancery-lane, Civil Engineer, for an "Improved Medicinal Compound or Ferruginous preparation, to give tone and vigor to the human system, particularly applicable in cases of weak digestion, and in the diseases called 'chlorosis.'"—June 12; 6 months.

Joseph Sanders, of Burton-on-Trent, in the county of Stafford, Gent., for an "Improved Lock and Key."—June 12; 2 months.

Edward Loos, of Air-street, Piccadilly, Chymist, for "Improvements in Extracting the Saccharine Matters from Sugar-canes and other substances of a saccharine nature, which improvements are also applicable in extracting colouring matters from wood and other matters used in dyeing."—17 June; 6 months.

Alexander Francis Campbell, of Great Plumstead, Norfolk, Esq. and Charles White, of Norwich, Mechanic, for "Improvements in Ploughs, Harrows, Scarifiers, Cultivators, and Horse-hoes."—17th June; 6 months.

Richard Beard, of Egremont-place, New Road, Gent., for "Improvements in Printing Calicoes and other fabrics."—June 17th; 6 months.

Bryan T'Anson Bromwich, of Clifton-on-Tone, Worcester, Gent., for "Improvements in Machinery, to be worked by the application of the expansive force of air or other elastic fluids to obtain motive power,"—17 June; 6 months.

Heurik Zander, of North-street, Sloan-street, Gent., for "Improvements in Steam-engines, Steam-boilers, and Condensers."—June 17; 6 months,

Henry Le Messurier, of St. Peter Port, Guernsey, Master Plumber, for "Improvements in Pumps."—June 17; 6 months,

John Lee Benham, of Wigmore-street, Ironmonger, for "an Instrument or Apparatus for correctly ascertaining the number of passengers conveyed in omnibuses and other public carriages."—June 18; six months.

John Wright, of Park-place, Glasgow, for "Improvements in mixing or alloying iron with other metals, for the purpose of increasing its strength, tenacity, or cohesion, which alloys among many other uses are particularly applicable to the construction or manufacture of links for chains and rings, and certain machinery, for effecting such manufacture."—June 18; 6 months.

Ambrose Bowden Johns, of Plymouth, Artist, for "Improvements in Colouring or Painting Walls and other surfaces, and preparing materials used for that purpose."—June 19; 6 months.

Peter Lomax, of Bolton-le-Moors, Weaver. for "Certain Improvements in Looms, for Weaving"—June 19; 6 months.

John Wertheimer, of West-street, Finsbury Circus, for "Certain Improvements in Preserving Animal and Vegetable Substances and Liquids."—June, 20; 6 months.

Charles Wye Williams, of Liverpool, Gent., for "Certain Improvements in Boilers and Furnaces designed to economise Fuel and Heat."—June 22; 6 months.

Henry Wilkinson, of Pall Mall, Gun Maker, for an "Improvement in Fire Arms."—June 22; 6 months.

Joseph Pons, of Union Cresent, New Kent Road, Gent., for an "Improved process of Hardening Wood and Iron, and rendering Wood Repulsive of Vermin, and proof against Dry Rot."—June 22; 6 months.

Matthew Punshon, of Norfolk-street, Blackwall, Engineer, for an "Improved Steam-engine, certain parts of which improved steam-engine are applicable to steam-engines on the ordinary construction."—June 22; 6 months.

George Calder, of Fen-court, Fenchurch-street, for "Certain Improvements in Stoves or Apparatus for Roasting, Baking, or Cooking, which he intends to denominate a Plantanum Roaster."—June 22; 6 months.

Frederick Parker, of New Gravel-lane, Shadwell, for, "Improvements in Revivifying or Reburning Animal Charcoal."—June 22; 6 months.

Wilton George Turner, of Park Village, Regent's Park, and Herbert Minton, of Stoke-upon-Trent, Stafford, for an "Improved Porcelain."—June 22; 6 months.

Luke Herbert, of Birmingham, Civil Engineer, for "an Apparatus for producing and communicating Artificial Light."—22nd June; six months.

John Alexander Philip de Val Marnio, of Margaret-street, Cavendish-square, for "Certain Improvements in the Manufacture of Gas, and in the Apparatus employed for consuming Gas for the purpose of producing Light."—22 June; six months.

Edward Brown, of Whiterock, Glamorgan, Copper Smelter, for "a new principle to be applied in the Roasting and Refining of Copper, whereby the oxidation of the metal is reduced, and the same is rendered more pure and ductile."—22nd June; six months.

Joseph Jennings, of Bessow Bridge, Cornwall, Assay Master, "For a Process for obtaining Metal from Pyrites or Mudic."—22nd June; 6 months.

William Vickers, of Firs Hill, Sheffield-street, Manufacturer, "for an Improvement in the Manufacture of Cast-steel."—25th June; 6 months.

John Arrowsmith, of Bilston, Stafford, Civil Engineer, "For Certain Improvements in Steam-engines."—25th June; 6 months.

James Bingham, of Sheffield, Manufacturer, and John Amory Boden, of the same place, Manufacturer, "For Certain Improved Compositions which are made to resemble Ivory, Bone, Horn, Mother-o-Pearl, and other Substances applicable to the Manufacture of Handles of Knives, Forks, and Razors, Piano-forte Keys, Snuff Boxes, and various other articles."—26th June; 6 months.

Claude Schroth, of Leicester-square, Gent. "For certain Improvements in the process, manner, or method of embossing or producing raised Figures, Designs, or Patterns, on Leather, or such like materials, and in the manner or means used for effecting the same; also in the making or forming of certain tools or apparatus used therein."—26th June; 6 months.

Pierre Auguste Ducote, of Saint Martin's Lane, "For certain Improvements in the Art of Printing on Paper, Callcoes, Silks, and other Fabrics."—26th June; 6 months.

William Newton, of Chancery Lane, Civil Engineer, "For certain Improvements in the Construction of Sun-dials designed to shew mean time."—27th June 6 months.

TO CORRESPONDENTS.

G. J. F.'s *communication on Railway Curves is received, and probably will appear in the next Journal.*

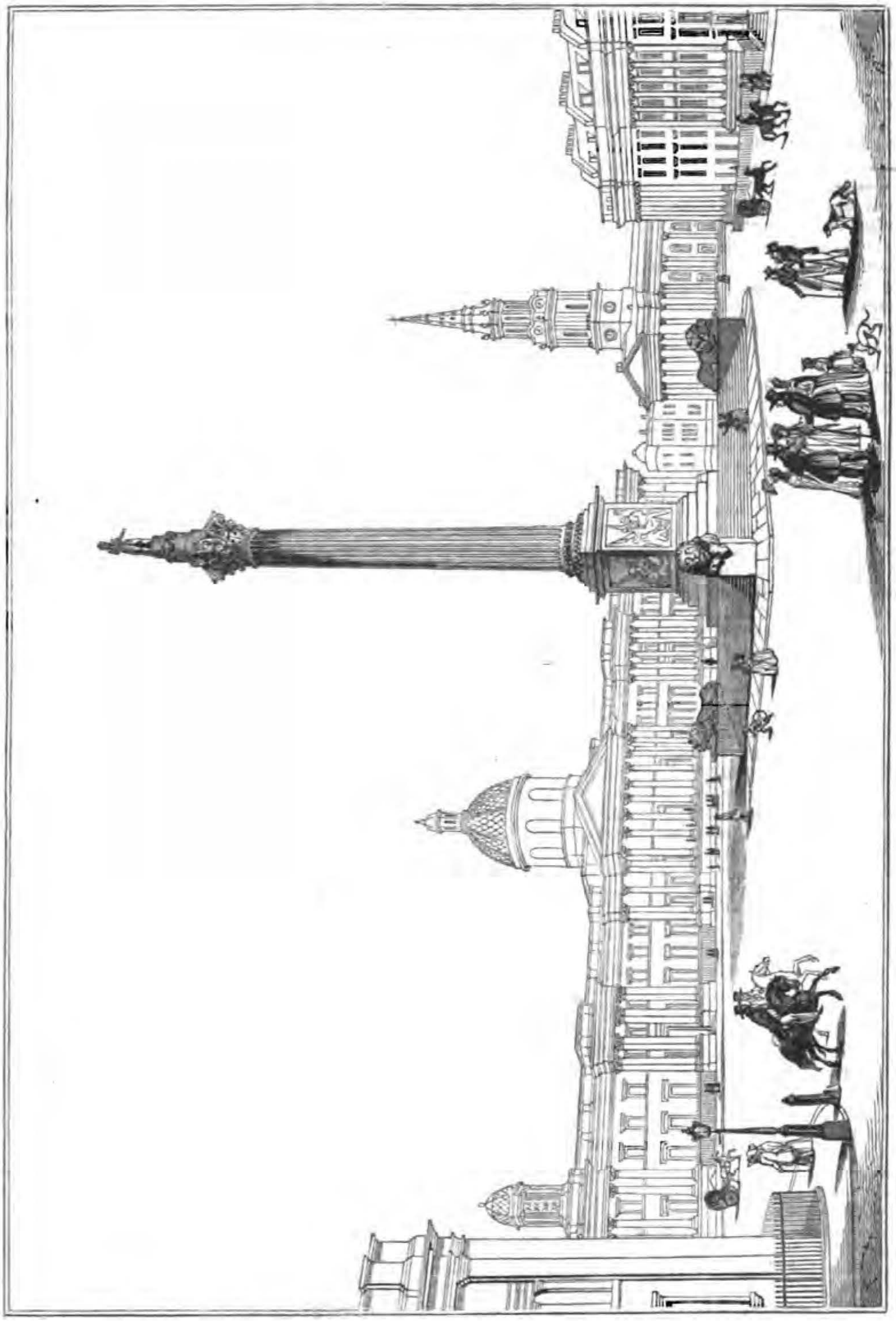
In answer to our architectural correspondent at York, we have much pleasure in informing him that we shall commence with the next Journal a series of architectural engravings.

The paper on "Subaqueous Explosions," will appear in our next number. We feel obliged to our correspondent for his communication, and shall at all times be happy to hear from him.

Nelson Memorial.—*In our next journal we intend to give all the printed descriptions of the designs and models which were to be had at the rooms in St. James's Street. Such candidates as did not give a printed description, are particularly requested to forward us a brief account of their designs or models on or before the 10th instant.*

VIEW OF TRAFALGAR SQUARE,

WITH THE PROPOSED NELSON MEMORIAL.



THE NELSON MONUMENT.

THAT the choice of Mr. Railton's design for execution has occasioned much discontent can be neither denied nor concealed, after it has been so generally expressed in different public journals; nor has such dissatisfaction been at all lessened by the circumstance that the committee appeared willing to retract their first judgment, their consenting to a second competition being, in fact, equivalent to an engagement on their part to pay greater deference to public opinion. As far as the committee are concerned, we think that they acted unguardedly in not distinctly stating, on the second occasion, that they wished for a column or something of that kind. This, it will perhaps be said, might easily have been inferred; still it would have been better had it been decidedly expressed, particularly as the adjudication of the two other premiums rendered it a matter of some doubt. At all events when they found themselves in precisely the same situation as at first—or rather in a different and more awkward one, being under the necessity of retracing their steps, and repeating the very choice which they appeared to have cancelled; they ought—if only on Mr. Railton's account, to have vindicated that choice by alleging, in the most explicit manner, their reasons for it. If they have not so, nor said anything to convince the public that the design finally determined upon was really more eligible than any other, the fault is theirs, and not Mr. Railton's.

With respect to ourselves, we do not feel that we are called upon here to say any thing in the way of criticism; and shall therefore confine ourselves to description. As far as precedents go, there are certainly more of them in favour of an insolated column as a monumental or triumphal record. The Parisians are now actually erecting a second monument of the kind, the *Colonne de Juillet* on the Place de Bastille. In our own metropolis we have already two, but the one now proposed to be erected will be of far richer character in itself, and will differ from them materially in the lower portion of the design; for in addition to the widely spreading basement or platform upon which the whole will be seated, the pedestal will be raised upon a graduated scale that will give it the appearance of greater security. Each side of the pedestal will be decorated with an historical bas-relief (probably to be executed in bronze), representing one of the four naval victories of St. Vincent, Copenhagen, Nile, and Trafalgar. The capital, which is after that of Mars Ultor at Rome, will be further decorated by a figure of Victory on each face of it. According to this second design, there will be neither abacus nor railing above the capital (in which respect as well as others it will differ from those of the Monument and York column), and we therefore suppose it is intended the upper mouldings should be hollowed behind so as to form a parapet to a gallery on its summit, as the shaft will contain a staircase leading to it. This second design is loftier than the first one by about six feet; and its principal dimensions are as follows:—

	Height.	Diameter.
Base	10	0
Pedestal	39	20 6
Base of column	9	0
Shaft	90	12
Capital	14	0
Cippus or pedestal of statue	14	0
Statue	17	0
	193	

To this we annex a comparative list of some of the principal monuments of the kind, ancient and modern.

	Entire height.
Pompey's Pillar	90
Trajan's Pillar	115
Antonine Column	123
Monument	202
York Column	137 9
Napoleon Ditto (Paris)	132
July Ditto (Paris)	156 10
Alexander Ditto (St. Petersburg)	175 6
Melville Ditto (Edinburgh)	152 7
Nelson Ditto (Dublin)	134 3
——— Ditto (Yarmouth)	140

Among the above there is only one instance of a Corinthian or foliaged capital, namely Pompey's Pillar, the shaft of which is a monolith or single stone. The shaft of the Alexander column is also a monolith of considerably greater dimensions, its diameter being 11½ feet English, and its height 84. This enormous mass of granite was transported from Finnland, where it had been worked out rough in the quarry.

For a description of the other designs as furnished by the authors themselves, see page 290.

THE NELSON MEMORIAL.

SIR—Whether the result itself be satisfactory or not, as far as Mr. Railton's design is concerned, I conceive that the proceedings of the Committee were unsatisfactory in the highest degree; if merely on account of the very great, and I may say, indecent precipitation with which they at length settled the business, hurrying over in about a couple of hours a question that circumstances had rendered it incumbent on them to deliberate upon carefully, and to canvass in all its bearings. Instead of which, both deliberation and discussion were completely set aside, and the affair was determined by Ballot! By Ballot! it is so perfectly MONSTROUS, as to be scarcely credible. Not even a single expression of opinion either one way or the other appears to have been produced; but as if anxious to extricate themselves as speedily as possible from a very awkward situation in which they were not at all likely to cut the very best figure in the eyes of the public, the Committee had recourse to a mode well calculated to screen themselves individually from reproach, and also to prevent futile and absurd arguments, by stifling argument altogether. It has also relieved them from the necessity of explaining to the public on what grounds they have after all awarded the preference to that very design which, greatly to the astonishment and dissatisfaction of almost every one else, had previously obtained the first premium; for they have so managed it that the only reply they or any others can now give is, that such was the result of the ballot. After what had previously taken place, such a course argued excessive timidity and a consciousness of not being able to justify their selection to the world: if it does not actually convict them of shuffling and duplicity. But as matters have turned out, there certainly is some ground for suspecting that the second competition was little better than a mere feint or ruse—a show of liberality and compliance with popular feeling, while they were predetermined to carry their point by resorting to the singular but highly convenient mode ultimately adopted. Such may have been the case, without supposing that every individual in the Committee either lent himself to, or was privy to such scheme. Possibly the suspicion may be altogether unjust, and totally groundless, except as far as actual circumstances give it the colouring of strong probability. Undoubtedly such scheme would have been a very *strange* one—to call it by no harsher epithet, but then perhaps, it is still more strange that matters should have turned out as they have done, and that no pains whatever should have been taken to guard against such very awkward construction or misconstruction as that here put upon the proceedings. Why should there be any room whatever for any such suspicion? Why, after such apparent concession and deference to public opinion as to rescind the first decision, allow a second competition to take place, and the whole to commence *de novo*, was the very choice that had before occasioned so much discontent, confirmed and ratified, without the slightest attempt being made to show that Mr. Railton's column was—if not positively in itself, at least, all circumstances taken into account, more eligible than any other design. Can it be affirmed that the second exhibition at all tended to reconcile the public to the drawing which had been before generally scouted as being of the most common place character, and without the slightest aim at invention of any kind? Hardly! If it was for the very quality just alluded to, for its being neither more nor less than a mere copy, without fanciful addition of any kind, that that design was approved, it might have been so stated, as artists would, perhaps, have been guided accordingly in the second competition. Or if, after the first one, and the designs it produced, the Committee were of opinion that some kind of column would be preferable to any other sort of monument, such opinion might as well have been made known, and then a great many who came forward on the second occasion, would either not have done so at all, or else would have adopted the idea of a column; had which been done, something more satisfactory and appropriate than any of the actual designs of that class might have been produced.

I am of opinion, however, for one, that there were several designs for columns superior to that by Mr. Railton; or admitting that they were not so decidedly superior as to leave no room for doubt, they certainly possessed such degree of merit as to render Mr. Railton's superiority doubtful in the extreme. Such being the case the most sensible and fairest mode of proceeding would have been, to have made in the first instance a selection of about half a dozen of the best class, and (dismissing all the rest) to have compared them together closely, scrutinized them and canvassed their respective merits at separate meetings, held at intervals for that purpose, and at which it would not have been amiss, had the Committee taken in evidence the opinions of one or two artists and competent judges, who, having no personal interest in the affair, nor any private bias in favour of any of the candidates, would have expressed their impartial judgment as to the respective merits of the designs. Had some such course been adopted, the pretensions of those designs would have been duly canvassed and sifted; and something like a verdict founded upon deliberate reasoning and examination would have been arrived at. Therefore had the ultimate result been precisely the same as at present, at all events some pledge would have been given to the public that every precaution had been taken to secure the best design of its kind, and that its rivals had not been rejected until after the most scrupulous examination.

Instead of this, has there not been a most singular and suspicious-looking precipitancy?—and after all what plea or excuse is there for it? It cannot be said that the urgency of the case was so great as to allow no time for the least delay: certainly not. A few weeks—a few months would have made no difference. The column will not be begun this year, that is pretty certain; that it will be set about next year, is not quite so certain; for I fancy it is now exceedingly problematical whether it be ever erected at all. In all probability the whole affair will now be suffered to die away quietly, especially as the funds in hand amount to barely half—if half the sum required. The Committee have got out of the scrape adroitly, if not handsomely, nor will they be very anxious to revive any mention of their proceedings.

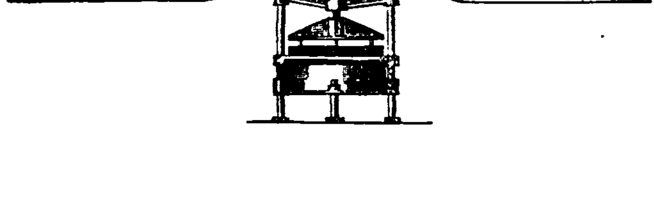
It must be owned that, as matters have turned out, competition has received a sad shock on the present occasion. But are artists therefore to sit down despondingly, and say that it is now quite hopeless to look forward to any more satisfactory system of competition? No; rather let them be more strenuous and urgent than ever in demanding such pledges beforehand as shall guarantee to them a fair and deliberate judgment. Let them insist upon there being an exhibition of all the designs before any premiums are awarded, or any kind of choice made:—let them insist that the votes of the committee and the reasons for the choice ultimately made be formally given to the public. It will be said that some of these suggestions have already been made: true, but we find that they require to be dinned into the ears of the profession again and again. Let them be forced upon them until they are shamed out of their apathy. What are the Institute about all this while? If they do not exert themselves manfully in regard to so momentous a point as that of public competitions, what is there they will consider of sufficient importance to call for their co-operation as a body? It will be answered that they have already taken it into consideration, and published a report upon the subject. Let them then consider it again and far more to the purpose, instead of now letting it go to sleep. But there are difficulties attending it: undoubtedly, and that is the very reason why it calls for all their energy, and for unwearied perseverance, until they shall have accomplished the so much needed reform.

ARGUS.

LORD WILLOUGHBY DE ERESBY'S PATENT MACHINERY FOR THE COMPRESSION OF PEAT.

DURING a constant residence in the mountainous districts of Scotland and Wales, where the inhabitants depend chiefly upon peat for their fuel, Lord Willoughby had given much attention to the manner of preparing it for use. From observing the impossibility of rendering it available in a wet season (together with its comparatively small value, even in the most favourable,) for domestic or manufacturing purposes, he was induced to enter upon a series of experiments for its compression by machinery. The first of these took place in the summer of 1834. The machine consisted of a powerful screw press, which is represented by Fig. 1. The chamber which contained the

Fig. 1.



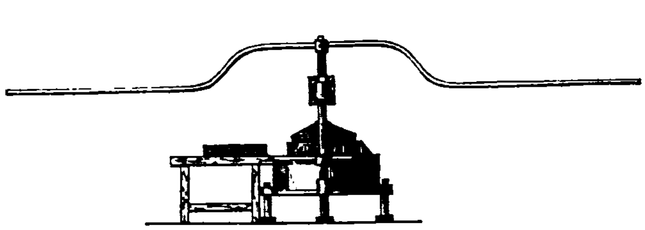
peat was three feet in diameter, and 14 inches deep. The interior was turned perfectly true, and had a moveable bottom, and piston fitted to it with the greatest accuracy. The piston was moved by a screw 4.5 inches in diameter; and the screw was turned by two levers of 10 feet radius. When put in motion by four men, it was capable of producing an effective pressure equal to 100 tons. The water contained in the peat was allowed to escape through small holes closely drilled in the bottom of the machine, and also round the cylindrical part of it forming the peat chamber. When finished, the machine was charged with about seven cubical feet of wet peat, and the piston descended upon it by turning the lever in the ordinary way. This forced the water through the apertures in great abundance; but long before the machine had attained its greatest power, the peat also began to exude; and although the holes were only three-sixteenths of an inch in diameter, but little of the original quantity would have remained in the machine, had the pressure been continued.

A second machine was constructed; and on a smaller scale than the first, in order to avoid expence. It was calculated to press but a single peat at a time. Fig. 3, is a front view of this machine, and fig. 4, a side view. The power is produced by racks and pinions in combination with two side-levers, as shown in the drawing. Instead of round holes in the peat chamber, for the escape of the water, it was formed of vertical bars of iron about half an inch wide, and fixed to strong cast-iron plates, one on each side of the machine, and so close together, that a piece of thin paper could scarcely be inserted between them. The peat however, when under high pressure, issued through the bars, as it had done through the small circular holes of the screw-press in the former experiment. It was therefore obviously necessary to employ some filtering substance to retain it, and at the same time permit the escape of the water. To effect this it was folded in linen cloth, before being placed in the peat chamber. In this manner its escape was completely prevented; but the process of compression became both expensive and slow.

A third machine was made upon the principle of the second; but the chamber for containing the peat was somewhat less, and the machine much more powerful. Figs. 5 and 6, represent this machine; it has the piston moved by a crank, in combination with levers, marked A, A, in the drawings. B, in figs. 4 and 5, is a short lever for removing the compressed peat from the machines. In fig. 4, the bottom is withdrawn, and the peat taken out from below; and in fig. 6, the bottom is made to rise, and the peat is discharged at the top. This machine worked infinitely better than the one with racks and pinions. The peat, however, continued to be folded in cloth.

The original screw-press was subsequently tried on a principle very different from its original construction. Fig. 2, is an end view of fig. 1, after this alteration. The perforated bottom was raised to the top

Fig. 2.



of the cylinder, and there secured with a strong cast-iron frame fixed to it, to support a sliding drawer about two feet square, and 4 inches deep. The peat was placed in this drawer, which was made of iron planed perfectly true, and the piston of the press, which was formerly round, was cut into a square, and by the aid of a leather washer made accurately to fit the sliding drawer. The bottom of the drawer consisted of a layer of ordinary linen cloth, beneath which was a second of hair-cloth; it contained fifteen peats of ordinary size. The machine being ready for an experiment, the sliding drawer, which is represented in fig. 2, was moved into its place, and there secured by two moveable bolts in front; this being done, four men turned the levers of the screw. No portion of the peat escaped; and the water it contained passed freely away through the filtering bottom. The success of this experiment left little to be desired, except some ready that not a drop of water returned upon the compressed peat, or re-entered the machine upon the pressure being removed. It was still evident that greater rapidity in compression was wanted than could be effected by sliding drawers, which required to be removed and replaced each time they were filled and emptied.

For this purpose Lord Willoughby proposed that his next machine should have two drawers, so connected, that when the one was removed the other would replace it, and the operation of the machine be uninterrupted. In order that they might be emptied with the utmost facility, after the peat had been compressed, they were hinged together, so as to admit of being readily reversed. For the machine, thus improved, a patent has been obtained by Lord Willoughby, extending to England only; but he wishes it to be understood that any individual is at liberty, upon a proper application, to avail himself of the invention gratuitously.

It may be useful to add a few general remarks to the foregoing description. In the selection of peat for compression, care must be taken to obtain a black peat, free from fibre. Peat of the proper description has very much the appearance of blackened butter, and is the only sort which will repay the expense of preparation. The peat should be dug of the usual size, namely 8 inches by 3, and 3 deep, and of a uniform shape, which is easily effected by a spade of a peculiar construction. All attempts which have been made to compress peat in large masses of various dimensions have invariably failed. In every instance the water has been retained in the centre of the mass, and expelled only from its surfaces. Even had the result of these trials been different, the peat so prepared would be useless for general purposes until cut into small pieces. Before compression, the peats must be placed to dry for five or six days under sheds, in the same manner as bricks and tiles, and after compression must remain under cover until perfectly free from moisture, when they will be fit for use. At the recommendation of several friends, Lord Willoughby has attempted to dry them in various ways by artificial heat, but without any satisfactory result. The peat, when properly compressed, is reduced about one-third in size, hard, and compact, and nearly black in colour; it varies slightly in density, sometimes floating, at others sinking in water. As to its uses, it will be found an excellent substitute for coal. It may be used in grates for domestic purposes, and has been tried successfully in calcining lime. In an experiment with the steam engine at St. John's foundry, Perth, where one of the machines already described was made, the peat was found to outlast an equal weight of coal, in the proportion of 16 per cent., the engine being worked at its ordinary rate. There is every reason to believe that it might be employed in the manufacture of gas, which it gives off in abundance, burning with a clear white light. It may also be prepared by charring, in the same manner as ordinary charcoal, by which its size is reduced about one-half. When charred in this way, the slowness and difficulty with which it burns renders it an extremely valuable fuel in many processes of the arts: this value is increased by its freedom from sulphur, and the comparatively small quantity of ashes which it leaves after burning. For the working of steel in particular, its freedom from sulphur makes it greatly superior to charcoal. It has been applied to this purpose by Messrs. Philip and Whicker, (late Savigny and Co.) St. James's-street, who have used it with remarkable success in forging razors and surgical instruments. The articles bear the stamp "*forged with peat*," as well as the names of these gentlemen, by whom they are highly recommended. The charred peat has also been employed in the working of other metals, particularly in the soldering of thin brass, with a most encouraging result. In conclusion, it may be mentioned, that it is as serviceable in the kitchen as common charcoal, and occasions no unpleasant taste or smell.

With the view of carrying Lord Willoughby's principle into operation, on a scale of greater magnitude than could be effected by manual labour, he engaged Mr. James White, of Lambeth, to assist him in adapting steam-engine power to his machine. Mr. White, foreseeing some difficulties in the application of any of the former modes of moving the piston, or the plate which compresses the peat, on a large scale, advised the use of hydrostatic pressure. The following is Mr. White's description of Lord Willoughby's machine, with the proposed adaptation of hydrostatic pressure and steam power.

"Fig. 7, is a general plan of this machine; and fig. 8, an elevation. In fig. 7, A is the steam engine boiler; B, steam engine; C, main shaft of engine; D, compressing pump; E, exhausting pump; F, hand gear for reversing the motion of the sliding frames which contain the peats; G, air vessel; and H, two cocks that open and shut alternately, the use of which will be explained hereafter. I and I, are pipes attaching the pumps, D and E, with the vessel J, from which four branch pipes, K, K, K, K, convey the water to the four cylinders, L, L, L, L, and by the high compressure of the pump D, the pistons will be forced out of them; and the compressing plate, to which they are all secured, low. mode of getting clear of the water at the top, and preventing its return upon the compressed peat, or into the machine when the pressure was removed. To effect this, large conical holes in the piston were filled with pieces of beechwood, through the pores of which the water was expelled in an upward direction, and conveyed beyond the edges of the drawer, through channels contrived for that purpose in the piston. The lower surface of the piston was covered with cloth in the same manner as the bottom of the sliding drawer. The result was ered upon the top of the peat with a power equal to 500 tons, or more if necessary.

"The peat is to be placed in a sliding frame M, of which there are two to the machine; one of them being under compression, while the other is being filled. This frame M contains 90 square pieces of peat, as represented in the drawing. They are shown compressed; for the rollers, upon which the frame M runs, have been withdrawn, and left it supported by centres at the ends only. It is now to be turned over upon these centres, and the compressed peats will be emptied into a railway carriage below, which is there to receive them, as shewn in the elevation, fig. 8. The sliding frame is to be re-adjusted, and the handle N to be pushed in, as represented at the other end of the machine; this having been done, the small rollers that are fixed, and centred to the parallel guides O, O, will be below it, and support it. It may then be refilled with as much expedition as possible.

"We shall now proceed to describe the mode of raising the pistons and compressing plate, which have been forced down by the introduction of water into the cylinders L, L, L, L, by the compressing pump D.

"The cocks H, are now to be reversed, and the exhausting pump E, will withdraw the compressed water from the cylinders L, L, L, L, and return it to the supply well, seen on the right of the elevation, fig. 8. This will cause a vacuum above the pistons. Hitherto it has only been pumping air to waste. At the same time the compressing pump D will continue storing up its power into the air vessel G, by [illegible] back the withdrawn water, and be ready for a second operation. If we suppose the four pistons in the cylinders L, L, L, L, are [illegible] inches diameter, and the water thus withdrawn, and the atmosphere at liberty to act upon the under surface of the compressing plate, to which the pistons are attached, there would be sufficient power to raise the whole mass, were it not for the adhesion which takes place between the under side of the compressing plate, and the upper surface of the peat. A power equal to 20 tons is requisite to separate them. To effect this object, the compressing plate has 8 regulating screws, which come in contact with 8 steel bars when down. There are 4 on each side of the machine, marked P, P, P, P, in the elevation fig. 8. The elasticity of these bars is calculated to overcome the resistance of the atmospheric pressure, which causes the cohesion between the compressing plate and the peat, and the exhausting pump E, to return the pistons and compressing plate to their original position, on the admission of air through a valve in the compressing plate. The handle F, of the hand-gear, is now to be reversed, which will bring out the sliding frame, containing the peats that are under compression, and the other sliding frame M, already described, being refilled, will replace it. This having been done, the cocks H, will be returned, and the highly compressed air, in the air vessel G, will force the water, that has been pumped into it by the compressing pump D, to the cylinders L, L, L, L, as presumed to have been the case in the former instance. The second sliding frame M, being now out, the handle N, is to be withdrawn; the frame will then swing upon its centres, the railway carriage being in the position to receive the compressed peats, and the sliding frame will be emptied as before.

"The quantity of peats which may be thus compressed in one day, may be estimated at 27,000, or 45 per minute, under a pressure of 400 pounds on the square inch, with a high pressure steam engine of six horse power. When a greater or less degree of compression is wanted, it can easily be effected by the weight W, on the lever of the safety valve of the air vessel G; but it ought to be mentioned, that loading the valve beyond what the machine is calculated to bear, may cause a fracture in some of its parts, or an explosion of the air vessel."

Fig. 3.

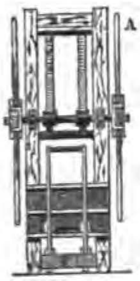


Fig. 4.

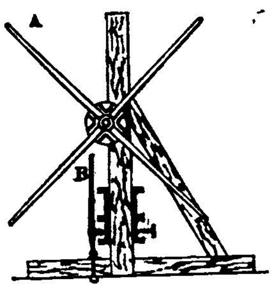


Fig. 5.

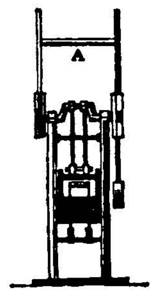


Fig. 6.

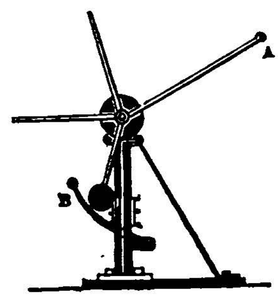


Fig. 7.

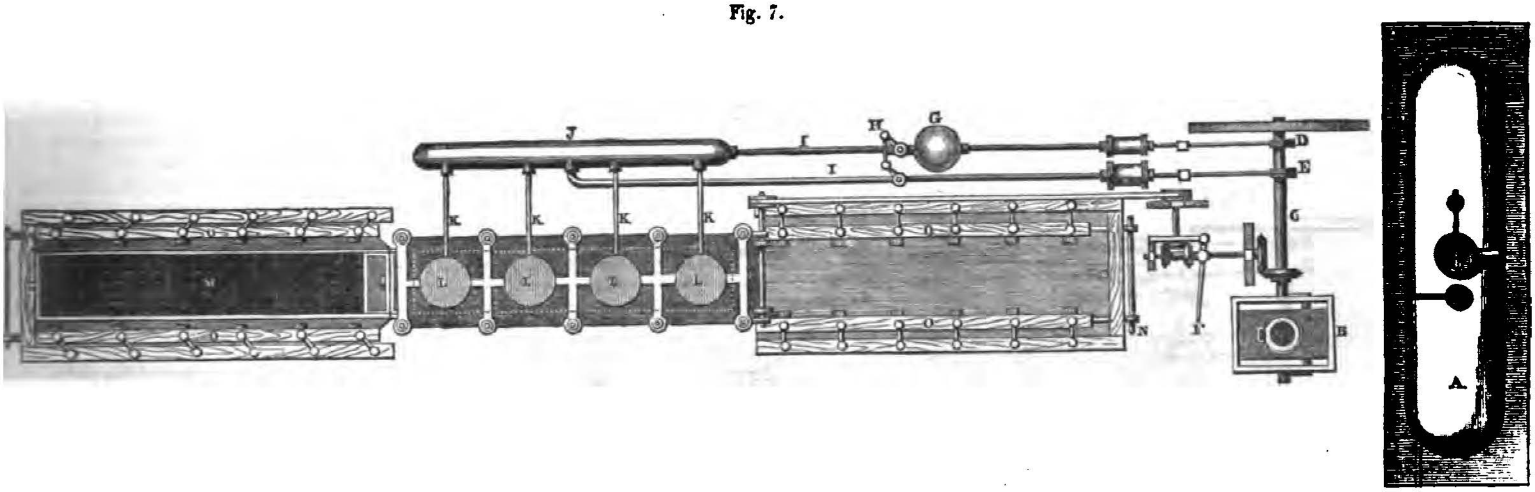
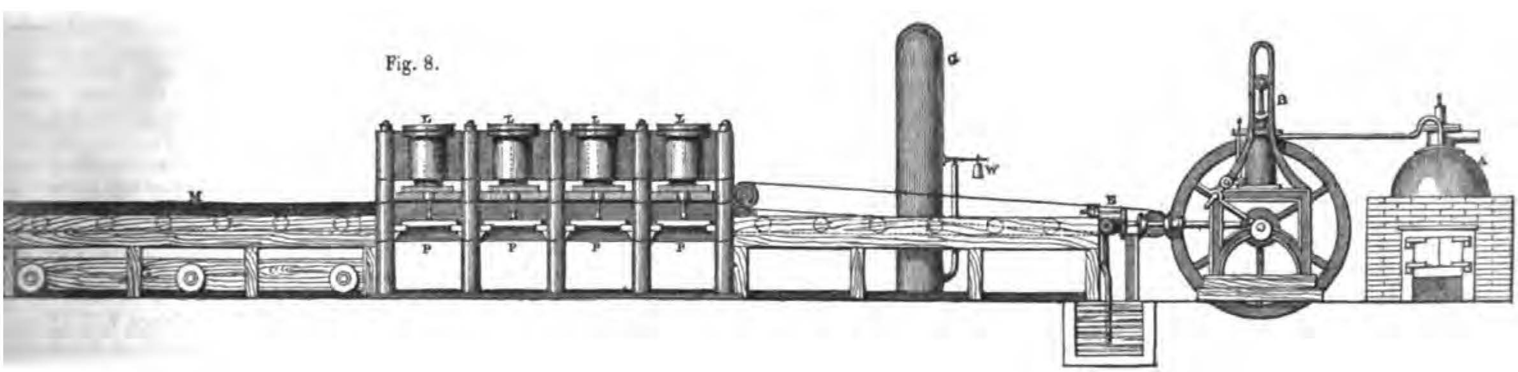


Fig. 8.



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

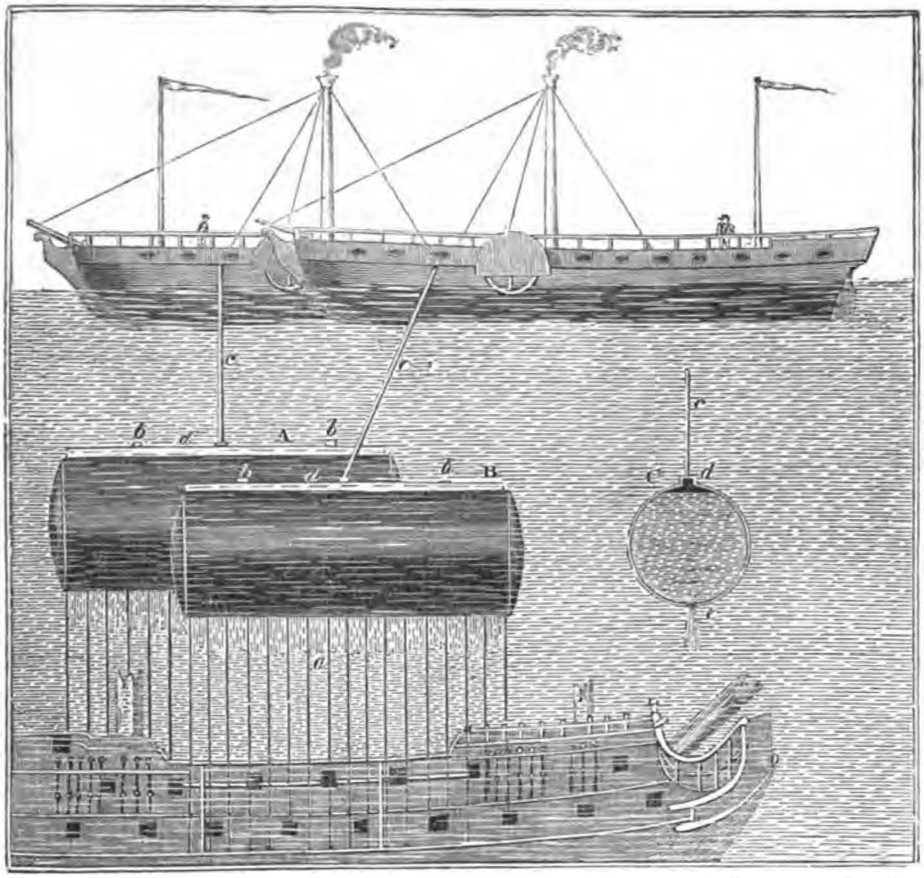
feet

DESIGN FOR RAISING SUNKEN VESSELS.

BY JAMES WHITE, C. E.

In the year 1832 I proposed a design for raising the Royal George, off Spithead, or other sunken vessels, a drawing and description of which was published in the *Gentleman's Magazine* for December, 1832; and submitted to the Board of Admiralty shortly afterwards. From the discouraging treatment which was experienced on presenting the invention to that Board, I might not have sought an opportunity to republish it; but observing, in the *Repertory of Patent Inventions* for last May, that a patent has recently been granted for the use of air vessels of the above description, for the purpose of raising sunken ships; I consider it a duty to myself, to establish the priority of any claim to the invention, by recording it in a work more generally read by scientific men, than the magazine in which it first appeared.

"Since the melancholy loss of this ill-fated ship, many ingenious designs have doubtless been suggested, and various plans submitted to the Board of Admiralty, for the purpose of effecting her removal. Whatever might have been the merits of such inventions, it is certain that very few trials have been made, and those few have entirely failed. The proposed plan, however, which brings all the powers of pneumatics and hydrostatics into operation, if acted upon, presents every probability of being successful; and thus removing a dangerous obstruction from one of the most important roadsteads in the kingdom.



"The figures AB represent the elevations of two air-tight cylindrical vessels, eighty feet long and thirty feet in diameter, made of iron plate about one-eighth part of an inch thick, and strengthened by deep flanches inside. The ends are of a spherical form, as shown in the elevations. The projection from the section C, marked *d*, represents an air-chamber, shown in the elevations to extend the whole length of the cylinders. Diametrically opposite the air chamber of each cylinder, there is an opening of an inch wide the whole length of the cylinder, represented by the dark place in the section C at *e*. The little projections *b b* in the elevations, denote the situations of valves or cocks, to allow the air, which the cylinders contain, to escape, as they fill at the opening *e* when sinking.

"The air-chambers *d* are calculated to equalize the difference of weight between the iron and the water displaced by the cylinders when they are fairly emerged with the chains *a*, and grappling irons attached thereto. The cylinders will therefore sink with the cylindrical part full of water, and the chambers full of air. When the water is to be expelled from the cylinders, as will be afterwards explained, the pressure from the air-chambers on the water will be equal the whole length of the cylinders.

"To make a survey of the situation of the ship, and to ascertain the best method to be adopted for securing the cylinders, would be essentially necessary as a preliminary step. If the results of such inquiry were favourable, the work might go on; but the whole of the operations under water I propose effecting on a new plan—a method whereby the depth does not materially affect the workmen. Had I not contemplated something of this sort, I might not have presumed on the possibility of effecting a work of such unparalleled difficulty.

"Supppose two such cylindrical air-tight vessels as described (to be made at Portsmouth or the nearest station where they are to be used, and towed to Spithead roads) were lowered above the Royal George, and strongly secured thereto by grappling irons, on the chains marked *a*, through her guns ports, or otherwise, as might be devised. The depth to which the cylinders should be lowered, in the first instance, must not be more, from the surface of the water, than the depth which the ship has sunk in the sand. By having the cylinders as near the surface of the water as possible, they will be exposed to perpetual agitation, and this will loosen the ship in her bed.

The cylinders being secured, the flexible tubes *c* are connected with pumps worked by the engines of two steam-boats, as shown in the drawing. A powerful injection of air is forced into the air-chambers of the cylinders, and the water which they contain expelled through the opening at the bottom. The dark place in the section C, at the top, shows the water partly expelled. When the entire expulsion of the water has been effected, the cylinders will obtain a buoyancy equal to the difference of the weight of the compressed air and the water displaced—a difference that will rather exceed than be under three thousand tons.

"Although the Royal George may still for some time remain immovable, if the fastenings can be made sufficiently strong to bear the strain, such will be the immense power of the cylinders, when agitated by the incessant rolling of the waves, that the ship must eventually break up, or be loosened in her bed, and recovered entire—the superincumbent pressure, which is most to be dreaded, being thus effectually overcome.

"In the event of a portion of the ship rising from her bed entire, the cylinders will probably ascend to some height above the surface of the waves. The cylinders are then to be towed by steam-boats into shallower water, and the ship lowered on chains prepared for that purpose; after which the cylinders are to be secured to the chains, one on each side of the ship, as low in the water and as close to her sides as possible. The water may then be expelled from the cylinders, as in the former instance; when it is presumed, with the cylinders so situated, the ship will be raised above water."

The following year after the above description was published, a working model of the invention was completed. It consisted of a small ship, with two copper air vessels about 18 inches long, and 6 inches in diameter. Each air vessel had a flexible tube communicating with an air chamber, into which air was compressed by an air pump, and the flexible tubes had regulating brass cocks on them, and the air chamber of the pump had an air cock.

The apparatus being complete, it was placed in a cistern full of water, the air vessels having been previously secured, one on each side of the ship, which was loaded with about 30 lbs. of iron, as ballast. In this situation the ship was kept floating from the buoyant power of the air vessels. But the instant the air cock of the air chamber was opened, it began to sink; there being a hole in the bottom of the ship, the preponderating weight of the ballast caused the air vessels to fill, by apertures below, and expelled the air from them through the flexible tubes, and finally by the air cock, until the ship and air vessels went to the bottom of the cistern.

The air vessels being now full of water, and the flexible tubes also to the extent they were immerged, the object of the invention was to restore them to a buoyant state, and thereby bring up the sunken ship.

I have mentioned that regulating cocks were on the flexible tubes, which afterwards were found to be indispensible. When the air pump was put into operation, both of the regulating cocks were open, and the compressed air went only down one of the flexible tube, displacing all the water from the air vessel to which it belonged; and then escaping, without displacing any water from the other air vessel. It was then necessary to shut the regulating cock of the buoyant air vessel, and expel the water from the other; but before much of it was displaced, the ship came up in a deranged state, having turned over in the ascent. It then occurred to me that the liability of turning over in the ascent would be avoided, if the ship was first raised on her stern, and afterwards in a slanting direction. To effect this the air vessels were altered, in place of having the apertures, for the exit of the water, open the whole length of the air vessels, as described in the original plan, to which this description is an appendix, they were placed at the ends only, transversely on the under surface, and the flexible tubes for conveying the compressed air to them, were brought nearer the opposite ends on the top of the air vessels. With this new arrangement the apparatus was sunk as before, but instead of pumping the compressed air to the air vessels, as in the former instance, with both regulating cocks open; 6 strokes of the air pump were first applied to one of them, then as many to the other; the regulating cocks being open and shut for that purpose. When this quantity of compressed air had been forced into the air vessels, the head of the ship began to move, and with every additional stroke of the air pump, it kept rising, until the whole ponderosity was overcome, and the ship then came up head foremost. The prow only coming a little above water in the first instance, and then stopping, owing to a quantity of water still remaining in the lower ends of the air vessels; but on this being expelled from them, the ship and the air vessels righted themselves into a horizontal position as they came above water.

By the application of the above principle to raising sunken vessels, several important advantages are obtained. First, the air vessels being made of iron, are sufficiently durable to last for a great length of time. Secondly, from the nature of their construction, they may be towed by steam-boats from one point of the coast to another. Thirdly, the principle operating independently of the tides, the work of recovering the wreck may be proceeded with at all times, when the weather will admit of it. And fourthly, by the plan of gradually raising the head of the vessel first, the immense superincumbent pressure of the water is greatly avoided. It will readily be understood how much easier a plank of wood can be raised from an adhesive bed, when one end of it is raised by degrees, than would be the case if the same power were applied at once to overcome its whole weight and adhesion.

When the ship has been raised upon her stern, it will still be necessary to overcome the remaining adhesion of this portion of the vessel, and to effect so much by the same buoyant power that raised the head, supposing it to be sufficient for that purpose, the velocity of the ascent would be so great, that there would be danger in disturbing the fastenings which secure the ship to the air vessels. It will therefore be necessary to fix an air vessel by the stern, and no deeper in the water than might be sufficient to clear the ship from all adhesion. When this has been effected, the further expulsion of the water from the former air vessels may be proceeded with, and it is presumed, the ship would be recovered as described with respect to the model.

Lambeth, July, 1839. JAMES WHITE.

IMPROVEMENT OF THE OUTFALLS OF THE RIVERS OUZE, NENE, WELLAND, AND WITHAM.

Sir John Rennie, who was for some time employed by a general meeting of parties interested in the drainage of the Rivers Ouze and Lynn, and Boston Deeps, has just finished and presented his reports. We understand that Sir John states that an additional fall of nearly six feet may be gained in the low-water mark of the river Ouze, and that by uniting the Ouze, the Nene, the Welland, and the Witham, and carrying them by one improved outfall into the centre of the great wash, not only will the drainage and navigation of the whole of that immense, fertile, and valuable district of land-draining by those rivers, called the Bedford Level, South Holland, and other districts, amounting to about a million of acres, be greatly improved, and consequently increased in value, but also there would, in all probability, in the course of a few years, be gained 150,000 acres of new and valuable land; this alone, taken at the value of £40 per acre, although a great deal of the land which has already been acquired from the sea in that neighbourhood is now worth considerably more, would amount to £6,000,000, and when it is considered that the whole county of Rutland only contains 95,000 acres, and the Isle of Wight about 100,000 acres, the great magnitude and importance of the undertaking, which is estimated at £1,800,000, may be readily conceived. Sir John Rennie's report has not yet been published, which we understand, however, will shortly be the case, when we shall not fail to recur to it again, and make such remarks as circumstances may require.

RAMBLES BY PHILOMUSÆUS, No. 1.

THE VASE ROOM IN THE BRITISH MUSEUM.

The arrangement of this valuable collection adjoining the Egyptian department, seems after several abortive attempts to have commenced in reality. The endeavour to arrange them according to form and colour is very meritorious, but the plan is far from systematic.

For a long time this collection was left in a state of barbarous confusion, and then it was arranged somewhat in the chimney ornament style, by a fanciful grouping of tall vases alternating with those which were shorter. No attention seemed to have been paid to anything like a useful classification, and the whole disposition was so chaotic as to leave little hope of amendment.

The classification should be either antiquarian or artistical, and would resolve itself into the several modes of origin, age, form, colour and design. The more useful method is certainly that which can be available to artists, and the disposition adopted seems to unite several of the features of what would have been distinct classification. The vases are arranged according to form, and the subdivisions of these according to colour, so that this double purpose is answered, and it happens in most cases that the same classes of design are also thrown together.

A case with one elliptical form is however interposed between those which are spherical, and no regular gradation is preserved in the general disposition of the several classes of forms. The proper course would be to commence with the cylindrical form, then proceed to the spherical, thence to the upright ellipse, the flat ellipse, the egg and the egg reversed. The various modifications of these again should be further distinguished according to the several parts of the vase. The essential parts of the vase are the neck or capital, the shaft, and the base, and the accessaries are the handles, &c.

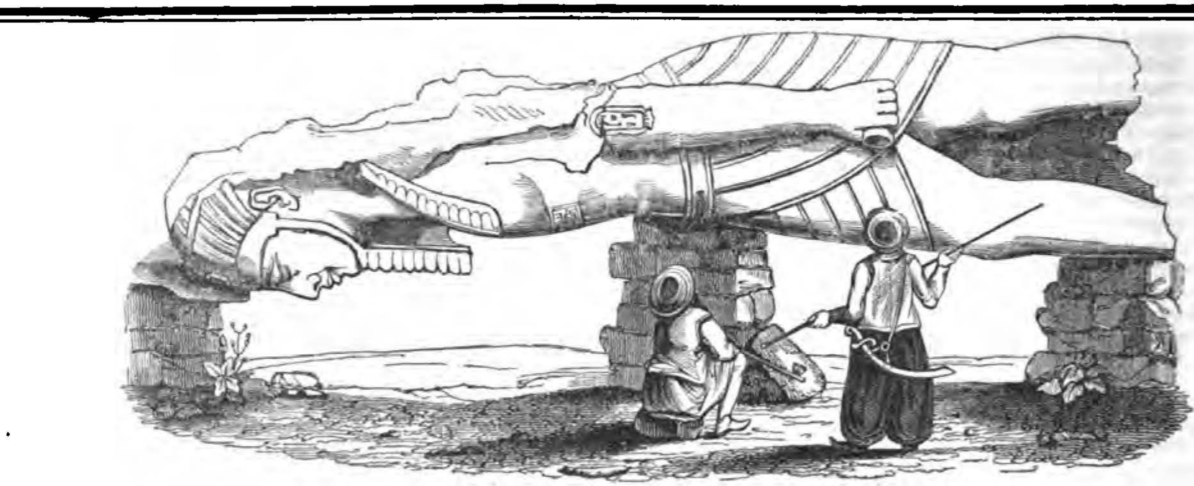
Many of these vases are exceedingly beautiful both in form and colour, and one series with black designs exquisitely rich. The designs are frequently interesting, and consist of allegorical representations, the exploits of Hercules, warlike exercises, domestic occupations, and caricatures. Some of the horses are drawn with a quaint freedom which is very striking, and the ease of the flying genii cannot sometimes be too much admired. The illustrations of domestic manners are very numerous, and include ladies reading, women drawing water at a fountain, sacrifices, musical performances, &c. A vase in the form of the head of a negro is an accurate representation of the existing members of that race, and an excellent proof of the preservation of the type, as also of the non-negroism of the Egyptians.

In the Egyptian department are many very elegant vases, and in the lower room is a tazza, which is well deserving of attention from the purity and severity of its outline. In the vestibule of the Elgin collection is a fine tazza recently presented by Lord Western, and in the Townley rooms are two or three well known marble vases.

MR. CRACE'S STUDIO.

That a new era for the extension of the arts has commenced is apparent; its progress indeed strikes us at every step. One of the most interesting features of this march of taste is the studio recently fitted up by Mr. Crace, at his establishment in Wigmore-street. It is such a work as in Paris would excite the admiration of the professional press, and be hailed as an accession to the architectural riches of the age.

We enter a small shop of a plain and subdued character, with a few decorative patterns lying about, and then proceed through a passage into the studio. This consists of three compartments thrown into one suite, and is fitted up with all the richness of a nobleman's library. The first portion is in the style of James I. or later Elizabethan, the central in the Gothic, and the last in that of the Renaissance. The accessaries are equally in character; tables and chairs, imitative armour of carton de pierre, papier maché ornaments, and patterns for decoration being distributed about. The windows are filled with painted glass, and the whole has an air of tasteful richness, which would do as much honour to a nobleman to possess, as it does to the artist to have executed. Although it is only a collection of specimens, yet they are so united, and the character of the whole so well preserved, that they communicate the idea rather of a private apartment than a pattern room. With these attractions spread out before them, noblemen will be as little able to restrain their purse-strings, as their ladies are at the mercer's or the milliner's.



COLOSSUS OF SESOSTRIS.

During the period of their dominion in Egypt, the French erected a bridge across the Nile, uniting Old Cairo with the Isle of Rhoda Of that structure no other vestige now remains than a fragment of the first arch attached to the old stonework of the Nilometer. On the other bank of the river stands the city of Gizeh, about two leagues from the pyramids, and which formed the northern boundary of ancient Memphis, whose southern limit and necropolis were what is now Sakara. The road along the course of the river leads to Bedrechein, beyond which village the former site of some large city is attested by the massive blocks of granite and fragments of columns that strew the plain. Pieces of shattered stone project every where through the sands that have already buried up the principal monuments of that immense city, and which ere long will completely obliterate all remaining traces of it. Between Bedrechein and the village of Mit Rahineh rise two long hills parallel to each other, which are probably formed by the remains of a vast enclosure of unburnt bricks, similar to those that have been found in many other ruins. These bricks, which are thirty three centemetres (about thirteen inches) long, by eighteen wide and ten deep, are for the most part stamped with a hieroglyphic cartouch. Within this enclosure is the magnificent colossus exhumated by Captain Caviglia, to whom the world is indebted for several other discoveries no less important.

This gigantic statue is one of the finest pieces of Egyptian art; it is of a very fine limestone, and although incrusted in parts, still retains that polish which is met with only in sculptures of the same epoch. Notwithstanding that the lower parts of the legs are broken off, the present length of the figure is not less than eleven and a-half metres, or thirty-nine feet nine inches, English, and is remarkable for its proportions, at once elegant and severe. The face, which has been preserved in its fall by the head-dress, is uninjured, and is of the most exquisite workmanship. It is that of Sesostris, so often represented in the principal temples of Egypt, who reigned, according to the chronological table of Abydos, 1565 years before the Christian era. It is, therefore, but on a much larger scale, a faithful resemblance of the Sesostris in the museum at Turin. Upon the arm, and on the front of the breast and the girdle, is a cartouch indicating his name.

M. Caviglia took the precaution of having the face of the statue turned downwards, in order to preserve it from the mutilations the Arabs are in the habit of inflicting upon all representations of the human figure. He has also caused it to be propped up by masonry at each end and in the middle.

According to all appearance this colossus, near which are massive foundations of limestone, was placed against one of the jambs of a large doorway, and had a companion figure against the other one.

At a short distance from the spot where it remains, is the small hut or cabin near some palm trees, which served Caviglia as his residence during the years he employed in investigating these ruins. It is now occupied by an Arab, who acts as the keeper and cicerone of this monolithic statue. In a line with the latter, but at some distance from it, are some small columns of rose-coloured granite, in a very ruinous state.

To the north of the colossus was once a temple of white limestone, dedicated to Venus Athor, by Rhamses the Great, and without the enclosure on the east side of it, are the remains of another temple ornamented with coupled pilasters, also of rose granite, which was dedicated to Phta and Athor (Vulcan and Venus), the two great divinities of Memphis.

MOMENTUM OF FALLING BODIES.

SIR—It was in consequence of the difficulty which attends the comparison of the effects of pressure and moving force, that I entered upon the discussion in the 16th Number of the Journal, Vol. II. page 18, not that I hoped to clear it away, but because the subject is highly interesting and useful, and I hoped to elicit information through the medium of your Journal. It was with great pleasure, therefore, that I saw the letter, page 255 in No. 22—and I hope that the discussion will now fall into abler hands than mine. I will, however, beg space in your next number to enable me to make a few observations on Mr. Neville's letter.—The words in italics will point out where I think he has misconceived my remarks on the subject.

1. The inference that I draw from the experiment detailed in Vol. II. page 18, is that a weight on the spring keeps it steadily to a point, that *one-half* of the same weight falling with a velocity of 2-3rd foot per second would have attained when its motion was destroyed.—2. In comparing the effect of the falling weight on the pile with that of the weight it is to sustain, it is presupposed that that pressure would cause the pile to *penetrate;* otherwise why drive the pile at all?—3. To suppose the incumbent weight to move with a velocity of *one, two* or *more than three feet per second* is to suppose what is not likely to take place; and to found a calculation upon such vague data could not lead to any accuracy of result. In short, one might as well guess the result at once and save the trouble of all calculation.—4. Mr. Neville says that "in falling bodies, *after* the force θbv is expended, b *then* acts by its weight, and very little consideration will shew that they cannot be added together." But there is but *one* collision; the effects of the weight and the acquired momentum are *simultaneous* and of the same nature, whether b and θbv are so or not. Indeed b and θbv represent the *effects* of the forces, and it is not very easy to point out in what the difference in the nature of these forces consists: since, should the motion be infinitely slow, the effect would evidently be the same as though the body remained at rest. 5. I believe that I may have been wrong in applying the formula $m=b+\frac{3}{2}bv$ to the cases taken from "Hutton's Course," where the motions are not occasioned by gravity, but in all cases of *falling* bodies, I still think I am right in adding b to $\frac{3}{2}bv$. For if the true formula be $\frac{3}{2}bv$ nearly, and b be discarded; taking for example $b=10{,}000$ lbs. and $v=\frac{1}{10{,}000}$ foot then the force $m=\frac{300{,}000}{2}\times\sqrt{64\times\frac{1}{10{,}000}}=24{,}000$ lbs.; or in other words, the consequence of its fall through that small space would be the loss of three-fourths of the force it exerted when in absolute rest: but if the factor b be not discarded and m be $=b+\frac{3}{2}bv=124{,}000$ lbs.

B.

ON STEAM POWER.

Sir—Enclosed is the copy of a letter addressed to the President of the Institution of Civil Engineers, which, should you consider worthy a place in your interesting and valuable Journal, I beg you will make use of it; my only object in sending it to you, is, that it might direct the attention of those who employ steam-power, to a more economical mode of obtaining that power, at the same time considering that it is the duty of those who have the opportunity of making experiments, to publish any result which would tend to husband one of the greatest resources of our national prosperity.

I must however observe, in justice to myself, that the original letter was forwarded to the President, some days before I read, or was even aware, that the Institution had published the first part of their 3rd volume of Transactions, containing Mr. Josiah Parkes' paper on a similar subject, and which you criticised in your last number.

I am, Sir, your obedient servant,

F. Ham, *Civil Engineer.*

Rose Lane, Norwich, 8th July, 1839.

To the President of the Institution of Civil Engineers.

Sir—I am induced to address the Institution in reply to Mr. G. H Palmer's paper, since it appears, from your having considered it of sufficient importance for insertion in the 2nd volume of your "Transactions," that the recorded duty of the Cornish engines, is *still* a matter of surprise, in fact, Mr. Palmer seems more inclined to doubt the accuracy of the accounts, than that of his data.

That it is possible to raise 120,000,000 lbs. one foot high, with one bushel, or 94 lbs. of coal, I do not for a moment doubt; and moreover venture to say, that even that duty, enormous as it appears, as contrasted with the ordinary duty of a Boulton and Watt engine, is not the maximum the Cornish engines might be made to perform; this assertion but ill accords with Mr. Palmer's calculations, which are correct, from the data he assumes, viz. that 7 lbs. of coal are required to convert 1 cubic foot of water at 40° into atmospheric steam, in the boiler of a Boulton and Watt engine, as at present constructed, but which is very wide of the mark, as regards the effect of the combustion of 7 lbs. of coal under different circumstances, for instance, I have proved by several experiments made some years since, that 7 lbs. of coal will convert into atmospheric steam, at *least three* cubic feet of water at 40° under peculiar management, which simply consists in exposing a much more extended surface to its action than is usual, and in diminishing the *rate of combustion* as an example, the same quantity of fuel maintained in combustion for 12 hours, will evaporate at least *three times* the quantity of water than it would if consumed in 2 hours, other circumstances being the same; this is an effect I have for some years daily produced in an ordinary steam boiler, and have not the slightest doubt, but that with more complete apparatus, and a still slower combustion, nearly double that amount might be obtained; here then is a solution to the problem, the Cornish engines very seldom if ever work up to their speed, frequently to not more than a third, the fires are then damped up, slower combustion ensues, and hence the result, with the most complete Boulton and Watt; on high pressure engines the case is different, rapid combustion is required, in the absence of an extensive boiler surface, to supply the requisite quantity of steam, and promoted to a most wasteful extent, by tremendous chimneys, fans, &c. Intensity and consequently radiation are certainly increased by these means, but neither iron nor copper conducts it in any thing like the same ratio; in fact, I believe, that when the boiler is highly heated, the water is actually repelled from the surface of the plates, by an atmosphere of caloric, from its not being able to absorb it with sufficient rapidity; I am moreover confident, that were slower combustion practised, fewer explosions, and a mere tithe of the present destruction of boilers would result, independently of its effecting a considerable saving in fuel, which would most amply repay for the capital invested in extra boiler room.

Mr. Palmer's paper has certainly been beneficial in exciting inquiry, and has induced me, as I dare say it will others, to institute a set of experiments, on the relative effect of fuel in evaporating, under different rates of combustion, and I therefore purpose, as opportunities occur, to investigate the matter in as philosophical a manner as my experience will enable me.

I find also inserted in the same volume, a paper from Mr. Wicksteed, on the effective power of one of the Cornish engines, ascertained by weighing and measuring the quantity of water delivered from a depth of 536½ feet. I should have been much better satisfied with that report, had the experiment been continued for a longer period than 2¼ hours, as it is, it can only be regarded as an approximation to the real duty performed by an expenditure of a certain quantity of coals; in the first place, he does not state whether the boilers were feeding or not at the time of the experiment, or that they contained precisely the same quantity of water and pressure of steam after, as before the experiment; secondly, the eye alone is but a very poor judge of the quantity of fuel contained in the furnaces at any period, and a few pounds consumed, either more or less than the assigned quantity would make a very sensible difference in the result; in fact, I would defy any one, in conducting a similar experiment, and judging from the eye alone, to say within 10 or 15 per cent. more or less, what quantity, not of coal alone, but of combustible matter, had been expended. I do not exactly understand what Mr. Wicksteed means, by saying, that "at the end of 2¼ hours the fire was lowering and the *speed of the engine* decreasing;" does he mean by the "speed reducing," that the engine was a longer time in making the stroke, or, that a longer interval elapsed between each stroke? for if I mistake not, the interval between each stroke of most, if not all, the Cornish engines, is quite independent of the engine, and governed by a water or air regulator, which is completely under the control of the engineer, consequently the interval between each stroke does not afford any, or the length of time in making the stroke sufficiently precise, notice of the 94 lbs. of coal having been expended or otherwise. It appears that during the experiment the engine was not making quite five strokes per minute, had it been working at its maximum speed, he would have found his 103 millions of pounds actually raised one foot high reduced to about 50, or perhaps even so low as 20 millions; considering the state of the boilers and flues, which he states "had not been cleaned for *eleven* months," arising from an increased rate of combustion being required to maintain the density, and supply the increased rate of expenditure of the steam, otherwise how can the great discrepancy between Capt. Lean's reports of the maximum and average duty of the Cornish engines, and Mr. Wicksteed's experiments be accounted for, and if the latter gentleman expects the engine he is erecting at Old Ford, to raise 120 millions of pounds one foot high, with 94 lbs. of coal, at *its proper speed*, without considerably increasing the boiler surface, so as to *admit of slow combustion*, he will be most grievously disappointed.

These remarks are made with the highest respect for Mr. Wicksteed, and as our joint object is to elicit truth, I trust they will be received in good part, and serve as an introduction to my better acquaintance with him, and allow me to say that an experimenter cannot be too precise in stating the particulars of the precautions he adopts to ensure accuracy, for they not only serve as a record of his ability, which may do him honour, but render the report itself the more valuable, inasmuch as science advances, truth or error can be more easily deduced from it.

I am, Sir, your's very respectfully,

Frederick Ham.

Rose Lane, Norwich, May 2, 1839.

SUBAQUEOUS EXPLOSIONS.

We are very glad to see that Mr. Bethell's interesting paper on blasting rocks, &c. under water by the aid of galvanism, read before the Institution of Civil Engineers, accompanied by experiments, and first reported in our Journal in May last year, (p. 198, Vol. I.) is likely to lead to the greatest practical use and benefit. Colonel Pasley, we are happy to find, has entered upon this investigation, and his well known perseverance and accuracy in experiments will, we trust, lead to the general adoption of voltaic electricity for the purpose of subaqueous and subterraneous explosions. On this subject a very interesting paper, entering minutely into details, appeared in the last June number of the *United Service Journal*, from which we give the following extract:—

"We shall now proceed to state, as far as has come to our knowledge, what has been done in this country respecting the application of voltaic electricity to practical purposes—that is, if supported by detailed and well-authenticated evidence as to when and where, without regarding the mere assertions of any individual, in respect to his having blown off the decks of sunken vessels by the voltaic battery, such as to the best of our recollection we have read in a scientific journal of reputation; but in which neither the names of those wrecks, nor the time or place of any of his operations, were specified; and therefore our noticing them could give no positive knowledge or satisfactory information. It is well known that small charges of gunpowder have often been fired by this means in lecture-rooms, or in scientific institutions, in this country, both in air and in a bucket of water; and nothing is easier than to do so in a room, where failure can scarcely take place without extreme neglect, as no accidents are to be apprehended from the elements. But to secure a charge of gunpowder that is to be fired by voltaic electricity, at a great depth of water and in a rapid tide-way, is no easy task, as Colonel Pasley afterwards found on undertaking this operation. When he first received the order to attempt to demolish the brig William, in the Thames, he was of opinion that voltaic electricity would afford the best means of effecting that object; but at that time he was not provided with a proper battery, and though he might have procured one in time, yet he preferred inferior methods, which he and his corps thoroughly understood, to an untried though more promising method, which he did not think that they would be able to reduce to any certainty, without a vast number of experiments and a considerable loss of time; because those distinguished chemists and electricians, both in this and in other countries, who have recently brought the important science of electro-magnetism to such perfection, having nothing to draw their attention particularly either to subterraneous or subaqueous explosions, had never investigated the best mode of applying the voltaic battery to large explosions, under difficult circumstances. As soon, therefore, as Colonel Pasley, by application to the Master-General and Board of Ordnance, had received a voltaic battery of ten large cylinders, &c., made by Mr. Newman, of Regent-street, on Professor Daniell's improved principle, he commenced a series of experiments for reducing the application of voltaic electricity to the purposes of military mining, as well as of great subaqueous explosions, to a system, in which he was assisted by Captain Sandham and Mr. Howe, under whom Serjeant-Major Jones, and as many non-commissioned officers and privates as were found necessary, were continually employed for more than four months. And it is a remarkable fact, that, though neither Colonel Pasley himself, nor any officer or man under his command, had ever used such a battery before, yet, in consequence of the very clear directions received from Mr. Faraday and Professor Daniell, they succeeded, on the very first trial of their battery, in firing small charges, both in air and in a bucket of water, in the manner usual in a lecture-room. But when they took those precautions, which appeared absolutely necessary to insure the success of similar explosions at the bottom of the Medway, at the distance of 500 feet, which they considered sufficient for the safety of the operators, in firing the largest possible charge or charges in deep water, so many failures took place, that at one time ultimate success appeared a matter of doubt: for it often happened that the arrangements which never failed in air or under ground failed in water; and those which succeeded in a pond near their barracks failed in the Medway. At last, after trying more than a hundred different experiments, they succeeded in reducing the operation of igniting gunpowder by the voltaic battery, both under ground and under water, to as much certainty as their former mode of firing mines in dry soil. They did not adopt any of Dr. Hare's arrangements, because it did not appear that he had ever used them under water.

"To record their various experiments, which commenced on the 23rd of November, 1838, would be tedious and useless: suffice it to say, that they first succeeded in firing an experimental charge of 1 lb. of powder only, at the bottom of the Medway, at the distance of 500 feet, on the 7th of February, 1839; that they fired their first mine, at the same distance, with a charge of 30 lbs. of powder, which, having a very small line of least resistance, blew up a field-work in presence of Colonel Warre, the Commandant, and most of the officers of the garrison of Chatham, and numerous other spectators, on the 11th of February; that they fired a charge of 45 lbs. of powder at the bottom of the Medway on the 16th of March; and that they fired a charge of 40 lbs. of powder at the bottom of the Medway on the 23rd of March, by which they knocked to pieces a sham wreck. These two last explosions, each of which was also at the distance of 500 feet, took place in the presence of numerous spectators, chiefly officers of the garrison, whom Colonel Pasley invited to attend, not only from being of opinion that the voltaic battery may become extensively useful for military purposes, but also from a desire to fix the time when each peculiar process was first publicly carried into effect. In reference to this point, it was rather mortifying to him, that after he thought everything was right, the first mine which he invited the officers of the garrison of Chatham to attend entirely failed, owing to a very small and delicate piece of platinum wire, which is always placed inside of each charge, having been broken by some accident, so that the voltaic circuit was incomplete. This failure, which never occurred before nor since, in any of his numerous experiments, led to the precaution of always testing each charge, by ascertaining, with two or, at the most, three cylinders or cells of the voltaic battery, whether the connexion between the two copper conducting wires and the platinum wire within the charge is perfect, which is known by the battery decomposing water, a process requiring much less power than is necessary for igniting gunpowder, and which is done in a small glass tube to contain the water, prepared and used as directed in article 961 of Faraday's Chemical Manipulation, (page 458.) If no decomposition take place, which is, of course, known by the wires not producing any effect when brought near to each other within the water, but without actual contact, as directed by the author, the platinum wire in the charge must necessarily be broken, and the case containing the powder must therefore be opened again, to make the connexion good; but if air-bubbles, forming and ascending in the water, should shew that decomposition is taking place, the connexion of the conducting wires and of the piece of platinum wire must be perfect. There is another reason for not bringing the wires in the proof tube into contact, not stated by Mr. Faraday, who was writing without reference to the presence of gunpowder in any part of the circuit, namely, that such contact might ignite the charge, if the battery were strong enough; in order to avoid all risk of which, two cells should always be tried first, this number never having been known to ignite gunpowder in any of the experiments now alluded to; and if two should not act upon the water, let three be tried with caution, which number, though it may ignite gunpowder near to the battery, that is through a very short circuit, will not ignite it when the proof tube for decomposing water forms also a part of the circuit, because the action on the piece of platinum wire, which passes through a cork coated with wax at the bottom of the tube, diminishes the force of the voltaic electricity upon the other piece of platinum wire within the charge. In testing their experimental charges, therefore, by the decomposition of water, great caution was always used by the engineers at Chatham, after the accident above alluded to, which caused them to have recourse to this expedient. This failure taking place on Saturday afternoon, the 9th of February, caused the experiment to be put off till the Monday following, the 11th of February, when the mine was fired successfully as before mentioned, the charge being placed under the field work that was to be blown up, and the conducting wires being led from thence, entirely under ground, in a trench cut for the purpose about a foot deep, to the battery, at the above-mentioned distance of 500 feet.

"It is rather curious, that the first intended explosion at the bottom of the Medway, to which Colonel Pasley invited the garrison, should also have failed, which was caused by an unforeseen circumstance.—One of the officers under his command, who had fitted up the charge and made all the arrangements for the experiment, having been unexpectedly required to attend an inquiry, by an order from the Inspector-General of Fortifications in London, and having forgotten to mention to another officer, who was therefore suddenly appointed to execute it, one of the precautions necessary, and which had been provided for, namely, to secure the conducting wires leading into the charge against any strain tending to separate them from the canister containing it. From the omission of this precaution, the head of the canister was pulled open by the strain alluded to in a strong tide, and all the powder spoiled.

"Several officers residing in or near the metropolis, some of whom were Members of Parliament, as well as several men of science, and members of the institution of civil engineers, having expressed their desire to be present at the great explosion, by which it was proposed to blow up a sham wreck, Colonel Pasley appointed Saturday, at half-past two o'clock, at which hour he knew that they might arrive without inconvenience, and return to London after the experiment, if necessary. The plan of operation, of which he circulated programmes, announced that the whole proceeding necessary should be done in presence of the spectators. His first experiment, announced for the 9th of March, which would have been executed at high water, having failed, he appointed Saturday next, the 16th of March, for repeating it, on which occasion the ebb of a spring tide flowed with so much violence at the hour appointed for commencing, that the charge, when let down to the bottom of the river to grapple with the supposed wreck, could not be brought in contact with it; and though the voltaic battery succeeded in producing the desired explosion, the wreck remained uninjured. On this account, therefore, Colonel Pasley appointed a repetition of the same experiment on the Saturday next following, which being completely successful shall now be described.

"The battery used was on Professor Daniell's improved construction, as before stated, which from its admirable property, in which it surpasses all former voltaic batteries, of retaining its power undiminished for several hours, he has named the *constant battery*. The copper cylinders, or cells, were of the largest size that has been used, namely, 21 inches high by 8½ inches in diameter, with zinc rods, &c., of proportional dimensions. Colonel Pasley had ordered it to be fitted up with porcelain cylinders inside to contain the zinc rods, in preference to membranes; but on trial he found that the former were continually breaking in spite of every precaution, and therefore he adopted the latter, which are ox gullets, and which only cost as many pence as the former do shillings. The conducting wires, rather more than 500 feet long, were of copper, one-fifth of an inch in diameter, which were both attached to the same 2-inch rope, being previously covered with tape and coated with waterproof composition, and the rope itself being previously saturated with boiling tar, after which they were all bound round together with broad tape, coated with the same waterproof composition, and served round with hemp yarns. Thus the whole had the appearance of a single rope, oval in section, capable of being coiled up, which was done upon a drum of 4 feet in diameter. This precaution was found absolutely necessary to prevent kinks in the wires, and the arrangement of saturating the rope with tar was also found necessary, to prevent its contractions and expansions between wet and dry from breaking the joints of the copper wire. At the far end, where the wires were to be introduced into the charge, they were separated for a few feet in length into a fork. The case containing the powder was a tin cylinder made for the purpose, and just capable of holding the proposed charge of 40 lbs.; but to prevent the loss of the whole charge in case of accidents, a small canister capable of containing about ½ lb. was introduced into one end of this cylinder, with a perfectly sound and strong metallic partition between the two. This small canister was called the priming-box, and two short copper wires, called the priming wires, were led into it, the ends of which were connected inside by a piece of platinum wire about an inch long. These wires must only be in contact with wood, tape, or canvass, and therefore the priming-box had a wooden lid, through which these wires passed, but the rest of it was usually made of tin. In immediate contact with the platinum wire, mealed powder was used, but the rest of the powder in the priming-box was common large-grained powder. Colonel Pasley rejected on trial two sorts of fulminating or deflagrating powder, that had been used, one by Mr. Wm. Snow Harris, of Devonport, and the other by Dr. Hare, of Philadelphia, because he found no superiority in either of these over mealed powder. He also rejected iron wire on trial, because the platinum wire fired gunpowder with three cells of Daniell's battery, whereas the iron wire required four to effect the same object. To secure the entrance of the copper wires into the priming-box, by a water-proof composition, elastic enough neither to be cracked nor deranged by those strains or pressures, which cannot be entirely got rid of under difficult circumstances, and at the same time to prevent a pull upon the copper wires from without breaking the very delicate platinum wire fixed to their ends inside, were objects, the attainment of which gave infinite trouble. The expedients usually recommended, of corks coated with sealing-wax, for the copper wires to pass through into the charge, and India-rubber tubes, or varnish, to insulate the remaining length of each copper conducting-wire, were rejected; the former as being fit only for a lecture-room, and the latter as being too expensive: instead of which pitch, softened by bees-wax and tallow, was used at the suggestion of Serjeant-Major Jones, who had tried a great number of experiments for ascertaining the best sort of water-proof compositions for bags of gunpowder in 1832, when Bickford's fuses were first used by the corps at Chatham, and who also, at the same period, discovered the means of imitating those fuses in an efficient manner.

"Such being the preparations, the sham wreck, which was a small rough fir-vessel, 5 feet long, 3½ feet wide, and 2½ feet deep, was sunk at low water, opposite to Chatham gun-wharf, on the 23rd of March, the day appointed for this final experiment, having a ring and lines attached to it, which were supposed to have been fixed by a diver, the ends of which were kept in a six-oared cutter, having on board the voltaic battery, the coil of conducting wires on their drum, and the charge of powder, which was attached to them by fixing their extreme ends to the priming-wires before described, and covering the joints with tape and water-proof composition. As soon as the supposed wreck was sunk, the charge was lowered and hauled into its place in perfect contact with one side of the wreck, by means of those lines, and the end of the downhaul was then made fast in the boat to the conducting-rope and wires, so much of the latter having been veered out and sunk, as was necessary to allow the charge to reach the bottom. All this having been done at slack-water, and consequently without any obstruction from the current, the boat was moored nearly over the spot, and remained there for several hours, until the period appointed for the explosion, when the flood-tide was running strong, and the depth of water over the charge about 30 feet. At the hour appointed, a great number of spectators being assembled on the wharf opposite, the cutter warped upon her cables against the tide, until the full extent of 500 feet of the conducting wires was veered out, after which Captain Sandham, the executive officer in the boat, made the signal by bugle that all was ready, one of the conducting wires was now connected with one pole of the battery, on which Colonel Pasley, who was amongst the spectators on the wharf, gave the order also by sound of bugle to fire; and as soon as the last note of this sound was heard, the second conducting wire was brought in contract with the second pole of the battery, and immediate explosion took place. A brisk shock was instantaneously felt and a dull sound heard on the wharf; in a few seconds after which a small column of water was thrown up, followed immediately by all the fragments of the sham wreck, which, being separated by the explosion, floated up to the surface. On the same occasion, some small charges were also fired at the bottom of the Medway, one of which having been kept ten days in a bucket of water, before it was sent down to the river, proved the efficiency of the Serjeant-Major's composition. The successful result of this experiment, not so interesting to the spectators, was felt to be of equal importance with the former, and had been looked forward to with still greater anxiety.

"On the 6th of April, Colonel Pasley blew two large hard sandstones to pieces at the bottom of the Medway, one by one charge, the other by two successive explosions, each charge consisting of ½ lb. of powder. The holes were 3 inches in diameter, and the charges were contained, one in a tin cylinder of a diameter to fit the hole, the two others in cylindrical canvass bags of the same size. Over each charge was placed a wooden cone, and the upper part of each hole was tamped by small broken stones, on Mr. Howe's principle before described. One stone being of a compact form was split into five pieces by the explosion; the other being much thinner, and consequently having little resistance either above or below the hole, the first charge only blew out the bottom of the hole below and the tamping above. This stone was therefore got out of the water, and the second charge put into the centre of the hole, having its own wooden cone over it, whilst one of the two cones previously used, which had floated up to the surface, was introduced under it, and then the hole was tamped both above and below this second charge, which, on the stone being again lowered to the bottom of the river, was fired by the voltaic battery, and the stone was thereby broken into three pieces. In this experiment all the preparations were made on the wharf-wall of the Gun Wharf, from whence the stones, when loaded, were let down to the bottom of the pier near it from a crane, and the slings used in this operation were not disengaged before either of the explosions, which enabled the men employed to get up the second stone, after the explosion of the first charge lodged in it, which had not broken the slings. These blasts were fired from the wharf, where the voltaic battery was placed, with conducting wires 60 feet long in two of the experiments, and 100 feet long in the third, which being of common bell-wire, only about one-sixteenth of an inch in diameter, required no less than eight cells of Daniell's constant voltaic battery to produce ignition, although the same number of cells will fire powder under water at five times that distance with the larger wires before described. These experiments in blasting rock under water were tried in reference to the important object of removing obstructions in rivers or in harbours, by blasting with the voltaic battery, in which case the holes in the rock would require to be previously prepared, and the charges introduced into them, by means of the diving-bell. Numerous experiments were also tried for firing several charges simultaneously by the voltaic battery, but the results were not satisfactory, as the engineers at Chatham were never able to fire more than two or three charges simultaneously at any respectable distance; but they have not seen reason as yet to ascribe their disappointment to the fault of the battery, but to the circumstance, that having no more than 500 feet of the large conducting wires, they were obliged, in all their attempts at simultaneous explosions, to make use of the small common bell-wires, which they found by direct comparison not to be capable of conducting the same intensity of voltaic electricity to more than about one-fifth of the distance to which it could be conveyed by the larger wires of about three times their diameter. Accordingly, the officers present at these experiments think that it would be perfectly impracticable to fire a charge of gunpowder under water by a voltaic battery composed of six of Daniell's large cells only, at the distance of 300 or 400 yards by using common copper bell wires as the conducting wires, according to an opinion given in a paper published in the "Civil Engineer and Architect's Journal," for the month of May, 1838. From their own experience, they consider that gunpowder could not be fired at the last-named distance, by such conducting wires, with any battery composed of fewer than 90 of Professor Daniell's largest cells, which would probably be a more powerful voltaic battery than has ever yet been used by man.

"On the 17th of April, Colonel Pasley repeated one of Mr. Wm. Snow Harris's experiments before alluded to, by causing the wires from his voltaic battery to pass through two barrels full of gunpowder, and two small charges of 5 lbs. each, the latter being provided with small platinum wires for explosion, whilst the copper wires passed straight through the former in their bright state, but the holes, which had previously been bored in opposite staves of the barrel, for admitting those wires, were secured by waterproof composition. The conducting wire from one pole of the battery passed first through a powder-barrel on dry ground; secondly, through one of those small charges sunk in the pond near Brompton Barracks; thirdly, through the other powder-barrel on dry ground; and, fourthly, through the other small charge, which was also sunk in the same pond; after which it was led back to the other pole of the battery, the whole circuit being 1130 feet, but the distance from the battery to the most distant barrel of powder being, of course, rather less than half the above. On the signal being given to fire, each end of the conducting wire was brought in contact with a pole of the battery, so as to complete a circuit passing through all those four masses of powder; but only one of the small charges was fired, instead of both, as was intended, which the officers present at this experiment ascribed to the use of small bell-wires, as there was not a sufficiency of the larger sort of wire to complete the whole circuit without them. After this explosion, some merriment was occasioned by one of the powder-barrels being dragged into the pond by accident; but being got out and opened immediately, the powder was found uninjured, thanks to the waterproof composition. The remaining charge was then connected with the other powder-barrel, and the circuit which passed through both was completed, upon which an immediate explosion of the second small charge took place. A great number of military and other spectators were assembled to witness these explosions, each of which threw up the water to a much greater height than any of the larger experimental charges had done in the deep water of the Medway. The circumstance of the powder in the barrels being uninjured in these two experiments, though the voltaic electricity passed through both of them in the first, and through one of them in the second—for if it had not done so, the circuit could not have been perfect, and no explosion would have taken place—affords by a parallel experiment a confirmation of Mr. Snow Harris's proceedings at Plymouth in 1823, to repeat which was all that Colonel Pasley had in view at the time. He was on this occasion, as before, disappointed in his simultaneous explosions, but he considers it of no use to try any more experiments on this subject, till he shall be provided with a greater quantity of large wire; and even for the common purposes of blasting rock, either on shore or under water, with a length of conducting wire not exceeding 80 or 100 feet, he would never use copper wires of smaller diameter than one-eighth of an inch. It is to be remarked, that in using the voltaic battery for practical purposes, the principle conducting wires may serve for several hundred successive explosions, because in all those experiments the priming wires which led into the charge were always short pieces, afterwards connected with the former, and these priming wires, or a part of them only, were destroyed, whilst the principal conducting wires were not injured. Though the experiments at Chatham confirm the opinion of the scientific inventor of this improved voltaic battery, that the same number of cells possess greater power in a high than in a low temperature, yet one great advantage of voltaic over common electricity for practical purposes, is the superior hardiness, if one may use the expression, of the former. Whilst the common electrical machine can do nothing, excepting in warm dry air, the voltaic battery may be said to brave the elements, all Colonel Pasley's experiments having taken place in the open air, and several of them when the battery was exposed to violent rains, and, on one occasion, to a severe snow-storm. In these experiments, it being necessary to carry the battery about, which was done by a couple of bearers like those of a sedan-chair, and to convey it on the river in boats, sometimes subject to motion, the connecting screws, as originally fitted, proved liable to derangement in those movements, which led Mr. Howe, with his usual ingenuity, to suggest an improvement on the mechanical fitments of the battery, which renders the parts much more easily connected for action, but which, requiring a part of those fitments to be made of a sort of brass instead of copper, Colonel Pasley would not adopt, until he had made a reference to, and obtained an opinion from, Professor Daniell, that this mixed metal, which was made of fifteen parts by weight of copper and one of zinc, would not be objectionable; and on trial, having had a second battery of ten cylinders, also of the same dimensions as the first, constructed at Chatham by the artificers of the corps under his command, and fitted up in this manner, it was found quite equal in power to the first, which he received from London.

"As every engineer officer who is acquainted with the common mode of firing military mines by a piece of portfire or slow match, connected with a powder-hose, leading to one or more charges, knows that some delay, usually of at least one minute, always occurs between the lighting of the portfire and the explosion; and, further, that it is quite out of the question to expect several mines to go off simultaneously by this system, for no two equal lengths of portfire, or equal lengths of powder-hose, were ever known to burn exactly alike,—it is evident that the voltaic battery, which communicates ignition to one or more changes instantaneously, offers the only possible means of firing defensive mines at the moment of time when they are required; that is, when the enemy's troops, in advancing to the assault of works thus protected, are seen to be upon the very spot of ground under the surface of which those mines have been prepared. At that critical moment, the tap of one piece of copper wire upon another opens the earth under their feet, and launches them into the air; and though mines are perhaps more terrible in imagination, than destructive in reality, yet the instantaneous action of the voltaic battery, which gives no warning and brooks no delay, may, on such an occasion, be the means of repelling an attack, against which the same number of mines, fired by the common mode, might prove unavailing; because an enemy's column, marching to the assault, might either have passed beyond, or not yet have reached, the position of such mines at the period of explosion. For large subaqueous explosions, to be directed against wrecks sunk in deep water, and in a rapid tideway, the superiority of the voltaic battery over all former expedients is no less striking; so much so, that Colonel Pasley has always declared, since his late successful experiments with it, that if he had been possessed of such a battery, and known how to use it, last summer in the Thames, a great deal of trouble, time, and expense would have been saved."

NELSON MEMORIAL.

We have been induced at the request of several architects and artists to publish the descriptions of the various models and designs exhibited at the St. James's Bazaar, there being no document in which they are collectively described. We have not been able to obtain the whole of them, but if those architects or artists whose descriptions we have omitted, will furnish us with them, they shall appear in the next journal.

Model No. 2, *Thomas Hopper*.—The custom of mankind has been to elevate those characters who have distinguished themselves, by investing them with power and titles, and to transmit those names to posterity who have been pre-eminently exalted, by erecting temples to their memory.—Such was the practice of the great nations, whose example other nations have endeavoured to imitate. The Jews had a divine command to erect a temple for the Ark of the Covenant, and Christian nations have dedicated churches to honour the memory of men of eminent piety. Even Trajan's pillar was part of a temple.

Believing that the highest honour which can be bestowed in commemoration of great actions by a nation, is the dedication of a temple to immortalize the character of the hero: and as no difference of opinion exists, as to the immense superiority of Lord Nelson, over the multitude of naval heroes whose names adorn the British history, he, above all men, has deserved the noblest tribute that a nation can bestow.—Such being the conviction of my mind, I have endeavoured to design a naval temple, commemorative of Nelson, and founded on the principles of ancient art. I have adopted a circular open temple for many considerations, but above all, because I think it best adapted to the site, and calculated to improve the grouping of the other buildings in Trafalgar-square.

The upper part of the temple and the steps only are exhibited: the crypt and basso relievos want of time compelled me to omit, as well as the painting of the dome.—The crypt I propose to surround the granite pedestal which supports the statue, on which Nelson's motto should be inscribed: the columns of the crypt to have the names of the ships and the commanders delineated on them, and the niches to contain the statues of the commanders who fell in the battles; and also paintings of Nelson's arious personal encounters.—The pedestals which divide the steps are intended to contain the entrances to the crypt, and the statues of the three seconds in command.—The divisions on the frieze to contain, in sculpture, the history of a naval fight: the architrave within to contain a procession of naval triumph, and also a lamentation for the loss of the hero in the moment of victory. The dome to be painted with three stars as an allegory, descriptive of the three great battles, in all of which Nelson had triumphed. The centre to be lighted from the crown, in imitation of a star, with Nelson's last glorious command, the light from which would descend full upon the statue.—The capitals of the columns are composed of oak, thistle, and shamrock: and all the moldings and architectural ornaments are taken from parts of naval architecture, as the ornaments of the Erectheium were taken from the nautilus.—The design is formed to admit of a great fountain to play on the anniversaries of Nelson's birth,—and the three battles: and at night the whole building could be illuminated.

This is all that would be required in the dedication of the temple of Nelson.

P. S. The flag ships of the naval crown are intended to represent the navy; the commanders to represent the officers of the service; the sailors who support Nelson's statue, to represent the foremost men; and the naval crown, which surmounts the building, is intended as the emblem of power and authority, and of the immortality of Nelson.

Model, No. 3, *T. Butler*.—In the model which I offer to the consideration of the committee, I have laboured to embody those points of character upon which is founded the naval greatness of England, and which in my humble opinion, (in whatever way they may be expressed) ought not to be forgotten, in association with a monument consecrated to the memory of a hero, whose achievements are among the most renowned of the only nation upon earth that has claimed and maintained the wide dominion of the seas.

The extreme elevation of the monument would be 84 feet, and, as materials, I propose granite and bronze, as being best adapted to withstand the deteriorating effects of this climate. The statue of Nelson, and the graduated shaft upon which it is placed, together with the subordinate figures, and the rest of the effective part of the monument in which the story is told, would consist of metal; and the massive base I propose to construct of granite.

The projected height of the statue of Nelson is 19 feet, that of the figure of Britannia 20 feet, and that of the Sailor of the like dimensions. Britannia is represented as resting with her left hand on the anchor, her hope, glory, and strength, and with her right hand she points at once to Nelson, and the first word of his ever-memorable signal, "England expects every man to do his duty," which appears inscribed round the column.

Behind Britannia and above her head waves triumphantly the British Flag, grasped by the sailor, in the rear of the monument. This figure of a seaman stripped for action, represents the unshrinking front and unquailing heart, with which England has ever met her enemies. The top of the column is enriched by a chaplet of laurel, and on the pannels of the base are inscribed Nelson's three grand victories,—Nile—Copenhagen—Trafalgar. The four lions would be of granite, the same material as the base, and the whole encircled by a chain cable supported by globes of granite.

The *estimate* of the monument is calculated according to the proposed sum, 30,000*l*.

In this design, it has been as much as possible my wish to avoid remote allegorical allusion, by adhering to an alphabet of symbols, so familiar as to be legible to the plainest understanding, and to impart to the whole a naval and a British character. It has also been my study to observe somewhat of a pyramidal form, as best calculated to lead the eye upwards to the hero of the story.

MODEL No. 62, *James Hakewill.*—Before attempting to design a Nelson memorial adapted to the locality of Trafalgar-square, I have asked myself, and others upon whose judgment I placed reliance, the following questions, which, with the replies, I subjoin.

Must it not be desirable that the National Gallery be as little masked as possible?—Undoubtedly.

What form of monument would best ensure that object?—A column.

As there are several points of view from which the monument would be seen, what form will give, on so many angles, the best outline?—A column: its contour being always the same from whatever point it is viewed.

Is it correct in principle or feeling that the statue of a subject be placed looking down upon royalty, as the statue of Nelson would be, if placed on the summit of the column immediately over that of Charles the First?—Certainly not.

Would it not be better, then, to place the statue of the hero on the base of the column, following out the example of Sir Christopher Wren?—I think so; for that altitude would allow the interesting contemplation of the features an person of the hero, and *render a secondary statue unnecessary*. The height would preserve it from accidental injury, and the projection of the cornice protect it from the weather.

Of what material would you recommend its construction?—Of stone; for of the tens of thousands of bronze statues which embellished ancient Greece and Italy, ACCIDENT alone has preserved to our time scarcely half a dozen. The statues which adorned the summits of the columns of Antonine and Trajan, are probably now circulating among the populace of Rome, under the degrading form of Roman baiocchi; we know that that of Henry the Fourth from the Pont Neuf, transformed into pieces of two sous and stamped with the emblems of revolutionary France, forms the common medium of traffic of the Parisian vulgar. No memorial intended to convey information to posterity, should be formed of a valuable and convertible material;—and, with such examples before him, who will be bold enough to say the Pitts and the Foxes, the Wellingtons and Nelsons, of our time, will arrest what seems to be the course of nature.

Upon this basis I have formed my design.

"Si quæris descriptionem, aspice."

MODEL No. 7, and DESIGNS Nos. 73 & 74, *John Goldicutt, F. R. I. B. A.*—Addison, in his work upon medals, produces one of Britannia seated on a winged globe, holding in her right hand a Roman standard, (S. P. Q. R.) This medal was struck in honour of Antoninus Pius, who extended the boundaries of the Roman province in Britain.

There is also in Addison's work a medal of Marcus Aurelius Antoninus, successor to A. Pius, representing Italia seated on a celestial globe; for it exhibits a section of the zodiac, and is studded with stars, probably struck in honour of the Quadi, Parthians, &c.

Allegorical figures standing on spheres, or holding a ball in the palm of the hand, are of the most ancient date; perhaps the medal Eternitas struck by Ant. Pius, is one of the finest: it represents a matron holding in her right hand a globe surmounted by a bird having a radiating crest.

From the Romans having placed Britannia and Italia reposing on spheres, there is classical authority for choosing such a basis for a statue of Nelson, the hero of an hundred battles.

The sphere, which is posited so as to bring Britain on its zenith, is 30 feet diameter; the statue of Nelson 13 feet high; the entire base 25 feet. From the base line to the crown of Nelson's head the whole is about 70 feet. This altitude will be in accordance with the adjacent buildings, and especially the National Gallery, which measures 50 feet from the base line to the apex of the pediment. The diameter of the monument across the bastions which support the allegorical figures measures 40 feet.

An elevation such as this possesses the advantage of bringing the colossal figures fully into view to the public eye, and every feature can be traced. Moreover, upon a sphere the figure is thrown out in a manner not to be achieved were it placed upon a column, in which, from the continuity of the shaft, and the figure terminating that continuity, there is less of attraction and imposing grandeur than in a massive globe, a geometrical figure characteristic of stability and strength; and therefore, in every respect, if we may be governed by the taste of the Antonini, indicative of victory and peace, and of the power of that country whose "flag for a thousand years has braved the battle and the breeze." From the National Gallery to the statue of King Charles, the ground slopes about 16 feet. It is proposed to lower this ground from the National Gallery, to such a level as would give perspective elevation to that building, the Church of St. Martin, and the College of Physicians. This would be accomplished by a terrace on the south side of the road skirting the front of the National Gallery, and which would be carried partially along the east and west flanks of the square southwards. The quadrangle thus levelled would confer perspective elevation also on the monument, and be better adapted to its adjuncts and accessories. The base on which the sphere rests is surmounted by allegorical figures. Fame, Neptune, Victory, and Britannia, occupy the east, north, west, and south points of the base; on the lower section of which tablets appear in these cardinal points inscribed with the words Nile, Copenhagen, Trafalgar, and "England expects every man to do his duty." Thus, beneath Fame, to the east, the Nile; beneath Neptune, to the north, Copenhagen; under Victory, to the west, Trafalgar; and Britannia, after the medal or national coin, sits over the last words of the hero. Beneath these entablatures the masonry of the base indicates stability, and allows the eye to rise gradually, first to the allegorical figures, in the midst of which the sphere rests in its own simple grandeur, leaving the colossal figure of the hero disengaged and entire. A circular area extends 60 feet from the base, which, being paved and surrounded by a ballustrade, may serve the purpose of private promenade to view the monument, or be made a permanent sheet of water which the adjacent mains may supply. This water would be in character with the profession of Nelson and of his country, giving besides to Trafalgar Square, a great degree of municipal comfort; for whether we view this water as an ornament, or physical agent conferring salubrity on the atmosphere of a city, there can be but one opinion respecting its adaptation to the design it surrounds. It is proposed to construct the sphere of polished granite or bronze, and the whole to be polished to resist the effects of smoke and atmosphere; and that access be had to the interior of the monument, where a chamber and other depositories should be constructed, to contain the busts of illustrious persons distinguished by acts of valour, and where thousands who visit this great metropolis may be admitted to inspect the same,—drawn to the object by the display of a building of massive grandeur, unique in character, and interesting in effect.

MODEL No. 13, *M. L. Watson.*—The design is an oblong pedestal supporting a statue of Nelson, and surrounded at the base by allegorical groups of figures. The first group represents a nymph rising from the ocean at the command of Neptune, with a wreath of laurel, whilst Britannia directs the attention to the hero for whom it is destined. On either side are the victories of the Nile and Copenhagen. The fourth group is designed for the victory of Trafalgar, with peace and power. The whole subject is raised on a platform, on the four angles of which are placed the different oceans in which Nelson distinguished himself. Throughout the composition I have endeavoured to convey boldness, energy and grandeur, and to impress on the mind the stirring character of the British navy. My original sketch for this design, will be found among the water-colour drawings, unaltered since the first competition.

The architectural parts of the design are proposed to be executed in granite, the sculpture in bronze. Height 120 feet; width 64 feet.

MODEL No. 17, *Frederick Claudius J. Parkinson.*—The height of the obelisk, with pedestal and substructure to the surface of the ground, to be 145 feet.—The extreme length of the monument, 120 feet. The height of Nelson to be 12 feet, and the other figures in proportion, as shewn in the model. On one side of Nelson stands Britannia; on the other, Victory. In the semicircular recesses are deposited the arms of the subdued nations, in commemoration of the victories achieved; the captives being guarded by the British lion.—On the opposite front of the monument, is placed a sarcophagus, with angels protecting the tomb of Nelson; above the sarcophagus are affixed the arms and mantle of the hero.—The sides represent the prows of ships, with various other nautical emblems.—The obelisk is surmounted by the shield of Britannia and the British ensigns.—Various other emblematical figures and trophies are shown in the model.

The sculpture executed in bronse, will amount to the sum of	16,000	0	0
The monument, composed of the best granite, will cost .	12,600	0	0
	£28,600	0	0

MODEL No. 19, *William Groves.*—In the rudely embodied idea, bearing my name, I have endeavoured to place before the noblemen and gentlemen of the committee, a composition which should appear at once triumphal and monumental, and therefore presenting the character which an Englishman attributes to a sacred edifice—while, from its simplicity of outline it should not clash with the surrounding buildings.

The monument is surmounted by a group representing Strength rearing, and Wisdom and Justice supporting the Admiral's flag. Immediately beneath at the angles are the four winds, Zephyrus, Notus, Apeliotes and Boreas, with their respective attributes, publishing to the four quarters of the globe, the glory of the hero, who stands on an elevated pedestal beneath, in front. On his right is Britannia, who has just embossed the name of her favourite on her shield, thus converting it into a Ægis for future war. On his left is the wingless victory of the Athenian, which I have selected as the most applicable to the hero, whom she never quitted.—At the back in the centre, is commerce seated, her right hand resting on a trident, her left on a sphere, (indicative of her influence over sea and land,) and her foot on a rudder. On one side of her is the genius of the Torrid Zone, and on the other the genius of the Temperate Zone, surrounded by the emblems of commerce, and depositing the produce of their respective climes at her feet. On the pedestals at the sides, I propose putting the hero's arms, and above them inscribing the names of the officers, his companions in victory. In the front and two side panels in the base, are reliefs commemorative of his great victories. *Copenhagen.*—Neptune ordering the British Flag to be reared in triumph on the ocean. *The Nile.*—On the left the Nile; behind, the genius of Alexandria advancing with extended arms to welcome Britannia, who, accompanied by the lion, is standing on the broken and prostrate eagle of France. *Trafalgar.*—A sarcophagus bearing the hero's name; the genius of death about to deposit thereon a wreath of laurels; a weeping warrior is seated at the base of the sarcophagus, and at the sides are the flags of France and Spain. In the back panel would be particulars of the erection of the monument. On the four projecting portions of the base, four lions. The figures to be 15 feet high, and executed in bronze; the building in granite, and the total height of the monument from the ground line to the top of the flag staff to be 120 feet. The whole cost would be 30,000*l*.

Model No. 21, *Charles Fowler, Architect, and R. W. Sievier, Sculptor.*—The composition presented by the accompaning model is intended to combine architecture with sculpture; in order to obtain a more striking effect from their union, than either is calculated to produce separately: the one by its form and mass being calculated to arrest the attention and make a general impression, which may be heightened and perfected by the more refined and interesting details of the other. With respect to the first it may be observed, as the result of existing instances, that a mere structure cannot properly convey the feeling, or produce the effect required in the erection of a monument to commemorate any celebrated character or event; whilst, on the other hand, a statue or group of sculpture is ineffective for want of mass, and distinctness of form and outline: the former is appreciated only as a distant object, and the latter on close inspection. The object therefore has been to combine the advantages peculiar to each art, so that the many who pass along may be struck with the general aspect of the monument; and the few who may pause to examine its details, may find their first impressions carried forward and perfected by the beauty and significance of its historical illustrations.

With respect to the design now submitted, the endeavour has been to render it characteristic and appropriate; avoiding plagiarism, but without affecting novelty. The rostrated angles of the pedestals and the accompanying decorations determine its character as a naval trophy; whilst the basso relievo and other parts of the sculpture plainly tell of the hero and his achievements.

In regard to the structure it will be seen that the basement is distinguished by plainness and solidity; and it is proposed to be formed entirely of granite in very bold masses. The couchant lions on the angular pedestals are to be of the same material, but of a different colour.

The colossal figures seated against the four fronts of the pedestal represent Britannia, Caledonia, Hibernia, and Neptune; Britannia accompanied by couchant lions, and Neptune reclining on a sea-horse, 23 feet in length; under which is the entrance to a winding staircase, by which parties can have access to the gallery.

The die of the pedestal contains on its south front an inscription, briefly recording the fame and achievements of Nelson; and on the north front a few simple historical facts relating to him, and the erection of the monument.

On one side is a medallion containing the head of Nelson; in order that the lineaments of his countenance might be brought more distinctly within view, the statue being so much elevated: and on the other side are his armorial bearings.

The central compartment of the elevation has the dado or lower part inscribed with the names and dates of his four principal actions; and in the panel over each is a representation in basso relievo of some striking incident in each battle:

First.—Cape St. Vincent. When "on the quarter-deck of an enemy's first-rate he received the swords of the officers, giving them one by one to William Fearney, one of his old Agamemnon's, who, with the utmost coolness, put them under his arm."

Second.—At the Nile. "After his wound was dressed he was now left alone, when suddenly a cry was heard on the deck that the Orient was on fire. In the confusion he found his way up, unassisted and unnoticed; and, to the astonishment of every one, appeared on the quarter-deck, where he immediately gave orders that boats should be sent to the relief of the enemy."

Third.—Copenhagen. "A wafer was given to him; but he ordered a candle to be brought from the cockpit, and sealed the letter with wax, affixing a larger seal than he ordinarily used. 'This,' said he, 'is no time to be burried and informal.'"

Fourth.—Trafalgar. "Hardy, who was a few steps from him, turning round, saw three men raising him up.—'They have done for me at last, Hardy!' said he.—'I hope not!' cried Hardy.—'Yes,' he replied; 'my backbone is shot through.'"

The latter occupies the front, and displays at once the climax of his achi vements, and the termination of his brilliant career.

The gallery above is supported on cannons, in lieu of the usual architectural consoles, and the intervals in the soffite are enriched with bombs and grenades instead of rosettes. The railing of the gallery is composed of decorations and emblems having reference to the object of the monument, thus combining ornament with characteristic expression.

The upper compartment changes into the circular form, and is more fully charged with decoration illustrative of the honours which Nelson achieved. The four large wreaths encircling the pedestal contain respectively the naval and mural crowns, the viscount's and ducal coronets; beneath which are suspended the decorations of the four orders conferred upon him by their respective sovereigns.

The frieze of this pedestal is entirely occupied by the heraldic motto, which is peculiarly expressive and appropriate. The ornaments surmounting the cornice, which are analogous to the Grecian antefixæ, are composed of escallop shells; and the cupola is to be of copper gilt.

The statue of Nelson crowns the whole, and is to be executed in bronze, about 16 feet in height. The entire height of the monument, including the statue, will be 128 feet from the area of the square, being 19 feet more than the York column.

The structure, with all its decorations and accessories, to be completed in the most perfect style for the sum of 25,000*l*.; and ample security will be given for the due accomplishment of the undertaking for that amount.

Model No. 29, *Patric Park.*—Allegory, and particularly the old allegory of Neptune, Tritons, nymphs and sea-horses, can only be used in commemorating a man, whose virtues are unknown, or problematical. In a monument to a man like Nelson, such cannot be tolerated.—The character of man, is *stamped* on his counteuance, and proved by his form.—On this just principle, which is the vitality of true sculpture, I have based this design. I illustrate, by form and expression, in single statues and groups, the characteristics of Nelson, as thus:—his ardent youth—his hopeful contest in the West Indies—his daring manhood under Sir John Jervis—his heroic struggle at the Nile—his piety after that glorious victory—the applause of the world—his resolved character at Copenhagen—his death at Trafalgar—the sorrow of his country.—These characteristics claim our veneration, and sculpture hails with enthusiasm a character so congenial to her pure and sublime genius.—The obelisk is used as a sign post to attract attention to the sculpture.

The height is 95 feet; the statue of Nelson is 16 feet; the illustrative statues are 11 feet; and the groups of the proportion of 7 feet. All the sculpture to be executed in Ravaccione marble; the obelisk, &c. in freestone; for 30,000*l*.

Models No. 32 and 168, *S. Manning, Sculptor.*—A column representing the British state, founded on a rock; on one side of the base Nelson is receiving the trident from Neptune, accompanied by other sea divinities; on the other, he is dying in the lap of victory. The column is surmounted by a figure of peace.

Statue of Nelson 12 feet, monument 100 feet high. To be executed in bronze, marble, and granite, &c. Probable estimate under 30,000*l*.

Model No. 37, *William Pitts.*—Grandeur and simplicity have been the objects of attainment in this model. As a colossal statue he is raised overlooking the city which his judgment and valour have preserved, and his immortal memory is a glory to its prosperity.

The statue of Nelson is proposed to be 30 feet, the pedestal and steps about 60 feet, the entire height of statue, pedestal, and steps, 90 feet. The statue, lions, and subjects, in the panels, to be executed in bronze, the pedestal and steps in solid blocks of granite; to be completed in the best style of art, for the sum of 30,000*l*.

Model No. 38, *J. G. Lough.*—In the model I now have the honour of submitting to your inspection, my great aim has been to render it perfectly simple, and at the same time purely Nelsonic; with this view the four subordinate figures I have kept four feet smaller than the statue of Nelson, and have so interwoven them with the form of the pedestal, that is to say, adapted them to the curve of the pedestal, that the eye is carried to Nelson at once. I trust you will find that in this design architecture and sculpture are completely blended; an effect which could never be produced by a number of scattered figures; and in the monuments we have handed down to us of the best ages of the Egyptians and Greeks, we univertally find this point has been strictly attended to.

I propose that the monument should stand 40 feet high, the pedestal to the base on which Nelson stands being 24 feet, and Nelson 16 feet, whom I have represented in a boat cloak, holding a telescope, as emblematic of his constant vigilance. I have chosen the above-mentioned height as one at which the features of Nelson may be clearly recognized, and also as being peculiarly adapted to the intended site. The four lower figures are intended to be 12 feet in length, raised 8½ feet from the ground; they are meant to represent sailors—and I have adopted the costume at the moment of action, it being more sculptural. My idea of a monument being to make it national and intelligible to all classes. I have studiously avoided allegory; I have introduced such attributes as I thought would not interfere with the general outline. The two sailors in front are holding flags, supposed to have been taken in battle; the pensive one to the right holding that of Trafalgar, and the one on the left that of the Nile. The bassi relievi on the pedestal are intended to be cut in intaglio in the granite in the Egyptian manner, as my great object has been to produce a great whole and to preserve the general outline. The whole to be built of granite, except the five figures, which, with their attributes, would be in bronze—materials which would last as long as time; and with a view to its duration I have carefully avoided all paltry ornament and trifling mouldings; I have also abstained from the introduction of fluid—a thing always guarded against by the ancients, as a violation of the laws of sculpture. As it regards the cost, I have confined myself within the limits named by the committee.

MODEL No. 39, *E. H. Baily, R. A.*—An obelisk raised to the memory of Nelson by his grateful country. At the base, our great naval commander is represented supporting the imperial standard; on his left stands the genius of Britain, hailing with affection the hero of Trafalgar; his attendant, Victory, being seated on his right. At the back of the obelisk rests the Nile—Neptune with the subordinate deities of the ocean, form a triumphal procession round the rock on which the monument is placed, thereby indicating that the victories of Nelson were as extensive as the element on which he fought.

The height of the monument is intended to be 80 feet; the diameter of the steps the same extent, and the height of Nelson to be 9 feet; the other figures in proportion as in the sketch. To execute the whole monument in Ravaccioni marble, (the same as the arch before Buckingham Palace is built of,) 22,000*l*. If executed in bronze, 30,000*l*.

MODEL No. 40, *E. H. Baily, R. A.*—On four projecting parts of the base are four sea-horses, indicative of the element on which the hero's battles were fought. On three sides of the base are three colossal emblematical figures of the Atlantic, the Mediterranean, the Baltic; and on the fourth, that of the genius of Britain. Above these figures are four projecting antique prows, and still higher, four figures of victory linked hand-in-hand and facing the four quarters of the globe. On the summit stands the statue of the immortal hero.

The cost of erecting this monument would be from 25,000*l*. to 30,000*l*., according to the magnitude of the figures.

MODEL No. 41, *Patric Park.*—In this design, I devote one group of a victorious hero, 20 feet high, in honour of Nelson's deeds. The statue is 30 feet high; on one side of which, Manhood mourns the death of Nelson; on the other, Honour is consoled by the glory and triumphs of Nelson. Executed in Ravaccione marble; pedestal, &c., freestone; 30,000*l*.

MODEL No. 45, *J. Harrison, of Chester.*—In designing a memorial to Nelson, I have at the same time endeavoured to arrange a temple to the navy, suitable in its style to the general architecture of Trafalgar-square; and from its mass, or elevation, not appearing to take from the importance of the Gallery, or attempting to rival St. Martin's spire.

In the centre of the interior is erected a colossal statue of Nelson, around which are receptacles for the statues of future naval heroes as they arise. The 16 statues under the porticos are of the admirals of England, with the panel above each of them filled with bas-relief, illustrating the principal feature of their professional career. The sculptures in the tympanums of the pediments, and in the compartments of the base of the obelisk, are intended to carry out a biography of Nelson. And (if the funds permitted) to complete the design, the metopes in the frieze should be filled with sculpture, conveying a history of the navy (after the manner of the Parthenon). The whole surmounted by the obelisk, bearing in letters of gold on its imperishable sides to the four winds, the future watch-word to naval greatness. The four colossal figures, at the angles of the middle terrace, are symbolical of the Nile, Copenhagen, and Trafalgar subdued, and Thames triumphant. The crocodiles and lions are to be fitted up as fountains, to play on the anniversaries of naval victories, having the name of the victory hung in the panel over the four doorways. The space under the terraces are intended as vaults for any useful purpose, to be approached by doorways in the breast walls at the lower side of the square, which will admit of another flight of steps to make up for the dip of the ground.

The height to the apex of the obelisk is 100 feet; and, consequently, about 20 feet higher than the centre dome of the National Gallery. The height of the pediments is about 17 feet lower than that of the gallery; and the extreme width, from outside of columns, is about 17 feet wider than the centre portico of the gallery. The building, with its relievi's and statues of the admirals, it is proposed should be executed in one of the approved freestones of the country; the statue of Nelson in marble, and the symbolical figures, with the crocodiles and lions, in iron. The cost of the whole will be 50,000*l*. The model is worked to a-fourth of an inch scale.

MODEL No. 46, *Henry Case.*—In composing such a monument, to be placed in Trafalgar-square, there are many difficulties to be surmounted, in addition to that, of doing justice to the achievements of so great a man.

The large space to be filled, demands considerable extent and importance, in the design itself, while the general effect equally requires, that this shall be obtained, with as little obstruction as may be possible, to the view of the surrounding buildings. These objects combined, seem more easy of attainment, by adopting, as the characteristic of the design, the graceful and towering, rather than the massive and severe, taking care that the solidity and repose, so indispensable to greatness, be not lost.

The character of the place, (one of the gayest thoroughfares in London), also suggests a similar design. Art will be more effective when it avails itself of feelings already half formed, and strives to direct them to noble ends, than when it attempts to force them into other channels:—and in the temple, on the mountain, or the sea-shore, a hero's monument, should induce reflection, and impress by solemnity, but in the more busy and crowded parts of a city, where a thousand hurry past, for one who stops to think, it should address itself to emulation, at once, without the intervention of thought, possessing however, that which shall satisfy the mind of the more attentive beholder.

Again,—whatever the mental character of the man, gaiety cannot surely be misplaced, in a "Memorial of the Achievements" of one whose life was a succession of victories. If these ideas be correct, that design will be best adapted to the circumstances, which is most calculated, to excite, at a glance, in the thoughtless idler, or hurrying man of business, the desire, by a life like Nelson's, active and honourable, to win honours like his, from a grateful country;—which by its sculptures and inscriptions, shall tell, to the observant, more striking features of his life and character;—which shall leave on the minds of all the impression of a monument appropriate to a naval hero, and worthy of a Nelson;—and shall combine with these qualities, the indispensable conditions, that it shall assist the effect, of the surrounding buildings, and be in its dimensions of sufficient importance to occupy the most magnificent site in the metropolis.

This is the arduous task which has been attempted in the design now submitted to the committee, and for the accomplishment of which a Corinthian column appeared to me to offer the greatest facilities.

The column, with its pedestal, stands on a platform of an elevation of 14 feet 6 inches, at the angles of which are triumphal stelæ, 5 feet 6 inches in diameter, and rising 16 feet from the platform: they support the naval and mural crowns, the ducal and viscounts' coronets, proposed to be in metal gilded.

This is placed on a terrace 140 feet square, 6 inches higher than the ground immediately opposite the centre portico of the National Gallery. At each angle of the terrace is a trophy of sea-horses and flags, (proposed to be executed in bronzed metal, or black marble,) on a cippus surrounded with wreaths, inscribed with the dates of the numerous minor engagements in which Nelson was concerned; the pedestal of the column being reserved for the great actions. In each front are two lions, flanking a flight of steps 60 feet wide. The cippi are 12 feet 6 inches in diameter, and the lions are 7 feet high, from the blocks on which they are placed.

The pedestal of the column is rectangular on plan, its sides slightly inclined and panelled for the reception of relievi; over which are inscribed the names of the victories celebrated and Nelson's flag-ships: St. Vincent, Captain;—Nile, Vanguard;—Copenhagen, Elephant;—Trafalgar, Victory: these and the other inscriptions, are shown in the perspective view.

The podium of the platform bears on one side,—"England expects every man to do his duty;"—on another,—"Westminster Abbey or Victory;"—on the third,—"I have done my duty, I thank God for it;"—and the fourth is reserved for an historical inscription.

The column rises over four prows, issuing from a frieze, 3 feet in height, (emblematic of the sea,) and a plynth bearing the motto, "Palmam Qui Meruit Ferat." The base of the column is cabled. The capital was composed after a minute study of four of the most beautiful capitals Greek and Roman art has left us; I have endeavoured to collect their beauties and produce a whole more adapted to an isolated position than the ordinary Corinthian capital, and at the same time more easily executed on a large scale.

Over the column four Tritons support a Tholus, on which stands the statue of the hero, 17 feet 6 inches in height; in construction the support of the figure is independent of the Tritons. This part forms a lantern of observation, and from it the surrounding scenery may be viewed in every direction. The figure does not stand on a point, but on a circle whose diameter is more than one-third the height of the statue.

It is proposed that on the south, east, and west of the monument, the site should be reduced to a level, three feet higher than the ground at its lowest part, to form an extended base to the whole monument. This would make the levels, which at first appeared a disadvantage, a means of obtaining a considerable effect: on the south there would be two steps, each 1 foot 6 inches in height, broken at proper distances with blocks for candelabra, and with a flight of steps in the centre; on the north, a retaining and low parapet wall would place the National Gallery on a terrace; while on the east and west of the monument from an area 180 feet by 80, a flight of steps 30 feet wide, would give access to the upper level immediately opposite to each of the wing porticoes of that building; producing unity and the idea of purpose; and the repose on either side would heighten the effect of the monument. This is illustrated, and its effect shown in the general plan and perspective view.

If it should be thought desirable, a gallery, (a plan and section of which is shown,) for the reception of paintings, models and sculpture, (with a room for a keeper), may be obtained under the platform of the column. The gallery would be 12 feet high, and 16 wide, and have a total extent of 120 feet; larger dimensions might be obtained, but the keeping the platform within the smallest possible limits, seems of paramount importance; it would be lighted by skylights unseen from without. The entrance to the monument is also entirely screened from sight.

PRINCIPAL DIMENSIONS.	Ft.	In.
Height to the upper platform	14	6
———— base of column	50	6
Height of column including base and capital	118	0
Entire height	207	0
Entire height of the London Monument	202	0
Entire height of the Duke of York's Monument	137	9
Diameter of the proposed column	13	0
Extent of terrace	140	0

The entire cost of the monument, the masonry of granite, and of the best workmanship, would be 30,000*l*. It is proposed to introduce gilding in parts, as shown in the perspective view. In the drawing I have omitted the victories on the prows, as they appeared somewhat to detract from simplicity in the design; they are however retained in the model.

The time and labour I have bestowed on this design, to obviate the objections urged against a column as a monument, will I hope, offer sufficient apology for the length at which I have found it necessary to describe it.

MODEL No. 50, *Samuel Nixon.*—In monuments, it appears to be extremely desirable that the individual in honour of whom it is erected should be conspicuously pointed out; that his figure should in fact be the monument, and that all else should be merely accessory to that main object. The artist has therefore so composed this design, as that the eye shall almost involuntarily fix itself at once upon the statue; and he has endeavoured to represent the hero in that calm and dignified attitude, which appears to be best fitted for a monumental structure.

To denote his country, a group of statues representing Britannia exultingly rising from the waves, supported by Freedom and Order, is placed in front; to mark the scenes of his triumphs, the Atlantic with the Tagus and the Gulf of Bothnia, and the Mediterranean with the Nile and the Tiber, enrich either side; and, especially to point out that deep sense which he entertained, of having been raised by Providence to scourge and to subdue the enemies of his country and of social order, the Fates are represented as weaving the tissued thread of his career. The plinth course is proposed to be decorated with bassi-relievi of his achievements.

Model No. 51, *Richard Kelsey and Samuel Nixon*.—It appearing to be very desirable that the monument, and its accessories, should be made to appear a component part of the original design for the National Gallery; in the general arrangement of the whole area, this object is kept in view, and it is proposed that the ground should be excavated to the point of lowest level, that the retaining wall on the north side should form one terrace line, and the centre be occupied by a wide ascent, or scala regia to the National Gallery.

It is suggested that the steps should be bounded on either side, by a tier of colossal lions only, or of monuments to distinguished naval commanders, in which colossal lions should bear a prominent part; and it is anticipated that such an avenue would not only, in itself, be magnificent, but lead the eye gradually forward to rest upon the portico of the Gallery, and bring it into the picture. It is proposed that in the centre of this avenue, an enlarged, but exact model of Pompey's Pillar at Alexandria, should be erected; that the statue of Nelson should be placed in front of it, so as to be distinctly visible; that his achievements and those of his brother officers should be sculptured in basso relievo upon the sub-plinths which support the column; that the pillar should be surmounted either by a Victory or a Britannia; and that the whole should be made to form one majestic trophy, in that style of simple grandeur which best accords with the character of all great men.

It is conceived that not only do the simplicity of its composition, the gracefulness of its proportion, and the artist-like breadth of its foliage, render it peculiarly applicable for such a purpose; but that the circumstances of his first great victory having been achieved almost at its very foot, of his title being indissolubly united with Egypt, of the familiar acquaintance which mariners of all European nations have with it, and of the facility with which they might recognize and hail it as an old friend; appear to point it out as more appropriate for a memorial of "Nelson of the Nile," than any other example of ancient art, or any column composed by a modern architect could possibly be.

Designs Nos. 57 and 60, *Walter L. B. Granville*.—The triumphal column I propose as a memorial to Nelson is of the Corinthian order, after the ancient remains of the Temple of *Jupiter Stator* at Rome, which Palladio considered to be superior to any work he had ever seen, and anterior to the temple of *Mars Ultor*. It rises on a sub-basement to the height of 218 feet, including the statue.

The entire shaft is of cast-iron, composed of 26 courses of a proper thickness, and 111 ft. 3 in. high. It rests on a square pedestal, the die of which is 23 feet wide and 19 feet high; and this again upon an octagonal sub-basement, 19 feet above the ground, covering an area of nearly 32,000 square feet. The base of the shaft and the capital are cast in brass. The former is 6 ft. 9 in. high, the latter, 14 ft. 9 in. From the top of the capital, a round pedestal 15 feet high, made of cast-iron, and ornamented with brass festoons, supports the statue of Britannia Tonans standing on a globe, hurling the thunder-bolts as emblems of naval power with her right hand, and holding in her left hand the sceptre of the sea. This figure, typical of the pre-eminence of Great Britain on the ocean, has been deemed a more appropriate termination to a lofty column raised to the glory of the first naval commander that ever lived, than the statue of the hero himself, whose lineaments could not be perceived at such an elevation. It was consequently substituted for the latter. It will be 25 feet high, and it is proposed to make it of cast-iron gilt, or of yellow bronze, like some of the most recent monuments erected on the continent.

The pedestal of the column, 36 feet in height, is of masonry and solid stone, cased in by statuary marble; of the latter material are the four sides of the die, at the angles of which four colossal cariatids, in marble, stand to support the massive cornice and ornaments of the pedestal. They represent, by appropriate emblems, the figures of Spain and Denmark weeping over the defeat of their navies, and of the genius of Cape St. Vincent and of the Nile, as witnesses of the two great naval fights bearing those names. Resting on each angle of the cornice of the pedestal is an ancient rostrum, to give character to this great naval column, and rich hanging festoons link the four rostra together; all which ornaments are to be of brass. On the south face of the die the hero himself, seated in the triumphal chair of state, holding the truncheon of command, and having just received from his country the imperishable laurel, occupies the centre. He is clad in classical costume, and by the well-known lineaments of his countenance, carefully preserved by the sculptor, and placed within reach of the eye, will remind the beholder of the cherished object of this monument. On the broad plinth of the pedestal, however, and within a wreath supported by Victories, the name of Nelson is inscribed. The east and west faces of the die will represent, in alto relievo, the battles of the Nile and Copenhagen; while on that of the north side, over the entrance door, the closing scene of Nelson's immortal career, will present its naked and impressive truth to the multitude that daily passes in front of the National Gallery. The sub-basement, of an octagonal form, is enriched with 24 projected blocks close to the ground, intended to serve as plinths, to receive, hereafter, the statues of those naval commanders who most distinguished themselves during the last protracted war; or short pedestals, with the colossal busts only of such commanders, might be substituted for the statues on the blocks in question. A space is left between each statue on the faces of the octagon, whereon to inscribe the name, and a short epitome of the deeds of those commanders. In its interior, this octagonal sub-basement offers four spacious rooms 41 by 25 feet each, and 19 feet high (besides smaller apartments for the accommodation of keepers), which being well lighted from the top present an excellent opportunity for forming a naval library, and gallery of pictures. The shaft of cast-iron is 13 feet 6 inches in diameter close to its base, and under the astragal 11 feet 4 inches. A band 4 feet wide, beginning at the base of the shaft, rises spirally to the height of 62 feet, developing a superficial length of 724 feet of cast-iron bas-reliefs, representing the Fasti of Nelson, and those of the naval history of Great Britain connected with his career. The figures will be 3 feet high. The flutings of the shaft descend from below the astragal to where the spiral terminates. A light geometrical staircase of wrought iron, 3 feet wide, runs all the way from the ground up to a door in the round pedestal which supports the statue. The door opens into the upper part of the capital, so arranged as to form a gallery for the visiter,—thus avoiding the usual unsightly appendage to insulated columns of a top railing which disfigures the abacus in most of those monuments. The staircase will consist of 365 steps of very light construction, and be lighted by loop-holes, or *soupirails*, placed in different parts of the spiral band as well as among the flutings. The great entrance door, at the north side of the octagonal sub-basement, will be seven feet high by three feet and a half wide; and will afford immediate access to the staircase, through a spacious waiting-room.

To this description I have only to add that I have selected iron as the material for my column, because it is the emblem of strength—because it may be supposed to proceed from the iron cannon captured by the hero to whom the column is erected—because it is not only the most abundant metal found in Great Britain, but also that in the working of which the English has outstripped every other nation—lastly, because the use of iron for so gigantic a structure, offers the character of originality, and the more important quality of economy. The Prussian and the French governments have felt the truth of this, and while the former raises pyramids and obelisks in cast iron, the latter is now occupied in erecting colossal fountains in the *Place de la Concorde*, with the figures made of cast iron.

Since my first proposition of a cast iron column, objections have been started against the employment of that material, on the grounds, first, of its being of an easily oxydizable nature; second, of its being likely to be struck and damaged by lightning. The latter ground, I am happy to state, is considered by some of the first philosophers in this country, who have been consulted on the subject, to be purely imaginary. On the contrary, as the iron shaft from its apex will be continuous down to the ground,—should the electrical fluid be at all attracted by the column, the fluid will be transmitted, as in the case of the ordinary protecting rod on the top of houses, to the earth, and there dispersed in silence. As to the first ground of objection, that of the easily oxydizable nature of iron, it is happily done away with by the most recent discoveries of chemistry. Many are the processes now in use for protecting the surface of iron in the most effectual manner; and without entering into the most scientific of these manipulations, it may be stated that the preparation employed by the Prussians in all their public monuments of cast iron, has hitherto preserved them most completely.

RECAPITULATION OF THE SEVERAL MEASUREMENTS OF THE NELSON COLUMN.

	Feet.	In.
Sub-basement	19	0
Pedestal	36	0
Base	6	9
Shaft	111	3
Capital	14	9
Meta	15	0
Statue with the globe	25	0
Total	217	9

ESTIMATE.

It was proposed to erect the former column for the sum of 25,000*l.*; but in consequence of the increased quantity of sculptured marble in the pedestal, and the addition of the sub-basement in the present column, the sum required will be 29,500*l.*

COMPARATIVE ALTITUDE OF TEN TRIUMPHAL COLUMNS IN EUROPE, INCLUDING THE INTENDED ONE TO NELSON.

	Feet.	In.
1. Duke of York (London)	123	6
2. Earl Grey's Column (Newcastle)	134	0
3. Place Vendome (Paris)	136	0
4. Alexander Column (St. Petersburg)	144	0
5. Trajan Column (Rome)	145	0
6. Colonne de Juillet (Paris)	148	6
7. Antonine Column (Rome)	150	0
8. Melville Column (Edinburgh)	150	5
9. City Monument (London)	202	0
10. Nelson Memorial (London)	217	9

Design No. 64, *Thomas Bellamy*.—The erection of a memorial to the hero of Trafalgar being at length determined upon, the country will doubtless ere long be enabled to look upon a monument worthy alike of Nelson and of the arts; and honourable to that national feeling which, after the lapse of 33 years, is now awakened to record imperishably his brilliant exploits.

The columnar form from the time of Duillius (the first naval hero to whom the Romans decreed a monument), through those of Trajan and Antonine down to our own day, has generally been adopted whenever a monument has been required of colossal dimensions, and is consequently most favourably associated in the public mind; but, notwithstanding this association, and the intrinsic beauty of the column when of good proportion, its fitness is questionable when applied as the isolated pedestal of a statue.

The proximity of Trafalgar-square to the York column renders it highly important that any monument to be erected there, should be essentially distinctive in design from that monument. That monotony may be avoided, and something new in art produced.

Much has been said on the injurious effect which any object erected near the National Gallery would have upon that edifice, if the parts of which that object might be composed were to be larger than those of the Gallery itself, but this could only apply if the parts of the Gallery possessed magnitude, or approximated to that quality, which is clearly not the case. Its facade would in truth be benefitted by any monumental object that should present a marked contrast to it in scale and character.

The simple form of the obelisk when magnitude is taken into account, renders it, next to the pyramid, perhaps the most imposing of all forms; and it would be difficult to point out a situation better suited for its adoption than Trafalgar-square, where contrast with existing forms, masses and materials is most necessary.

The obelisk of the accompanying design is 96 feet high, and 12 feet square at its base, being larger than that before the Lateran church at Rome. The author had conceived the idea of procuring it of one block from the granite quarries of Ilyter, but the funds announced as available for the memorial are too limited to allow of more than mention being made of the idea. The memory of Nelson would perhaps not be unfitly recorded by a form which had its origin on the banks of that far-famed river, at the mouth of which he won one of the brightest of his laurels. The tridents, ships, and victories on the bases of the obelisk, and on the obelisk itself, are sunk below the surface of the granite, as are also the words—Nile,—Copenhagen,—Trafalgar,—and, the signal to the fleet on the day of the last quoted battle, "England expects every man to do his duty;" with which each face of the uppermost base of the obelisk is respectively charged. This design might be executed for 28,000*l.*

Design No. 67, *George Foggo.*—Round the mainmast of a man-of-war are piled trophies of Nelson's valour—mute ponderous cannon, silent musketry, &c. In front the hero receives additional tokens of success—the swords and banners of humbled France and Spain; but beneath, in the base of the monument, a bas-relief, in form of a ship's hull, represents the Conqueror of Trafalgar death-struck—passing to immortality. The word "*Victory*" inscribed over the scene of triumph, and against that of death "*Westminster Abbey*," remind us of his vigorous—almost prophetic—eloquence and enthusiasm. At the mast-head (decorated with three crowns of sea-weed) a British Tar proclaims the glorious victory. On either side is seen a figure in action, intended to represent some renowned companion of Nelson's prowess; and reliefs of the Nile and Copenhagen will complete the exterior.

The ornaments consist entirely of objects obtainable at sea, and characteristic of our navy and its illustrious leader, who dared beyond the rules of art. Objects that savour of preparation, and partake not of enthusiastic impulse, and likewise the mystic visions of antiquity, have been discarded for the more terrible features of modern warfare.

The interior of the basement will afford well-lighted space for fifteen or twenty bas-reliefs or pictures, commemorative of our navy's gallantry.

The height proposed is about 160 feet, which from its prominent position, and the effect of perspective, will appear lofty among surrounding objects; the principal figures about 12 feet. At that proportion the monument can be well executed in stone far more durable than Italian marble, under 25,000*l.* A real mast of a line-of-battle ship would be most suitable for the upper shaft, and bronze may with propriety be applied to various decorations.

Design No. 68, *Carl Tottie.*—The colossal statue of the hero (27 feet 9 inches), is placed on the apex of the column, which signifies Britain, and is supported by England, Scotland and Ireland, represented by the three counterforts, each carrying their respective genius (with appropriate emblems, the Rose, Thistle and Shamrock) in inclined position, contemplating the great services of Lord Nelson. The divided composition is redeemed or brought to unity below the basement by the three steps or gradius. The platform with the three second counterforts, supporting the lions as symbols of strength and power, comes next; below these the steps are spreading to an amazing circular extent, according to the immensity of British connexion and influence, as likewise the great firmness of the united kingdoms. Underneath one of the lions is the entrance to a circular gallery, decorated with naval trophies, connected with the spiral staircase, which by 320 steps brings the visitor on the balcony to enjoy a magnificent prospect. The whole height from the pavement to the top of the statue is 217 feet 3 inches. All the sculptures of Scotch granite. Erected of granite and Portland stone, estimate, 28,000*l.*; and entirely of Aberdeen granite, 40,000*l.*

Design No. 72, *Thomas Bellamy.*—The design consists of a platform 150 feet square, charged at the angles with marine and naval emblems; the base of the pedestal is sculptured with colossal models of first rates and victories, and bears the following inscription ranging round its four faces:—

TO ADMIRAL HORATIO VISCOUNT NELSON, DUKE OF BRONTE,
This memorial is erected by public subscription,
A. D. MDCCCXXXIX.
Thirty-four years after his death, to commemorate his unparalleled achievements.

The plinth bears the names of Nelson's three great victories, Nile—Copenhagen—Trafalgar—and the memorable signal to the fleet, "England expects every man to do his duty."—The circular portions of the pedestal are sculptured with a dance of Tritons and dolphins, oaken bands, prows of ships, shells of the nautilus, and with the palm.—This design might be executed for 27,000*l.*

Design No. 89, *Frederick Claudius J. Parkinson.*—A triumphal archway 100 feet square, enclosing a circular temple formed of 12 Corinthian columns supporting a richly panelled dome; under the centre of which is placed the statue of Nelson, with various emblematical figures.

The height of the building to be 70 feet. The length of each front including the steps and landings, 140 feet.

The cost of the building would be 18,300*l.* The statue and emblematical figures would not exceed the amount of 8,000*l.*

Designs Nos. 90 and 91, *Richard Kelsey.*—Agreeing with Mr. Nixon that, if a column be deemed an inappropriate memorial of Nelson, there is but one other kind of monument which, under the circumstances of the proposed site and the money to be expended upon it, can well be considered applicable to the purpose; the artist has, in both his sculptural designs, made the statue the most conspicuous feature. In one composition it has been his object to place before posterity all the distinguishing characteristics of the man and the hero; and to render it fitted to illustrate the poet's idea, "This story shall the good man teach his son."

It is proposed that each face of the basis shall significantly teach one great lesson. In this elevation, his *mercy* is chiefly shewn. The inscribed quotations of his own words, "May humanity, after victory, be the predominant characteristic of the British fleet," and "The moment an enemy submits, from that moment I become his protector," breathe that angelic feeling. The sculptured group of a beautiful female pleading for a fallen warrior, reiterates the charge: and it is impressed more deeply by the basso-relievo of the wounded Nelson rushing from a bed of anguish to save his drowning enemies.

On the remaining sides it is proposed, in like manner, to depict his courage, his perseverance, and his integrity.

In the other design, the proportions of the masonry are altered, and the groups at the foot of the centre block are intended to point out the immediate results of his exertions; as, the protection of the East and West Indies, the saving of Egypt and the Turkish empire, the general assistance of Europe, the dissolution of the Northern Confederacy, the exaltation of the British empire, and the humiliation of our enemies.

The bassi-relievi in this front include the incidents of his death, his funeral, and the general regret; which is also further shown by the mourning figures in the centre.

The drawing of Pompey's pillar is merely intended to show the effect of placing the statue of Nelson on the summit. The substructure is also altered, and the revolutionary dragon writhing under its deadly wounds is intended to point out the attainment of the great object of his life.

In the three sculptural designs, the statue being considered as distinctly the chief feature, all else, however colossal it may be in itself, is kept subordinate and unobtrusive. It is anticipated that, from a distant point of view, the mere mass of each would be perfectly expressive of that strength and simplicity of character which marked the man; that, on a nearer approach, the groups and statues would detach themselves and attract attention; and that, upon closer inspection of bassi-relievi, composed in the quiet but expressive style of Grecian art, the interest would be fully kept up, and all the beautiful lessons of his life form a pictorial history, at once adapted to impress the uneducated and to gratify the most refined. The artists who submit them beg very respectfully to remark, that they are only sent in as sketches; they feel them to be capable of many and great improvements, and regret that time has not admitted of more than one being modelled; but should the leading idea of the composition point out either of them as adapted for the monument in memorial of Nelson, it would give them the greatest pleasure so to improve it, as to be creditable to themselves and to their country.—With respect to the scale upon which they should be erected, that must much depend upon the money which will be really applicable to the purpose, but they conceive that the statues should be about 30 feet in height.

Samuel Nixon proposes that as to his design the statue of Nelson should be in bronze, the masonry in granite, and the accessory sculpture in the best of our native stone.

Richard Kelsey proposes that no portion of his designs should be in bronze, but that the finest grained granite should be used in all the colossal work and the reliefs, but thinks it may be necessary to adopt other material for the main groups of statues.

Richard Kelsey would wish the model of Pompey's pillar to be ten feet in diameter, and has no doubt of being able to give the shaft the appearance of being hewn out of one stone, and thus to obtain all that imposing effect which appertains to monolithal monuments.

Design No. 97, *James Henry Nixon.*—This design is a monument of colossal dimensions calculated for duration, in which the form is simple, the material imperishable. The statue of Nelson in a calm and dignified attitude, is intended to be 30 feet in height; and being placed on an elevated pedestal and basement, would prove a commanding object from Parliament-street, shewing the figure distinct from the surrounding buildings; and not so high, but from its colossal size, the features would be plainly distinguishable when viewed from below: the total height of the monument to the top of the figure, would be 90 feet. On the basement is intended to be sculptured in bas-relief, a representation of the most remarkable actions; showing the

The temple is divided by ornamental pilasters into four compartments: the one towards the south being left open, affords an ample view of the statue, which is placed on a pedestal in the middle of the building, and receives a direct light from the centre of the dome—for this purpose covered with stout glass; the other three compartments are closed up with bas-reliefs of his principal victories.—A faithful resemblance of the heroic victor would thus be handed down unimpaired to posterity, enshrined within those glorious achievements, which shed lustre on the annals of our country, and immortalise his name.

The height of the monument is 60 feet, that of the statue 15 feet.

The entire work can be executed in the most perfect and elaborate manner for the sum specified, in the following materials.—the base of grey granite, the temple of Anglesea marble, the statue and bas-reliefs of statuary marble, the lions of red granite, and the trophies of bronze.

DESIGN No. 134, *Thomas H. Lewis*.—The design consists of an enriched octangular obelisk 150 feet high, surmounted by a figure of Britannia, and having a statue of Nelson 12 feet high, on a pedestal about 30 feet from the ground. Bas-reliefs of his victories adorn the faces of the obelisk, which rises from a double platform occupying the centre of the given space.

DESIGN No. 144, *J. Taylor, jun.*—A triumphal pillar 172 feet high, surmounted with a statue of Nelson, 18 feet high, ascended by a spiral staircase inside, having a gallery on the top sunk out of the capital of the column, and a short railing almost imperceptible.

On the front of the pedestal the hero is represented as falling, while defending Britain, who is seated on the column above; victory descends and sustains him in death, while he grasps to the last moment the standard of h s country. A British vessel is seen in the back-ground, and on that side the column a weeping willow is introduced, referring to the universal feeling which deplored the loss of this greatest of all naval commanders.

The figures in the fore-ground are entire, the back-ground in bold relief.

On the other three sides of the pedestal may be represented the three principal naval actions in which he was engaged.

N. B. It is submitted, that a sculptural group, commemorating Nelson, should represent his dying moments, as he expired in action, and in the midst of the greatest of all his victorious naval engagements.

With a Wellington, and other heroes who have survived the conflicts in which they were engaged, an animated statue alone is appropriate; not equally so with those who fell in action, which event it is considered should stand recorded as well as their bravery and prowess.

DESIGN No. 148, *G. B. Moore*.—In designing the memorial, attention ought to be directed to the period at which it is proposed to erect it. In the excitement of victory, trophies are allowable; but after twenty-four years of peace, to revive the exultation of triumph, would be unworthy the generosity of a great civilized Christian nation. The ancients never restored their trophies, when destroyed by time or accident, considering that old enmities ought not to be perpetuated. The present memorial should be rather a testimonial of gratitude, to one who died to obtain an honourable peace, than a record of national glory; and all allusions to victories should be introduced as illustrations of the actions of the hero, and not as triumphant emblems. Under this train of feeling, this design has been composed.

The subjects of the bassi relievi have been selected to illustrate the various virtues of Nelson.—No. 1, Duty: Nelson proceeding to his vessel during a storm near the Goodwin Sands.—2, Intrepidity: Cape St. Vincent: Nelson boarding the San Joseph.—3, Mercy: the Nile: Nelson saving the enemy from drowning.—4, Piety: the Nile: Nelson and his sailors returning thanks to the Deity after the battle.—5, Justice: Nelson in the Senate claiming attention to the services of his compatriots.—6, Magnanimity: Copenhagen: Nelson rendering justice to the brave defence of the Danes.—7, Solicitude: Nelson, on his arrival in England, visiting his wounded seamen.—8, Heroism: Trafalgar: the death of Nelson.

Above the bassi relievi are medallions of George III., George IV., and William IV., the sovereigns he was honoured by; and Victoria I., marking the reign in which the memorial is erected. At the angles are lions and boys denoting courage combined with gentleness. The statue of Nelson is in front of a pillar, supporting the heraldic banners of England, Scotland, Ireland, and Wales; and terminated by an angel bearing the olive-branch of peace, emblematical of the end for which he struggled and fell; for if any man could say with truth he fought for peace,—it was Nelson.

DESIGN No. 150, *Thomas Moule*.—This design, presenting a union of architecture and sculpture, sufficiently announces its destination by its leading forms. The statue of Lord Nelson is represented on an enriched pedestal; which, with the basement and its graduated foundation, makes the total height of the monument 65 feet. Its greatest diameter is 140 feet.

Nelson, the principal object, is intended to be represented at the moment of perceiving a decided advantage obtained over the enemy. The admiral is attended by a captain, and near him is a boatswain, ready to communicate orders. Without diminishing the importance of the principal figure, this group would show the different grades of the navy, and form a just tribute to their successful co-operation.

The figure of Lord Nelson, 15 feet in height, might easily be discerned from the extremities of the large square in which the monument is required to form the centre object. To place a lofty column in such a situation is objectionable in point of taste, as its height would overpower the facade of the building erected as a National Gallery, in front of which the monument of Nelson is intended to be placed. That building presenting a lengthened elevation of Greek architecture, this design is made, with corresponding reference to its prescribed site.

The pedestal bears, on its principal front, a bas-relief of King George III. receiving the Admiral as Viscount Nelson—a title granted to the brave seaman, in 1801, for his services in the Baltic; together with the appropriate motto—"*Palmam qui meruit ferat.*" On the reverse of the pedestal is intended a bas-relief representation of the public funeral decreed to Nelson; the car bearing his body, approaching St. Paul's; and with the inscription of his last words—"England expects every man to do his duty."

Between these bas-reliefs, on one side, is intended to be placed the arms of Nelson of Burnhamthorp, with the crest of his family; on the other side, the heraldic augmentations, as Lord Viscount Nelson, K.B., Duke of Bronte in Sicily, Knight of Saint Ferdinand, &c. &c. &c., badges of military honour.

The basement of the pedestal is square, having upon its angles massive naval trophies of victory over the French, the Dutch, the Spaniards, and the Danes. To give breadth and quantity to the design, correspondent with the very large space for which the monument is required, the basement is extended on its western and eastern sides by an architectural elevation, terminated by rostral columns, each of which is surmounted by a classical figure of victory, making a height of 45 feet: the lower part of the shafts of these columns is environed by boarding-pikes used in the navy. The whole basement, divided into three compartments, is enriched with sculpture in bas-relief, representing the consequences of the battles of the Nile, Copenhagen, and Trafalgar: dismantled ships of war, prizes from the enemy, are shown on their way to British ports.

The monument is intended to be placed within an enriched enclosure, elliptical on its ground plan, and 140 feet in length, rising to the height of about 9 feet. A part only of this inclosure is shown in the architectural elevation, as it was deemed necessary to exhibit the graduated and broad foundation of the basement, which could not actually be seen in a general view. The pedestals on the enclosure are surmounted by female figures, bearing alternately palm branches, naval crowns, laurel wreaths, and the funereal torth. The fronts of the pedestals to be charged with emblems of the sea, and the trophies between them to record separately the successive victories in which the gallant Nelson was engaged.

Including the ornamental decoration, the author of this design feels convinced that, under careful management, the whole may be carried into execution (in Portland stone) with the means proposed, viz. 30,000*l.*

DESIGN No. 160, *Thomas Bellamy*.—It is proposed by this design to form a semi-circular platform in the centre of Trafalgar-square, elevated one step above the paving of the road next the National Gallery, and continued of the same level to the line of paving connecting the Strand with Cockspur-street, along which line it acquires a height which is ascended to by steps. This platform is enclosed by a metal railing, except at the steps and opposite the National Gallery, which are reserved as approaches to the platform and monument.

The base of the monument is circular, 100 feet in diameter, having six radial blocks sustaining colossal couchant and dormant lions, significant of the result to which the achievements of Nelson mainly contributed. The pedestal which rises from this base is also circular, having three radial masses sustaining colossal seated figures, personifications of the Nile, Copenhagen, and Trafalgar, his three great victories, over which are characteristic trophies in bronze. The three intermediate faces of the pedestal are each charged with an alto-relievo illustration of some striking incident in each of the said battles. The three minor pedestals bearing sea-horses are charged with the names of the most important of Nelson's lesser victories. The columnar portion of the pedestal is 12 feet in diameter, and has a wide gallery supported by corbals decorated with Tritons, underneath which in relief is the motto, "Palmam qui meruit ferat." The terminating portion of the pedestal is encircled by an arrangement of tridents and festoons of laurel, and has a palmated capping. A naval crown receives the statue of the hero 16 feet high. The whole height of the structure from the paving to the top of the statue is 153 feet. The material of the substructure is proposed to be of granite; that of the superstructure free-stone, well selected as to durability and colour. The parts proposed to be of bronze are distinguished by its colour.

REPORT ON STEAM VESSEL ACCIDENTS.

THIS report is one of the most laborious compilations which has yet been submitted to the public, and its authors have exhibited great research in the extent and objects of their inquiries. Government commissions have frequently been complained of as uncalled-for jobs; but the parties to this present affair seem to have exerted themselves to show, that theirs was not a subject with which you might go from Dan to Beersheba and find all barren. It appears to be a kind of encyclopedia, pointing out not only what ought to be done, but also what ought not to be done, what has not been done, and what never will be done. We had thought, in fact, and expressed ourselves to that effect at page 91 of our present volume, that this very inquiry was totally uncalled for, and although we have read this marvellous report with great attention, we cannot but remain of the same opinion still. In the absence of statistical data, we might have expressed ourselves with some diffidence, but with the documents now before us we feel perfectly assured of the justice of the opinions we then entertained.

gallant conduct which ever marked the daring career of the illustrious hero. On the four projecting blocks of the basement are represented emblematical figures of those virtues which Nelson is acknowledged to have possessed in an eminent degree,—Courage and Mercy, Fortitude and Justice. The whole of this design, carefully executed in red and white granite, can be erected for the sum proposed by the honourable committee.

Design No. 110, *R. E. Carey.*—A partially enclosed column, surmounted by a statue, with a mausoleum interior; altogether forming a sculptural architective monumental pile, commemorative of the hero. Height 170 feet.

Beneath the azure vault of nature's vast architrative dome, of collossean form, (visible to myriads of lesser breathing mortals, scattered around o'er hill and dale,) stands the sculptured representative to unborn ages of the person,—the most glorious of the greatest maritime nation's naval heroes, Nelson. The statue, with naval trophies, surmounts a column, around which twirl antagonist dolphins, emblematic of sea war.

Beneath a gallery are embodied a series of four allegoric bas-relievoes, hypothetical of the hero's attributes, enterprise, valour, victory, and immortality.

Enterprise, a youth of fiery mien, with heart swollen with enthusiasm, over-canopied by the perils of stormy danger; he sees, through the vista of breaking thunder-clouds, starry rays encircling the hero's wreath of laurell'd glory; emulations incentive: with eager haste to win the prize he throws off the habiliments of inglorious inactivity, and, with heroism armed, dashes to the immortal goal, in vain withheld by the syrens, Luxury, Effeminacy, and Fear.

Valour, with destructive weapon, rushes to the pinnacle of danger's rock, followed by his brave compeers with victory's pennon streaming; there, with energy heroic, they engage with invasion's monster and its usurping legion, —scattering with destruction the foe to oblivious death and darkness.

Victory.—The conquering victor, lion-skin habilimented, sits on the throne of conquest, crowned with laurel by radiant glory and the sire renown, in whose historic tome the hero's achievement stands recorded: amid captured prizes, that lay scattered at the hero's feet, the captive leaders of the foe upon bended knee, deliver to the conqueror their inglorious arms; whilst, with soaring flight aloft, on wings of swiftness, Fame with trumpet blast to the world the victor's triumph proclaims.

Immortality.—The hero's bust, laurel wreathed, rests on fame's pedestal in glory's altar, enshrined; lighted by the censor light of imperishable immortality; thus, through the darkness of obscurity, and through all time, his resplendent fame is rendered manifest to man, woman, and infancy; who approach the altar with their choicest gifts as offerings, dedicative to the hero's memory; the man with implements laborial; the woman with sweet fruits; and infancy with lovely flowers and gentle innocence; whilst, with united voice, Europe, Asia, Africa and America, acknowledge the hero's greatness.

Descending from the allegorically *ideal* to the typically *real*, is presented a second series of bas-relievoes, illustrative of the memorable events that occurred during the hero's victorious achievements; the battles of St. Vincent, the Nile, Copenhagen, and Trafalgar.

Between the lower bas-relievoes are placed personifications of Genius, Fame, Victory, nd the Sea.

The structure at various parts is graced with naval trophies and emblematic devices of the sea and war.

From four double flights of steps a circular collonade is approached, in which are arches; thus, through their gates is viewed the interior, a mausoleum.

Beneath fame's monumental pile, as by a nation's joint acclaim enshrined, on pedestal the sculptured sea hero lies in sepulchral rest; though mantled in death's pall, he is wreathed with fame's laurel glory; laved in the gorgeous golden rays of day's effulgent orb, or bathed in the silvery gleam of the gentle, calm, sepulchral beams of the silent queen of night.

Over the front arch is placed the Nelson heraldic arms.

Surmounting pedestals (at the summit of four semi-flights of steps) are placed sculptural groups of naval characters, engaged in the various occupations on board a British ship of war; thus, steering the ship, taking the observation, weighing the anchor, and firing the gun.

Around the structure are placed 8 British lions on pedestals.—The object of the erection of the galleries is to afford a near inspection of the sculptures. —The entrance to the galleries staircase is by a door in the side of one of the archways.—The monument to be encircled by an ornamental stone promenade; and the whole enclosed with an iron palisade and gas lamps of a naval design.

Design No. 117, *James Thrupp.*—Britannia's great naval hero, and the upholder of her maritime supremacy, receiving from his country the laurel crown, and from the nations, whose fleets were subdued by his genius and daring, tokens of their submission, is the idea intended to be expressed in this design.

A few words in explanation, and more particularly of the emblematical representations of France, Spain and Denmark, may not perhaps be deemed irrelevant.

The subject seems to require that they should be represented as warriors. The act of lowering their banners has been chosen, as being the actual mode of expressing submission adopted in naval warfare; and also because it neither implies arrogance on the one part, nor abjectness on the other; for it might be that of the bravest warrior when unable longer to contend against his foe.

The eagle France has long appropriated to herself as an emblem, as may be seen on the monumental records of her own victories. Ancient coins have been the authority for that indicative of Spain; and to Denmark has been given the raven of the north. The lesser kingdom has also been represented under a more youthful form than the others. The medallions of the respective reigning sovereigns on the shields mark the era.

In pourtraying the hero it has been the aim to avoid any expression of ostentation; for Nelson's illustrious deeds were ever accompanied by a simple dignity of character. The principal basso relievo tells his fate: the colours of the hostile fleets are struck—the hour-glass is broken—Nelson has fallen—and the flag of his country enshrouds him. The rays of a setting sun betoken that he terminated his career in glory. The other bassi relievi are to represent some of the noble traits of the hero's character; such, for example, as that which he exhibited when wounded at the battle of the Nile.

While desirous to retain the proportions and the general features of those examples in art th t have been sanctioned by ages, the architect has attempted to engraft upon them the characteristics of a triumphal pillar. The shaft is enriched with laurel leaves, and the names of the principal battles; and the capital is formed of four figures of victories, bearing wreaths entwined with Nelson's heraldic motto:—Palmam—Qui—Meruit—Ferat:—words which seem alike appropriate to the act of Britannia and to the hero himself.

The letters it is proposed to cut through the stone:—thus formed, they will not readily be obliterated, nor affect the outline of the shaft, whilst they will serve to light the staircase within.

The inner side of the abacus may be sunk sufficiently low to render a gallery-railing unnecessary as a protection.

Nelson's last immortal signal encircles the pedestal.

The whole height of the design, with the crowning figure, is 168 feet; and its cost, provided the figures of Nelson and Britannia only are executed in bronze, will not exceed 30,000*l.* The present inequality of surface in the intended site it is proposed to alter by lowering the upper portion.

Design No. 128, *An Architect of Middlesex.*—A monument to the honour of the greatest hero that ever adorned the annals of a maratime nation, worthy of the genius, valour, and ambition of his country, is an undertaking very difficult to effect successfully. Nevertheless the author flatters himself that he has solved this important problem in a fitting, clear, and distinct manner.

The author's first point is to represent the history of the hero in a language at once technical, expressive, and comprehensive, to all classes of the nation. —His second point is, to express this technical language in a clear and elegant style, united to historical truth.—His third point (which, until now, has been neglected by every one,) is to build the monument to harmonize with the buildings which surround it, especially St. Martin's Church, and the National Gallery.—The author has endeavoured to effect this object as completely as possible, and thinks the monument, when finished, will give the National Gallery a more elegant, imposing, and materially improved appearance, as a public edifice.—This epico-technico poem is to be thus realized:

"After the victory of Trafalgar, sanctified by the hero's own blood, the spoils and trophies are brought on the Admiral's ship to the capital of the British empire, to be exposed to the admiration of the nation."

Trafalgar-square having been selected for such an exhibition, will be made to represent a port at the entrance of a canal in the metropolis. This port is protected by four moles. The two moles towards the south will be surmounted by two rostral towers, on which are represented the capture of the enemy's vessels: the other two moles towards the north, will be surmounted by trophies gained in his various battles.

The four principal victories of the hero, viz. St. Vincent, the Nile, Copenhagen, and Trafalgar, will be represented by four great bas-reliefs placed round the moles, and explained by inscription in Mosaic asphalte on the pavement. Above the towers and trophies are placed four great globes, indicating the tropical parts of the world over which England reigns, viz. Asia, Africa, America, and Australia; and over each globe is set the British crown. In the midst of the port is seen the ship Victory, that has brought home the spoils and trophies gained by Nelson. In the centre of the deck, on a pedestal raised upon a large die, is placed a colossal statue of Nelson, in the dress of an Admiral, leaning on his sword. On the four sides of the die are placed an inscription and 3 bas-reliefs, viz., towards the south, or grand entrance, is inscribed a summary of the history of the hero, with the dedication. On the east side is a bas-relief descriptive of his nativity. On the north, his inauguration; and on the west, his apotheosis. Two lateral basins supply the port with water. The port is surrounded by a balustrade, and the four moles by a railing. The die is protected by four large, and eight small bar stones, with chains hung in festoons. At each entrance are two pillars, on which are placed two lions. The pavement and deck will be inlaid with inscriptions and ornaments of Mosaic asphalte. In the interior of the ship are apartments for one or two porters, who will have the care of the keys of the towers, and whose duty will be to keep the monument perfectly clean, and likewise to preserve it from wanton injury.

It is almost impossible to give an exact *estimate of the expenses* of a monument which may be constructed so d fferently with regard to the artists, and materials employed, and of which the cost of the statue and bas-reliefs may differ so considerably. Nevertheless, the author believes that it would not exceed the sum of 30,000*l.* The expense would be easily diminished by building the two towers lower and without rost, rendering the south moles similar to the north, viz. surmounted by trophies only, and sacrificing the two lateral basins.

The author hopes that the committee will condescend to observe that his plan can undergo such modifications as they may deem fit, under any circumstances. If the original idea is preserved, the author does not doubt but that it might be made the most classical and important monument of the age, and worthy of the national honour.

Design No. 132, *Raphael Brandon.*—I have adopted the form of a circular temple to commemorate the deeds of the illustrious hero, as it at once offers a complete protection for his statue, however beautifully executed, and forms a magnificent object when seen from the various avenues to the square.

In some of the printshop windows is to be found a very important engraving of the philosopher endeavouring to find out the wind in the kitchen bellows, an example from which Her Majesty's government appear to have derived a lesson on this occasion. Having been foiled in a previous attempt in 1831, they rediscovered, *mirabile dictu*, that accidents really did occur to steam vessels, when it struck their enlightened minds that a commission must be the very machine to find out the causes of the said phenomena, and accordingly appointed Captain Pringle, of the Royal Engineers, and Mr. Josiah Parkes, Civil Engineer, as fit and proper persons to conduct this momentous inquiry. The instructions to these gentlemen were to find out, 1st. the number and nature of the accidents which have happened in steam-vessels within the last ten years, as far as they can be ascertained, and 2ndly, the practical means of preventing the recurrence of such accidents. They accordingly sent round a circular, calculated to enlist the prejudices of particular parties, and entrap them to commit themselves and neighbours. Of some they asked, "What accidents have occurred in boilers not of your construction?" of those who might think steam-vessel proprietors too chary in repairs, they inquired, "Are the engines and boilers of steamers in your opinion overhauled and repaired as frequently as is requisite to maintain them in a safe working state, both as regards the boilers and effective working powers of the engines? Not contented with this, they raked up all the old newspapers and penny-a-line paragraphs they could find, and applied to the Thames waterman for the favour of their sentiments on the subject.

The result of all this labour is a large blue book, which is printed at the public expense, and prefaced with a letter from the commissioners, stating what they had and had not done, and also the important facts that "they had received, in answer to their queries, much information from gentlemen residing at places which their time did not admit of their visiting, and that they had also inspected vessels building, and machinery in progress of construction;" and this is but a sample of the miserable twaddle which was the natural result of such a preposterous job. The deaths of pigs, boats' oars being cut in two pieces, and similar valuable matter, are in fact the staple of the report. The commissioners, naturally feeling diffident of the possibility of manufacturing a report with such materials, extended, in their public zeal, the sphere of their labours, and not only reported accidents which occurred above twenty years ago, but in every part of the world, and of all classes and descriptions. We are unwilling to attribute motives further than the natural anxiety to earn a guinea, or it would certainly have appeared to us that this looks something like a crusade for the purpose of annoying an important interest, and concocting a government job. Their zeal, however, has overstepped their discretion, and they have themselves furnished the materials for refuting their own absurdities. Having with great labour mustered up 92 accidents, they thus classify them; wrecks 40, explosions 23, fires from other causes 17, and collisions 12; and then proceed to dilate upon the several subdivisions of these various classes. The enumeration of the several causes of accidents establishes, indeed, nearly a separate cause for each individual accident.

The schedule of accidents in the Black Book, on which the superstructure of jobbery is to rest, has not been analysed by the commissioners, so that we must ourselves save them the trouble. This list begins in 1817, twelve years before the period defined for the inquiry, and extends down to the period of going to press, enumerating more than one case of the same vessel, including all the varieties of accidents to which vessels of all kinds are exposed, and having about as much to do with the specific object of inquiry as the commissioners had to be employed at all. It includes cases in North America, the Mediterranean, Portugal, Germany, France, and Heaven knows where, and displays an extent and variety of research not equalled since Dr. Johnson's Essay on Broomsticks. The sources of information, of which even the commissioners themselves do not attempt to uphold the credit, are country papers, penny-a-liners, hearsay reports, anonymous accusations (p. 2,) imaginary suggestions, and no testimony at all; (case of the Frolic, p. 4,) and would form but poor evidence in a court either of law or of conscience, the sole object being to make out as glaring and flagrant a case of mismanagement against the steam-boat interest, as the ingenuity of the operators could suggest. Where the horror could be touched up in the Greenacre murder style it has been attempted, and even animals pressed into the service to supply the deficiency. Of the 92 cases and no-cases detailed, above sixty are not even attempted to be attributed to machinery, and the whole amount attributable to such causes, including flues getting heated, explosions without injury, &c. only amounts to 26, of which above one-third occurred before the period assigned for the commencement of the commissioners' labours, and making, in twenty-two years, an average of little more than one per annum. With 800 vessels annually employed, the number of special accidents was seventeen in ten years, or about one-fifth per cent. per annum. Of these cases only 15 were fatal to human life, or not one per cent. per annum. The number of lives lost attributed to defective machinery amounts to 78!!! or about 3·6 per year, which, reckoning only two millions of persons carried in a year, makes a loss of life of 1-555th, or ·000177 per cent, or not one in half a million. The number of pigs we leave to the commissioners to calculate. The causes of the various accidents detailed, it is impossible for us to enumerate, but it is quite sufficient for us to say that most of them have nothing at all to do with the construction or economy of a steam-vessel; they include causes no longer in existence, (case of the Norwich, p. 9,) fires from soldiers smoking on deck and inflaming straw, sailors getting drunk, carrying too heavy a deck load of pigs, &c. &c. Reference of the cases to their correct causes it is unnecessary to say is not afforded by the commissioners, although we might naturally have expected it, as most of them have nothing to do with steam at all. We find that above one-third of them occurred in the Irish sea, and a great many on the east coast of England, and they are more rationally to be attributed to the want of harbours of refuge upon those notoriously dangerous coasts. We certainly find, as the commissioners acknowledge, that more accidents occur with the Scotch and northern steamers, than with any others; but we do not see why, on that account, the whole empire is to be subjected to the stringent rule of empirical inspectors.

Schedule B is a list of accidents furnished by the Watermen's Company, and is so ridiculous as to cease to be mischievous. Of the thousands of craft navigating the Thames, they are only able to manufacture 59 accidents in three years and a half, or seventeen a year. These, as far as they can be understood from the nonsensical statements, appear not to arise from the steamers, but from the parties themselves, drunken watermen, Trinity Mews sailors, amateurs and tailors' apprentices, and vessels unwieldy and overloaded. In order to show the injury to the watermen's craft, every species of vessel is crammed into the service, from steamers and colliers down to fishing smacks and ship's boats; cases are related as having occurred in the docks, and embellishments of every kind are introduced: "one of the boat's oars was cut in two pieces;" "a young man (the son of the owner of the smack, who is a widow), was drowned;" a long story about a Mr. Joseph Crannis, of Union Street, Southwark, and his wife Mary Anne, how they went to see his brother off to Hull; "the passengers were dreadfully alarmed;" "a seaman who had just arrived from the West Indies was drowned." The number of lives said to be lost from these causes is 43, or 12 per annum; but in order that an idea may be formed of the means used by the commissioners to manufacture accidents, we will just take the account of 1838. 24 accidents are put down, 8 of which are barges swamped, some with 84 tons of coals on board, several are by steamers working against the tide or in the ice, one is a case of a steam-vessel from HULL to London, about a passenger named Stamford going into the engine-room, getting entangled in the machinery, and being crushed to atoms; his remains were put into a small box and landed at the Custom House Wharf!!! The whole number of boats lost in that year was 8, the number of people upset 19, and lives lost, 8.

As to the animus which influences the report, it might appear unnecessary still further to allude to it, but we cannot refrain from calling attention to the manner in which slanders are cast upon the gentlemen interested in promoting steam navigation.

Mr. Gibson says, "The steam-packet owner looks only to the *splendour of the saloon* and the velocity of the vessel; it is upon these alone that he depends for success, the safety of the passengers is altogether lost sight of; to ensure speed, the fabric of the vessel is made as light and flimsy as possible to hold together."

This needs no comment, and we abandon it to the indignation of our readers.

That the commissioners have failed in making out a case, themselves and their employers seem to be tolerably persuaded, and were it not for the pertinacity with which this rotten plank has been clung to, we should have left it to its courted oblivion. We cannot, however, forget that this is not the first attempt of the kind, and that it is not likely to be the last, nor that, by pretending to strike at a single interest, can they blind us to the fact, that they are attacking the whole industrial interests of the empire. That the measures recommended are as mischievous as the evidence on which they are attempted to be based is fallacious, is a natural result of the employment of persons who have proved themselves morally incompetent. That the system is vexatious and inquisitorial it needs no argument to prove, and that it must be injurious and inefficient is equally certain. What men can be found so little attached to their own ideas, or so unprejudiced against those of others, as to be safely intrusted with the control of the enterprise and genius of the nation? We have not found it in the highest ranks, and shall we seek it in mediocrity? Steam navigation itself slumbered for a century, the screw principle has lingered until the present day, and both the motive power, and the means by which it is conveyed, are evidently in their infancy. Watt was prejudiced against high pressure, the Rev. Dionysius Lardner, LL.D., proved to the sages at the Bristol association that Atlantic steam navigation was impossible, iron steam-vessels have been considered incapable of being guided by the compass, and dangerous as electrical conductors, and in fine no improvement has been proposed which has not in all ranks met many opposers and few friends. By the report of accidents a conclusion might be drawn that cylindrical boilers are safer than rectangular, and open at once a cause of litigation with some of the first men in the engineering profession. What, indeed, will Messrs. Maudslay & Field say to this dictum of these persons? In one part of England water corrodes the tops of the boilers, in others it destroys the bottoms, and in many places local circumstances must influence the form and material of construction. The commissioners, however, overleap all obstacles, strong in their own ignorance, they offer themselves as Coryphæi to all the inventors of the nation, and call upon manufacturers to submit themselves to their Procrustean bed. What will a survey do once in six months? will it ensure a due supply of water, or make engineers more attentive? Why, to be effectual, the excisemen must visit before every voyage, and maintain a surveillance as constant as that of a custom-house officer. To collect facts which are not wanted, and to find none which support their own measures, seem to be the distinguishing characteristics of these commissioners, and we need not be astonished that, without a single case of accident adduced, they should at once propose to arrogate to themselves the power of limiting the number of deck passengers to be conveyed, and exercising a still further interference with the commerce of the empire.

To bolster up their plans they refer to foreign countries, and on the presumption that the ignorance of the public is as great as their own, they presume to rely upon such authorities for support. The case of the United States has about as much relation to the state of affairs in England, as the number of assassinations in Lisbon or Rome have to do with the laws of crime here. Each country having about 800 vessels, the number of accidents in America have been about 230 in the space that 92 have occurred here, or 2½ to 1, and what basis of comparison that affords for the support of stringent measures, we think that our readers will best determine. Of the way in which the jobbers of different nations bolster up each other's views, there is not perhaps a stronger instance than in the report made to Congress, in which the example of English interference is referred to as strongly as the American authority is relied upon here. Baron Dupin and other French statists will be able to afford the worthy commissioners sufficient evidence as to the working of the French steam code. This has been in operation many years, and the result, according to the Baron, is, that France is most miserably behind this country in the extent of its mercantile steam marine, notwithstanding the protecting Ægis of safety valve laws, and regulations which even the English operators think unnecessary. Holland stands in precisely the same position, and as to the King of Belgium with his one or two steamers, his antiquated code is about of as much authority as those of the two kings of Brentford.

It appears, from the statements of the commissioners, that the mercantile steam marine of England is about 800 in number, and it forms, we should think, an interest which, instead of being selected for annoyance, merits some support. It is pretty clear that there are few branches of trade, manufactures, or mines, which are less destructive to human life, and we cannot therefore see the grounds for the selection of this. If any measure be adopted, let the whole shipping of the empire be subjected to it, and not one particular portion be singled out. The Admiralty courts are full of the cases of collisions of other vessels, the insufficiency of crews and stores is notorious, and the inutility of government inspection is flagrant; not a month passes without complaints against the emigrant ships, and as to the convict ships, their deplorable equipment is rendered a bye-word throughout Europe. Sailors get drunk elsewhere as well as on board steamers, and other defects are quite as crying as anything that the commissioners can assert against the persons connected with steam-boats. If, indeed, this ridiculous farce be kept up, it will be followed, we suppose, by legislative measures, and we shall see "An Act for preventing Accidents to Pigs and Steam-vessels, for creating a Jobation, instituting Branch Ebenezers, and making Drunken Skippers walk the Plank!"

With all their puffing of particular inventions, giving descriptions of this and copperplates of that, and with the enrolment of all the amateur gabblers, the commissioners are lamentably unsupported by parties interested. Of the hundreds engaged in the proprietorship of steam-vessels, they can only muster the support of five owners, and every thing else is on the same lamentable scale of desertion. The ministers seem to be heartily ashamed of the whole affair, and have intimated their disinclination to do anything with it this session, and if those mainly interested do their duty, we have no doubt will be obliged to abandon the job. Another affair of this kind, the Irish railway abomination, we have had some hand in suppressing, and we call upon our readers to co-operate with us in dealing a death-blow against one equally pernicious.

For the benefit of our readers, we give a copious abstract of the report, in order that all who may be interested shall be prepared to defend themselves, in case there should be an attempt to smuggle a bill into the House of Commons at the commencement of next session.

The report first details the manner the commissioners proceeded to obey the instructions of Government for obtaining the necessary information to form their report; it then gives particular instances of accidents arising from wrecks, founderings, explosions, fires, and defective boilers, from which we select the following extracts:—

Explosions.—We find, on analysing the explosions contained in the list, that by far the greatest number have taken place in steamers belonging to ports, where the practice of engine-makers is to apply *exposed* and *accessible* valves. Explosions have been most numerous in the Clyde, or in Scotch built vessels, both river and sea-going. The "Corsair," "Fingal," and "Antelope," are of the latter class; the "Earl Grey," "James Ewing," "James Gallocher," "Hercules," and "Dumbarton Castle," of the former.

The next greatest number have occurred in the Humber and Tyne steamers, where the safety-valves are similarly constucted; being five instances in river-steamers, and the "Victoria's," a sea-going vessel, on two occasions; at Liverpool, two, among the river-steamers, which had *exposed* valves. We did not hear of, or discover any Liverpool built and engineered sea-going vessel having *exposed* or *accessible* valves; nor does it appear that any accident of an explosive nature has happened to them; and we have not to record a single case of explosion of any Thames-built boiler, in passenger-vessels of any kind, nor in any other, excepting in a small experimental one, mentioned by Messrs. J. Seaward & Co. This freedom from explosion in the Thames is attributed by Messrs. Maudslay & Field principally, to the practice of using *inaccessible* and *sufficiently large* safety-valves.

Safety-valves are often tampered with, and weighted by the working engineers, much beyond the pressure originally assigned by the makers of the engines, in order to gain power and speed. Proof of this is given in the instance of the "James Gallocher;" and Mr. Fawcett, the eminent Engineer of Liverpool, states that "he has known valves—originally loaded at four pounds per square inch—to have been afterwards altered by some *blacksmith*, so as to give the engine-man power to load them as he pleased; and he believes them to have done so even to 20 pounds to the inch. The safety-valves of the "Duke of Bridgwater"—a Liverpool river-boat—were originally made inaccessible; they were altered so as to be fastened down, like the "Earl Grey's," at the pleasure of the engine-man, and the boiler consequently exploded, killing two persons, and seriously injuring many more.

Water and Steam Gauges.—There is a very general deficiency both in river and sea-going steamers—particularly in North Britain—of glass water-guages, and steam-pressure gauges; instruments absolutely essential to the safety of boilers, and used in all well-appointed vessels. Captain Bain observes that "the boilers of many vessels are without these simple instruments, and the engineers and firemen, when doubtful of the accuracy of the cocks, try to ascertain the height of the water, by hitting the boiler with a stick or a hammer, &c."

Effects of Explosions.—Cylindric Boilers.—The boiler of the "Norwich" (cast-iron) was broken into many fragments by the explosion, and the vessel destroyed; the end was blown out of the "Freedom's," and the vessel sunk; those of the "Vivid" and "Morning Star" burst inwards on the under part of the fire-tube, where both were worn very thin. The "Herald's" opened on the top, also corroded very thin. The "Victoria's" twice ruptured inwards, on the under part of the fire-tube; the iron apparently good, but the cylinder too large for the strength of material and pressure upon it.

Effects of Explosion.—Rectangular Boilers.—Of these, the outer shells of the "Graham," "Earl Grey," "Union," and "Duke of Bridgwater," were more or less ruptured, and projected forcing up the decks, &c. The vessels were much shattered in several of the other explosions, which occasioned fissures in the boilers, either above or below the water-level; the greater number, so far as ascertained, occurring below the water-level; in some cases opening the shell, and bursting into the cabins; in others, rupturing the flues, and doing mischief chiefly amongst the engine-men and firemen, according to the respective strength of the shells of the boilers and flues.

The "Earl Grey's" boiler had no stays; the "Union's," "Graham's," "Magdalene's" and others, had stays, but neither their number nor arrangement can now be ascertained.

Safety Valves.—In two instances—the "James Gallocher" and "Morning Star"—it is proved, that the steam was blowing off through the safety-valves at the time of the explosion, showing the valves to have had an insufficient area. In the cases of the "Graham," "Earl Grey," and others, it is proved that the valves were either fastened down, or too heavily loaded to rise at the pressure which burst the boilers.

The destructive effects of an explosion often render it impossible to determine, with sufficient accuracy, either the area of the safety-valves, compared with the power of the boiler, or the pressure at which the explosion took place. In the event of a coroner's inquest, these important facts are rarely inquired into; it is no one's business to ascertain them; jurors understand nothing about the matter, and are mystified by contradictory statements. In several of the cited cases, the spindles of the valves had been bent, or otherwise set fast; in that of the "Morning Star," though the valve rose, and allowed some of the steam to escape, we are informed by Mr. Greener, who examined the boiler minutely, and gave evidence on the inquest, "*that it was so rusted, it appeared not to have acted for years.*" Its area was also very inadequate, having only about one square inch of aperture to four-horse power; the engineers of the Thames steamers usually give an area to their safety-valves of one square inch for each horse power—a safe and excellent practice; but we found the dimensions of safety-valves so restricted in the vessels of some ports, that only one-fifth of a square inch was allowed to each horse power, an area so insufficient, that though the valves might be well made, and act freely, the pressure of steam would continue to increase when the engine stopped, and attain an elasticity exceeding the resistance of the boiler, though steam were continually escaping. An explosion is the necessary consequence.

Height of Water in the Boilers.—It is also difficult to obtain, after these accidents, credible information as to the sufficiency of water in the boilers, at the moment of explosion. It is probable—from the general absence of glass water-gauges, in the class of steamers whose boilers have chiefly exploded—that testimony on this point is not to be relied upon. The "Union's" is a clear case of deficiency of water, combined with overheated flues, and an oscillatory movement of the vessel. A simple contrivance to assist in ascertaining the true level of the water in a boiler, is described by Mr. Golightly.

Quality of the Metal of Boilers.—Some very intelligent remarks will be found in Mr. Greener's replies to our queries, on the important subject of the quality of iron used for boilers; a subject which is far from occupying the attention it merits either by boiler-makers, engineers, or steam-vessel owners. A piece of the "Morning Star's" boiler, in our possession, taken from the ruptured part, shows it to have been corroded to two-tenths of an inch in thickness, its original strength having been half an inch, and the iron very bad. The fire-tube ruptured at a pressure of about 23lbs. per square inch; its form was elliptic, three feet, by two feet six inches; the external shell, cylindric, 6 feet diameter.

Fires.—The charring of timbers *in the wake*, or proximity, of the boilers, is alluded to by the ship-builders, and many other correspondents, as a frequent cause of fire and injury to the vessel.

We here beg to draw particular attention to the excellent arrangements and practice adopted by the City of Dublin Steam Packet Company of Liverpool, and in well-appointed vessels of other companies, to obviate the evils arising from these fertile sources of danger to the vessel, and of expense to the owners. We refer to their use of iron beams and deck plates over the boilers, and about the funnel; of the complete separation of the boilers from each other, and from the sides of the ship; of lining the ship's sides with lead, covered again with iron, in the proximity of the boilers; of protecting the boilers from spray, rain, and the contact of coals, by a shell of iron; and the practice of sweeping down all the remaining coal into the bunkers, or iron coal-boxes, on the termination of each voyage.

The suggestions also of Messrs. Maudsley and Field, and others, that pipes from the boilers should be so arranged as to convey steam into the coal receptacles, and other parts of the vessels, in the event of fire, would give great additional security.

Collisions.—Collisions between steam-vessels, and between them and other craft, occur so frequently in crowded waters, they are often so fatal to life, and so generally attended with litigation, and expense in repairing damage, that the want of a law to diminish the evil, is the subject of complaint by nearly all our correspondents. Collisions occur both by day and by night, at sea as well as in rivers. They commonly arise from the absence of an universal understanding as to the "rule of the road" to be observed by vessels, in meeting and passing each other, and from the absence of an universal system of *night-lights* or signals.

The practice is at present regulated only by custom, or by the bye-laws of different ports, which custom, being various, is productive of serious collisions even on the high seas.

The same causes which produced the first collision remain still in full activity, and it is fearful to contemplate the loss of human life which the absence of a law on these subjects may produce at any moment.

There is yet another important point to be considered, as bearing on the means of preventing collisions.

A distinguishing sound should be provided on board steam-vessels, as an *alarm*, to notify their proximity to other vessels at night, on occasion, but more particularly during fogs or thick weather, when lights can only be seen on a very near approach. The want of such regulation is alluded to by several of our correspondents, and a means is also suggested for accomplishing the end. Sailing-vessels are generally provided with some instrument for making a noise, to which resort is had when circumstances require it; viz. bells, horns, gongs, &c. A steam-vessel carries with it an agent more powerful than any of these contrivances, and one which could not fail in notifying its approach, *distinctively* from every class of vessel, and from a much greater distance than bells, &c.; a circumstance of no slight consequence, when the greater velocity of a steamer is considered. The *steam-whistle* in common use, attached to locomotive engines, if applied to the boiler of a steam-vessel, would completely fulfil the desired end. All that is required is a small pipe opening into the steam-chest, and brought up on deck, with the whistle on the top of it, in a convenient position to be used when the commander may order it. By simply turning the handle of a cock, a prolonged sound is produced, or a succession of sounds, on opening and shutting the cock at short intervals. The sound from the whistle of a locomotive engine has frequently been heard more than two miles. We have made particular inquiries as to the degree of sound producible with low-pressure, compared with high-pressure steam, and learn that this whistle may be constructed so as to be equally as effective with the one as with the other.

BOILERS AND ENGINES.

Boilers.—That boilers are very frequently continued in use till they become dangerously thin, and that they are frequently deficient in safety apparatus, is a fact not only evidenced by the Table of Explosions, and instances given, but attested by a large majority of our correspondents. We were shown several in the yards of engine and boiler-makers, which (to use their own expression) "might be walked through;" indeed, the hand might be pushed through some boilers which we examined, but recently taken out of steam-boats. Mr. Shaw states that "the boilers of the 'Fingal,' in 1835, were so weak that they had to be shored between the deck and the tops of them, which expanded and contracted like a pair of bellows." Captain Bain writes that "he has frequently had occasion—sometimes under very trying circumstances—to stop rents in boilers by temporary expedients; that he has witnessed it in other vessels, and has seen boilers worked till they were as thin as paper, &c." Some boilers, in actual use, are only kept tight by the deposit of mud, concretions of salt and sand, &c. between the flues; these obstructions to the passage of heat are not removed, as the metal of the boilers would give way, and they must then necessarily undergo repair, which is delayed till they will no longer hold together, or till ruptures occur, and have produced mischief. The Appendix contains, in the replies to our 5th query, abundant testimony to negligence, and ill-judged economy of this nature.

The explosion of deteriorated boilers, is not the greatest disaster to be dreaded from steamers so ill provided; under the head of Wrecks and Founderings, the calamitous consequences of boilers failing at sea, are still more fearfully exemplified.

Nearly the whole of the passenger, and no inconsiderable portion of the merchandize, coasting traffic of the British Isles, is carried on by steam-vessels, the rapidly increasing number of which will presently be shown. It is impossible to determine, in the absence of official record, whether the number of accidents has increased in a greater ratio than that of the steamers; but our schedule exhibits an annual increase of disasters, and shows that nearly the half of them has occurred within the last three years; and that from the beginning of 1838 to the present time—a period of 15 months only—no fewer than 22 accidents have happened. They consist of—

11 wrecks, founderings, or imminent peril; 117 lives lost:

8 explosions	- - - - - -	20 ditto, and many persons injured.
2 collisions	- - - - - -	—
1 fire	- - - - - - -	—
22		137

In addition to the amount of human life sacrificed, 688 animals were thrown overboard, or scalded to death.

Seven of the vessels were totally lost, four of which are traced to have had defective boilers, or engines; and others had to undergo costly repairs.

It results from the opinions expressed by the engineering class of our correspondents, that great additional safety is obtained by employing several boilers, distinct from each other, rather than one only, or two boilers connected together; many dangers are avoided by this method. Independently of the obvious security arising from the means, thus afforded, of *shutting off* a disabled boiler, and even of repairing it, whilst the motion of the engines is continued by the others, this arrangement possesses many other advantages, and cannot be too strongly recommended for general adoption. Mr. Shaw gives a forcible illustration of the value of distinct boilers, in his account of the salvation of the "Thames," after her perilous collision with the "Shannon."

Engines.—The machinery by which a steam-vessel is propelled appears, notwithstanding its comparative complexity, to be maintained, generally, in better condition than the boilers. The foundering of the "Venus" in 1839 is an instance of a disaster occasioned by the breaking of the connecting rod; the more common derangements are fractures of cross-heads, beams, cranks, crank-pins, &c., of which we both saw and heard many examples; but the practice of using a pair of engines, particularly in sea-going steamers, is a great guarantee against shipwreck, as, in the event of one engine being disabled, the other can safely work the vessel. Duplicates of the parts most liable to fracture, should always be found amongst the stores of a steamer.

Several wrecks have been referred to by our correspondents which might have been averted, had the paddle-wheels been furnished with *disengaging apparatus*, which is effected too slowly, and clumsily, by removing the floats—an operation, also, difficult of accomplishment in tempestuous weather. British engineers are not likely to leave so great a desideratum long unsupplied; several plans for its accomplishment are already in partial use.

The report gives some particulars regarding the number of steam-vessels employed in the mercantile steam marine of the United Kingdom; in obtaining this information, the commissioners state that they had considerable difficulty in obtaining the precise number, as the law does not oblige those steamers to be registered which ply only within the limits of a port:—

AMOUNT OF THE MERCANTILE STEAM-MARINE.

Before presenting, in a substantive shape, all the provisions we have to recommend for the protection of the public against the evils which arise from defects shown to have existed, and to be still existing, as respects the condition and management of numerous steam-vessels, it is expedient to state the amount and importance of the actual mercantile steam-marine of the British Empire. These data we shall proceed to determine as accurately as our means permit.

The following Table gives, *approximately*, the numerical tonnage and power of steam-vessels afloat: it will materially assist in forming a correct opinion of the deficiencies of the present, and of the great importance of an improved system of registration and regulations.

A STATEMENT OF THE APPROXIMATE NUMBER, TONNAGE AND POWER OF VESSELS BELONGING TO THE MERCANTILE STEAM-MARINE OF THE UNITED KINGDOM AND ITS DEPENDENCIES.

End of Year 1838.

	Number of Vessels per Custom-house Return, 1838.	Size of Vessels per Custom-house Return.	Registered Tonnage.	Tonnage of Engine-Room, &c., not registered at the Custom-house.	Total computed Tonnage.	Computed Amount of Horse-power.	Computed Power per Vessel.	Total computed Tonnage per Vessel.
	No.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Horse-power.*	*Horse-power.*	*Tons.*
	256	below 50	6,106	10,816	16,922	6,400	25	66
	145	50 to 100	10,267	7,458	17,725	6,866	47	122
	84	100 to 150	10,034	7,761	17,795	7,483	90	211
	63	150 to 200	10,982	7,147	18,129	7,560	120	287
	76	200 to 300	16,654	10,839	27,493	11,188	147	361
	41	300 to 400	14,247	7,580	21,827	10,914	266	532
	10	400 to 600	4,488	3,506	7,994	3,000	300	769
	1	679	679	661	1,340	450	450	1,340
	1	1,053	1,053	810	1,855	500	500	1,855
No. of Vessels registered in 1838 - - - -	*677	- -	74,510	56,578	131,080	54,361	—	—
Not registered - - - - - - -	83	- -	4,154	5,484	9,638	2,129	50	116
Total number in Great Britain and Ireland, 1838	760	- -	78,664	62,062	140,718	56,490	—	—
Isles of Guernsey, Jersey and Man, 1837 -	† 6	- -	832	618	1,450	600	100	241
British Plantations, 1837 - - - - -	†44	- -	8,411	7,253	15,664	6,160	140	356
Grand Total - - - - - -	810	- -	87,907	69,933	157,840	63,250	—	—

* The Custom-house Return enumerates 678 steam-vessels; but the tonnage of one—burnt—is omitted.

† These are extracted from Mr. Porter's Returns, as we have not received them for 1838.

The total number of British and Irish steam-vessels, including those registered in Guernsey, Jersey, and Man, amounts to 766; of these 484 may be considered as river steamers, and small coasters; and 282 as large coasters, and sea-going ships.

The increase in 1837 over 1836, was 78; and that of 1838 over 1837, 59 registered vessels.

The report gives several extracts from the opinions of correspondents more fully detailed in the appendix:—

From manufacturers of engines and boilers, civil engineers and others versed in these subjects, we have received numerous communications, to some of which reference has already been made in our review of various accidents. It is difficult to classify the opinions of these gentlemen. One of two only of them think that any system of inspection would be intolerable, or practically useless; some ascribe all accidents to the sheer carelessness of those in charge, and detail special instances; most refer to the want of frequency in the repairs of boilers, and to the danger resulting from owners or agents working them too long; nearly all testify to the frequent incapacity of engine-men, and several to the necessity of examining them as to their knowledge and moral conduct, and allowing them to act only under license; some suggest that it would be sufficient, or of advantage, to employ a competent person to investigate the causes of an accident after it has occurred. The subject, as a whole, is elaborately and scientifically treated by several of this class of correspondents, particularly by Messrs. Maudslay and Field, N. Harvey, J. C. Enys, J. S. Russell, J. Oldham, E. Gilbert, John Seaward and Co. and others. These communications will be perused with interest, emanating as they do from a body of practical men engaged in the advancement of engineering science, a large proportion of whom suggest the employment of surveyors both of hull and machinery, as likely to obviate or diminish the occurrence of accidents. Messrs. Maudslay and Field conclude their observations as follows:—

"An occasional inspection, conducted by authorised and well-qualified persons, on liberal principles, so as not to be inquisitorial, or impede improvement, would have the effect of keeping up the attention of companies and owners, as well as of engineers, to the consideration of safety in the constructing, managing, and working of steamers; a subject which, from want of consideration, ignorance, or cupidity, is often overlooked or disregarded.

Many *desiderata* to perfect the equipment and sailing qualities of steamers are pointed out by these gentlemen, particularly a convenient and rapid means of *disengaging the paddle-wheels* from the engines, which, when permanently attached to them, offer so great an obstruction to the progress of a ship, as to render sails comparatively useless. It has been ascertained that when paddle-wheels are disengaged, steamers under sail have been able to cope in speed, and in facility of manœuvering, with other ships.

The importance of fitting the condenser with a pipe to draw water from the bilge, in the event of a serious leakage, or shipping a sea, &c., is strongly advised, as a powerful means of preventing a common cause of wreck and foundering. Engines require a greater supply of water to condense the steam at each stroke, than could be removed by all the pumps which it is convenient to attach to them; the condenser, therefore, is the most rapid evacuator of water, in case of need. This simple apparatus is now fixed in the best engineered steamers, and cannot be too strongly recommended as an appliance to all.

Heavier and more efficient ground tackling, a better equipment of sails, a larger number and better quality o fboats (particularly of life-boats, life-preserving apparatus, signal rockets, &c.) are alluded to by these and many other correspondents as desirable in steamers. An ingenious plan for the stowage of boats forming the cover of paddle-boxes has lately been invented by Captain George Smith, R. N., with the view of enabling a vessel to carry a larger number of boats without inconvenience.

The necessity of a complete and universally obeyed code of night-signals' and of one fixed "rule of the road," forms also a special subject of their remarks.

Our inquiries have convinced us that great public advantage would result from the adoption of a system of *registry*, *periodical survey*, and *license* of steam-vessels. A national registration would be the statistical record of all details of construction both of hull and machinery; the subsequent and periodical surveys would ascertain the actual condition of every vessel at stated periods; and access to these documents would furnish accurate knowledge, of an invaluable nature, to all parties interested in navigation by steam. Should the Government have occasion to hire or to purchase steam-vessels for naval, military or other purposes, these records would enable their officers to select vessels, whose strength, efficiency, capacity, power, &c., would be known; together with all the minor, yet important details necessary to determine the fitness of a vessel for any special service. These records, and their accessibility would stimulate the owners of steam-vessels to construct, and fasten them on the most approved models; to supply them with the best machinery; and to maintain them in the most efficient state of repair and sea-worthiness.

That the science on which Navigation by Steam depends for its economy, safety, its present success, and future advancement, would be promoted by these measures, cannot, we think, admit of a doubt. Persons commercially interested in this branch of our national power and prosperity, whether ships builders, engineers, owners or commanders, ardently desire and seek for results, and correct information, which at present are procured with difficulty, or are still oftener, unattainable. When it is considered that a large and increasing capital is expended on the hull, machinery and equipments of a single ocean-going, or large coasting steam-ship (a transatlantic steamer, costing above 50,000*l.*); that every deviation from already adopted dimensions, proportions of parts and power, or methods of constructing the hull and machinery, is an experiment in which not only mercantile success, but the security of life and property to a vast amount are involved, we think the value of a national, and accessible record of facts, cannot be too highly appreciated.

The importance of keeping a steam-log, on board ocean-going steam-ships especially, is alluded to by several of our nautical, and other correspondents, who also suggest that the contemplated Registration system should include a record of such logs.

We have reason to believe that the deposit of these useful documents would not be objected to by steam-ship companies; the log of the "Great Western" has been printed, and the owners of the "Liverpool" have adopted the same excellent means of registering all engineering facts and occurrences during the transatlantic voyages of that vessel.

The following Table has been supplied by Mr. Shaw, with additions by Messrs. Curling and Young, and Messrs. Maudslay and Field, and we believe it to be nearly correct. It contains some of the dimensions of the hull and machinery of the five largest steam-ships yet built or building, which principally influence their steaming and other requisite qualities. With an exact knowledge of these dimensions, and power, combined with a knowledge of the effect produced, which the logs would supply, the ship-builder and engineer would proceed on surer data; and proprietors could count, with greater certainty, on a new vessel answering its intended purpose. To the degree in which all these parties have been occasionally disappointed in their expectations, and how costly have been the alterations rendered necessary by mistakes, every large steam-vessel company could bear ample testimony.

DIMENSIONS.		GREAT WESTERN.	LIVERPOOL.	BRITISH QUEEN.	PRESIDENT.	UNITED KINGDOM.
Extreme length	*feet*	236	223	275	265	—
Ditto - - under deck	„	212	216	245	238	206
Ditto - - keel	„	205	209 5 in.	225	220	198
Breadth within the paddle-boxes	„	35 4 in.	30 10 in.	40	41	36 6 in.
Ditto including - ditto	„	59 8 in.	56 3 in.	64	64	—
Depth of hold at midships	„	23 2 in.	19 8 in.	27 6 in.	23 6 in.	22
Tons of space	„	679 ¼	559 ½	1,053	—	—
Tonnage of engine-room	„	641 ¾	581	963	—	—
Total Tonnage	*tons*	1,321	1,140 ½	2,016	1,840	1,400
Power of engines	*horses*	450	468	500	540	450
Diameter of cylinders	*inches*	73	75	77 ½	80	73
Length of stroke	*feet*	7	7	7	7 ½	7
Diameter of paddle-wheels	„	28 9 in.	28 5 in.	30 6 in.	31	28
Total weight of engines, boilers and water	*tons*	480	450	500	500	450
Total weight of coals, 20 days' consumption	„	600	600	750	750	—
Total weight of cargo	„	250	200	500	750	—
Draught of water with the above weight of stores	*feet*	16 8 in.	16 6 in.	16 7 in.	17	—

The practicability of executing two of the three principal measures recommended, viz. *registration*, and *periodical surveys*, is proved on a large scale by similar operations, conducted under the direction of the Committee of Lloyd's Register of British and Foreign Shipping.

The effects of the system pursued by this eminent establishment, on the security to property and life, on board sailing-vessels, have been highly advantageous to mercantile interests, and to the safety of ships. It appears, however, that as regards steam-vessels, the praiseworthy efforts of the committee are powerless and inoperative. It is stated by various correspondents, ship-builders, steam-vessel owners, and also by the intelligent surveyors of Lloyd's, that the mass of the proprietary of steamers do not register their vessels; or, do so, chiefly with the view of advertising a new vessel in the widely circulating volume annually published by that body. It appears, also, that of the steamers registered, many discontinue those periodical surveys required by the rules of the society, as necessary to determine their character in the list. That such is the fact, is shown by the circular issued to owners of steam-vessels by the committee, dated 6th December, 1838, and by the blanks in the surveys of steam-vessels registered in Lloyd's books, a list of which is communicated by Charles Graham, Esq., Secretary. The numerous derangements to which steam-vessels are liable are, clearly, far beyond the reach of a commercial body, unassisted with the authority of the law, and not possessing that mechanical knowledge, which can alone enable it to decide on the merits of a mechanical question submitted to them. Self-interest demands of the owner of sailing-vessels that he should register in Lloyd's books, and conform to their rules. The same principle actuates the steam-vessel owner to register a new vessel, but when that vessel is no longer worthy of a character, and when the owner knows he can no longer obtain a good reputation for his vessel at Lloyd's, he discontinues his surveys; which is precisely the time when a compulsory survey is required for the safety of the public.

Human life cannot be secured by under-writers, and passengers form the principal source of revenue to steam-vessel owners—to the greater proportion, the only source. Lloyd's Register holds out no inducement to this class to adopt its regulations; it appears, also, that on steam-vessel cargoes, in general, there is no difficulty in effecting insurance at lower rates than by sailing-vessels; and the large steam-vessel companies are very commonly their own under-writers, insuring only the value of the vessel, and, sometimes, that of the engines.

A trustworthy survey, and report on the state of the boilers, and machinery of steam-vessels, upon which so important an act as the granting a certificate, affirming them to be "in good order, and safe working condition," should be made,—not by the makers of the engines, or by fellow engineers, or by parties who have repaired, or who may be called upon to repair them,—but by competent persons independent of all interest in their construction, and of all connection with steam-vessel owners. Nor do rival engineers like to survey, and report upon each other's work. Observations on this subject, and much to the point, will be found in various letters in the Appendix, particularly by Mr. Williams, Mr. North; and full information on the system of Lloyd's Registry, as regards steam-vessels, will be found in Mr. Graham's communications.

The report concludes by giving an outline of *Proposed Legislative Regulations*, which we give in full:—

OUTLINE OF PROPOSED LEGISLATIVE REGULATIONS.

Having thus noticed those heads of the subject which appeared to require particular consideration, we now proceed to submit the outline of legislative regulations, which we recommend for adoption.

1. That a Board be appointed, in connection with and under the president of the board of trade, whose business it shall be to register, and classify all vessels navigated by steam, built, or building; the register to record detailed specifications of hull, and machinery—periodical surveys to be made upon them—and particulars of all disasters and accidents, which happen to, or may be occasioned by steam-vessels.

That the Board be authorized to appoint local or district surveyors, to inspect and report upon the condition of steamers; that, on such report being satisfactory, the Board shall grant licenses to the owners of steam-vessels to ply; that, if unsatisfactory, they shall withhold such license, as far as relates to the conveyance of passengers. Penalty for plying without lincense.

That the Board be empowered to investigate, personally, or otherwise, the nature and causes of accidents; to examine witnesses on oath; and call for the production of papers.

That the Board be required to make an annual report to Parliament of its proceedings; of the state and progress of the mercantile steam marine; and of the disasters which may have been sustained.

That the records be public, on the payment of a reasonable fee.

That the Board be empowered to frame and issue general instructions for the guidance of the local or district surveyors; also to publish an abstract of the law and regulations, with authority to require such abstract to be placed in a conspicuous part of the vessel; under penalties on neglect.

2. That the surveyors of hull and machinery be paid for their surveys by the owners of the vessels, according to a fixed scale, as is the practice for Lloyd's Register; that they shall forward their reports to the Board, which, in the event of the owner or owners objecting to the repairs required, in order to entitle the vessel to a passenger license, shall (if the objection regard the hull) call in one or two of the principal ship-builders of the port or district, unconnected with the work of such repairs, to survey the vessel, in conjunction with the official surveyor, and report specially thereon.

Should the decision of the Board be objected to, on the report of the surveyor (if the objection regard the machinery), it shall call in the aid of one or more engineers to survey and report in conjunction with such official surveyor.

Special surveys to be paid for by the owner or owners of the vessel, according to a fixed scale.

The first survey of the hull of a new vessel, to be made during its construction; and a specification of it transmitted to the Board, as is now done by the surveyors of Lloyd's to the committee.

A survey of the hull to be made during each of the first two years, and a survey every six months subsequently. All steamers to be docked, beached, or laid on the gridiron (as circumstances permit, and surveyed, after sustaining an injury by taking the ground, or otherwise, under penalty.

The first survey of the boilers, engines, and machinery to be made whilst they are being fixed in the vessel, and the requisite details of them to be reported to the Board.

Boilers, engines, and machinery to be surveyed every six months after the first year; and all serious accidents to be reported.

The surveyors to report on the fitness of a vessel, whether as a *sea-going*, or *river*-steamer.

3. License to express whether it be granted for cargo only; for towing-vessels; for the conveyance of passengers; or for these purposes combined; also, whether the vessel be intended to ply as a river, or sea-going steamer.

License to ply with passengers to be granted, or withheld, as aforesaid; a duplicate of which, or certificate to the same effect, signed by the Board, to be exhibited in the cabin or other conspicuous part of the vessel. All public advertisements of steamers to state whether licensed to carry passengers or not.

An annual charge for each license to be made on all steam-vessels, varying according to a scale of size and capacity; such charge to be in no case less than 1*l.*, nor exceeding 5*l.*

4. That the surveyor shall ascertain that the safety-valves be sufficient to pass all the steam which the boilers can generate in their ordinary state of work, at the pressure determined by the weight on the valves; the maximum of which pressure shall be fixed by the maker of the engines, or boilers, and the valves be loaded accordingly.

5. That, after an assigned period, no passenger license be granted to any vessel having safety-valves whose spindles or levers are exposed on deck, or capable of being loaded externally, unless satisfactorily protected. Penalty on engineers, masters, or others, for loading valves beyond the weight ascertained by the surveyor, and regulated as above.

6. That, in all new steamers; and, after an assigned period, in all steamers, now afloat, glass water-gauges, and mercurial pressure-gauges shall be required to be fitted to the boilers, to entitle the vessels to a license to ply with passengers.

No perfect mechanical substitute can be found for *care*, in the management of the steam-engine at sea, or on land; nor do we think that the use of the fusible discs enforced by the French laws, would be productive of additional security; nor, indeed, that any complexity of apparatus, attached to boilers, would contribute to the attainment of that object.

Apparatus, however, for indicating the level of water, and pressure of steam in boilers, is essential to their safe and economical management, and is of far greater import to the boilers of marine, than of land engines; accidents to the former, or failure in their supply of steam, being attended with peculiar dangers and disasters at sea, from which land boilers are exempt. Yet, it is a fact, accounted for, perhaps, by the circumstance of steam-vessels being owned and managed, generally, by persons unacquainted with the nature of the steam-engine, that these simple instruments are much more rarely to be found attached to marine, than to land boilers, which latter are usually under the direction of parties of mechanical education or knowledge.

7. That, in the event of the surveyor having information that any boiler be deteriorated in strength, or unsafe at its working pressure, in the interval of his periodical surveys, he shall be empowered by the Board, on his representation, to examine it; and in the event of the boiler proving faulty, the Board shall suspend the passenger license, until satisfied of the safety of such boiler.

8. That no steam-vessel be permitted to ply which is not furnished with a binnacle and compass, in good order.

9. That, after an assigned period, no sea-going steam-vessel, which carries coals on the tops, or about the sides of the boilers, shall be entitled to a passenger license; unless the boilers be protected by a shell of metal, or other sufficient security.

10. All river steamers to carry one effective boat—coasting and channel steamers two, or three boats, according to their size—and ocean steam-ships, four boats—as a minimum.

The surveyors to ascertain that these boats be kept in serviceable condition, and ready for use on emergency.

11. All steamers to be provided with sufficient hoses to convey water to any part of the vessel, with a serviceable outfit of water-buckets; and a moveable fire-engine to be carried in all coasting, channel and ocean-going steamers.

The proposed system of registration should include a classification of steamers; and as the character, to which each vessel would be entitled in its class, would depend on its general state of efficiency, we are disposed to think that many other important requisites for attaining the utmost practicable degree of security, would gradually be adopted by owners without compulsion; such as water-tight bulkheads in new vessels; powerful extinguishing pumps, worked by the engines; connection of the condensers with the bilge-water; disengaging apparatus for the paddle-wheels; heavier and more effective ground-tackling, &c. The publication of accidents, and of their causes, would also warn steam-vessel owners, commanders, and engineers, and instruct them how to guard against disasters.

In framing these recommendations, our object has been to suggest practical means for further securing public safety, without inflicting vexatious rules on steam-vessel owners; we believe that their adoption would tend materially to promote, and, in no respect, to cripple the progress of Navigation by Steam. We are confirmed in these views by finding them so much in accordance with the majority of opinions expressed in the Appendix, and they correspond with several of the regulations enacted by foreign states. They are, however, much less stringent in their nature than those proposed by many of our correspondents; and we consider them much less onerous, and more suitable to the peculiar character of the British steam-marine, than the laws of other countries. An abstract of these laws is annexed, and the whole are given in the Appendix.

There is one additional measure strongly advocated, but we feel great doubts of its practicability; viz. that of compelling the engineers employed on board steam-vessels to undergo preparatory examination, and to find surety for their good behaviour. There is no existing Board at the different ports competent to determine the fitness of this class of men for their occupations; and we think it would be difficult for any local surveyor to decide on individual qualifications. Important as we think it is to raise the grade of engine-men—who have, in fact, in their hands, the lives of all on board,—we are of opinion their means of doing injury to life or property would be so much abridged by the foregoing regulations, that it would suffice to impose a penalty upon them, for any wilful abandonment of duty, gross negligence, or drunkenness.

We, also, feel considerable hesitation in offering any suggestions as to limiting the number of passengers in steam-vessels, a measure which has been strongly urged upon our attention. *Cabin* passengers take care of themselves, and will not go on board, unless there be adequate accommodation; not so, however, *deck* passengers; from the increased number of whom alone, danger is to be apprehended.

Legislation, with respect to the number of passengers, must have reference to the tonnage, either by builder's measurement, or by register; but the stability of the vessel in carrying a load of passengers *on deck*, or in carrying a due proportion of sails, is materially affected by the weight and condition of the cargo under deck. Our difficulty on this subject is, therefore, much increased by the circumstance that a vessel carrying cargo, under deck, is, for that very reason, better qualified to take a *deck-load* of passengers with safety, than vessels, although exclusively appropriated to passengers; in consequence of the greater stability which vessels acquire, in a sea-way, by reason of the weight of cargo carried below.

That the obligation to carry some powerful steam-whistle, bell, or gong, be part of the proposed law, as regards steam-vessels; also that their rate through the water be defined, during fog, and thick weather, in crowded waters, whether plying by day or night.

THOMAS TREDGOLD.

To architects, engineers, and persons concerned in any department of building, the name of Tredgold must not only be familiar, but likewise respected and valued; and it is presumed not less so by many individuals in the higher walks of life. To all such it must be a matter of painful interest to be informed, that the family of such a highly-gifted man and martyr to science, consisting of an aged mother, two daughters in extremely delicate health, and a son of about thirteen years of age, are in very dependent circumstances. His friends have long cherished the hope that before this time—for it is now ten years since his death—their situation might have attracted the favourable notice of government; but as this has not been the case, Mr. Habershon, one of his early friends and his biographer, with John Donkin, Esq., his joint executor, have commenced a subscription in furtherance of this laudable object.

RALPH REDIVIVUS.

No. XVII.

OUR HOUSE IN LINCOLN'S INN FIELDS.

According to an article in the "Conversations Lexicon der Gegenwart," which professes to afford some information as to the present state of architecture in England, "Sir John Soane's buildings generally display superior taste, but are not always well-disposed in plan"! So far from which being the case, the very reverse to it is the truth, for while his plans were generally excellent, and displayed considerable invention, the taste manifested in his designs was apt to be very unequal, seldom good throughout, and occasionally most *baroque*, mean withal, and unmeaning. This front of his own, or we may now call it, of Our Own house in Lincoln's Inn Fields, although not his very worst production, is one which none will envy him the reputation of, since it manifests far more of whimsicality than of originality. Even supposing for a moment that nothing can be alleged against the taste shown in any of the separate parts, it is decidedly faulty and defective as a whole, not because it is in a style perfectly *sui generis*, but because it is a crude jumble, amounting to no style at all. The house itself, which shows itself plainly enough, is one thing, while the fanciful addition or excrescence by which it has been attempted to disguise it, though only partially, is something altogether different. The former is as plain and homely as either of the houses adjoining it; what has been struck up against it is, on the contrary, not only exceedingly fantastic, but not a little mean-looking into the bargain; which meanness of character, it should be observed, is altogether different from homeliness, it being neither more nor less than that which almost invariably attends paltry pretension and trumpery affectation.

Besides being remarkably poor and insipid in itself, this odd appendage to the front of the house is decidedly contrary to all just architectural principle, inasmuch as though really of stone, it has the appearance of being constructed merely of boards, the thickness of the stone-work being only a few inches, a species of delusion as disagreeable in itself, as it is at variance with that usually practised; for if most of our buildings are, according to some very veracious critics, mere "lath and plaster," they have, at all events, the merit of looking substantial, whereas in this case stone has been employed to form a flimsy-looking fabric, whose front is scarcely thicker than a wall of stout planks, which appearance is in some degree increased rather than diminished, by the arches of what was originally an open viranda, having been filled in with windows, since this adscititious structure has been thereby rendered the external front of the house, and the window sashes hardly recede at all within its surface. The upper story of it, on the other hand, which remains as before, looks as it always did, like a child's fabric of cards—thin slabs of stone set np on edge, but how held together it is impossible to guess. That there is any want of real security or sufficient solidity is not to be supposed, but there most certainly is a great want of the expression of the latter, if not altogether of the former; at the same time that there is nothing whatever of that lightness and slenderness combined with delicate richness, which produce such a charm in some styles of architecture—for instance, in many Gothic and Oriental examples, where tenuity in parts of the construction is made to conduce to beauty and to ornament. Here the architecture professes to the eye to aim at the usual character of solidity, there being no indication of a different principle having been adopted and suitably carried out. The unfortunate consequence is, that this capricious essay is not at all satisfactory according to any one principal of art.

Another very fatal oversight appears to have been committed, which is, that the elevation appears to have been considered merely with respect to its appearance upon paper, detached from everything else, without the slightest attention to the actual situation, for owing to its being rendered very conspicuous by being made to project beyond the line of the other houses, this building looks little better than a narrow upright slip, and far more insignificant than it would do if it did not thrust itself more forward than its neighbours. Unless it could have been made to endure examination better, it would have been more prudent not to allow it to court observation after the manner it does. Since it has been enclosed by the apertures being glazed, this viranda, if so it may be called, gives the whole house the appearance of projecting very awkwardly beyond any of the others, for the effect produced by it is altogether different from that attending any similar advancing part of a larger architectural mass.

No doubt as far as the house itself is concerned, this anomalous excrescence in front of it is considerably in its favour, inasmuch as it gives not only greater extent, but variety and novelty of character to the rooms which are enlarged by the space thus added to them. But then it is no more than reasonable to expect that this should be accomplished with greater attention to external appearance, so as rather to enhance it, than detract at all from it. It is comparatively easy to obtain either internal convenience or external beauty separately; the problem is to combine them in such manner that what contributes to the one shall also contribute to the other, and by way of referring to a somewhat analogous instance, though only a single one, it will be sufficient to mention the Bay and Oriel in Gothic architecture, as beautiful and characteristic features externally as they are within.

Had it been the production of a mere botcher and bungler, such a front as this in Lincoln's Inn Fields would have excited no particular surprise, whatever other mental emotion it might have occasioned. Very different, however, does the case become when we consider that it was designed by the late Professor of Architecture, who, whether deservedly or not, has been complimented almost unsparingly for his ability and talents. Nor can it be alleged as a mitigating excuse for his deplorable failure in this instance, that he was at all thwarted or checked in his ideas, and obliged to comply with the preposterous whims of a stupid, obstinate employer, quite contrary to his own better judgment and taste. Here he was under no control, but was at liberty to abandon himself freely to the inspiration of his own poetical fancy, and to realise one of those visions of architectural grace and beauty by which he was wont to imagine himself to be visited. What has been the result? Nothing better than a poor flimsy meagre box-looking erection, very little, if at all superior in its puny taste, to many of our London gin palaces. How far Sir John was satisfied with it himself, I cannot undertake to say, but if he was satisfied with it at all, he must have been satisfied very easily indeed.

Notwithstanding that he was checked by no scruples as to innovating very freely, Soane after all accomplished nothing approaching to a style, or even laying the foundations of one. He acquired a manner of his own, and nothing more. Instead of gradually advancing in the path he ventured into, he seems to have quite bewildered himself, to have kept groping about and fumbling at novelty, without being able to seize hold of originality. What his principles were, his architectural principles I mean, it is impossible to decide. In fact, he seems to have had no positive ones, but to have shifted and veered about just according to the whim of the moment.

With respect to taste, the whole of his own house convicts him of having been exceedingly unequal, and addicted to the trivial and the trifling. There are many exceeding clever and pleasing ideas thrown out in many parts of the interior, but hardly any one of them has been properly worked up. There are many ingenious contrivances exemplified in it, which as lessons and hints are valuable enough, yet beyond that may almost be pronounced failures. The whole is little better than a number of odds and ends of the kind jumbled together—an architectural *cento* of rags and patches, of little shreds and bits to serve as a sort of professional pattern card. So far, therefore, from treating it at all unjustly by so styling it, it is only by considering it merely as such that we reconcile ourselves to it, and overlook its incongruities as a whole. In the little court between the house and the museum at the rear of it, just enough has been done to show what might have been accomplished within that confined space, and how pleasing a bit of scenic architecture might have been produced, were it at all more than a mere beginning. At present it produces nearly the same impression as a picture would do that should be framed and hung up, though many parts of its canvas should not have been touched at all by the pencil. The museum itself is no better; it has no pretensions whatever to architectural design or effect, even in its plan, being an irregular, crowded, huddled-up, cut-up, mere make-shift of a place, where the casts, &c., are stowed away without half so much aim at arrangement as may be seen in the "show-rooms" of many tradesmen. The only room (excepting the small parlour next the court) that is at all satisfactory, properly studied, and consistently finished, is the picture cabinet, which is certainly a delightful little architectural bijou, a model for a small room of the kind, especially for one similarly situated.

Though it is no particular defect in the house itself that it is most ill-adapted for a museum open to the public, since it was not built nor afterwards altered for any such purpose, it is not on that account the less absurd that it should have been so appropriated, unless it had been freely devoted to public use, and rendered accessible every day and all day long, without other restriction than what would be indispensably necessary to protect it from injury. In that case about a hundred-fold the present number of persons might have visited it in the course of a year, all of whom would doubtless have brought away with them nothing but their admiration. As it is now managed, however, the whole affair is a piece of veritable humbug—one that tells people plainly enough what sort of meaning Sir John attached to the word "donation."

CANDIDUS'S NOTE-BOOK.
FASCICULUS VII.

I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please.

I. I was informed the other day that I had been severely reproached by one whose name was told to me, for expressing a very mean opinion of Nash's abilities as an architect, whenever I have mentioned him. In so doing I am so far from being at all singular, that I only seem to adopt the general opinion entertained of him, and therefore should have been very glad to have discovered, if possible, merits which the rest of the world had either carelessly overlooked, or been too obtuse to discover. My reprover is pleased to affirm that he possessed very superior talent; yet that bare assertion without something like proof to support it, may very well be set aside as amounting to nothing, or rather as a proof in itself that it would not be at all discreet to attempt to confirm the praise by pointing to any one of his works as a testimony in his favour. It is possible that he may have succeeded better in some of the things he did, but in those by which he is most known,—or at any rate with which I am acquainted, he exhibited, if not always the very worse taste—a most insufferably mediocre one,—vulgar commonplace stuff, and most deplorable insipidity. Look at the building which forms the east side of Carlton Place; look at the Regent's Park terraces, which Bartholomew terms "mortar skimmings by the mile": they are stamped by littleness and feebleness, which in some of the designs are rendered most flagitiously offensive by the coarse and vulgar tawdriness with which the fronts are bedizzened out. Uglier things there may be, but excepting our modern gin palaces, nothing so flagrantly *meretricious* in character. Whenever I look at the slatternly finery with which they are tricked out, I feel that I am standing in the presence of the "Harlotry of art." Yet to Nash it was that George the Fourth intrusted the task of erecting a palace; which, notwithstanding the sums so extravagantly squandered away upon it, is little less than actually disgraceful to the character of art in this country. Independent of mere size, the building in St. James' Park has nothing whatever to recommend it. It is not at all distinguished by greatness of manner,—quite the contrary, for there is not a single portion of it that is not stamped by littleness and insignificance. What a singular, and to ourselves, deplorable contrast does it present to the new palace of the Duke of Brunswick by Ottmer, engravings of which have reached this country. Though not free from faults, the Brunswick palace has at least a grand and imposing air. It looks like the residence of a sovereign, which is much more than our own does. As a palace for the sovereign of Little Britain the one in St. James' Park would be reasonably handsome and stylish—a smart piece of architecture enough; but for that of Great Britain it is not so well. However there may be excuse for Nash, poor man: John Bull is both very poor and very stingy; whereas, it may be presumed the Brunswickers have plenty of *mopusses*, and can afford to build palaces that look like palaces after they are built.

II. Greatly will Bartholomew,—who must not be confounded with St. Bartholomew the Great, exult at a damper having been thrown upon competition by the result of that for the Nelson monument. Poor competition, a most woful figure do you now cut! Well may you hang your head;—better would it be were you to go and hang yourself. As for the profession, they will very quietly go to sleep upon the matter. No wonder that committees laugh at them to their very faces, when they show that they may be kicked at and beaten with impunity, like spaniels. Never were there such pluckless creatures as they show themselves to be, when, without making the slightest protest against such treatment, they allow themselves to be bamboozled in the most bungling, barefaced manner. The Royal Exchange competition is already openly spoken of by many as being little better than an arrant hoax. The plans of the committee are it seems all settled, before a single plan has been sent in by those *invited* to compete for the building. Butler must have been thinking of architects when he penned his hackneyed distich,

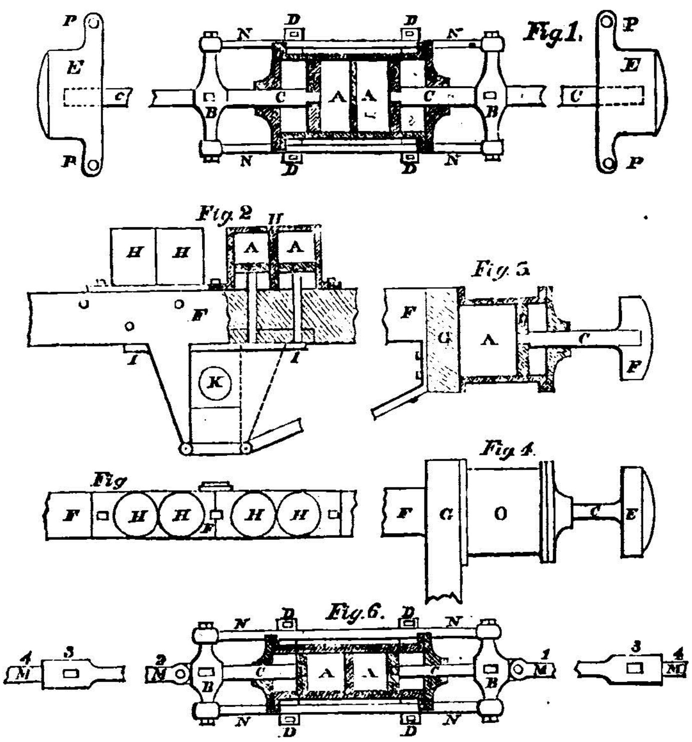
Surely the pleasure is as great
In being cheated as to cheat.

III. Baron Von Klenze has just got a severe thrashing: I do not mean that he has literally been beaten black and blue, but has been so cut up that he is likely to look very blank and blue for some time to come. Has he then, it will be asked, been attacked by some impudent shallow-pated journalist? No: his theory and opinions have been deliberately ridiculed as false and extravagant by Professor Wiegmann of Dusseldorff, who is himself an architect. The Professor's tone is not particularly courteous, nor does he omit the opportunity of giving the Baron a hard hit wherever he can. Among other things he ridicules his affected language, and the solemn obscurity in which he wraps up his meanings or no-meanings in such manner that it requires an Œdipus to unriddle them. "Architecture," says the Baron, "in the ethic (?) meaning of the term, is the art of shaping and putting together natural materials in order to accommodate them to the purposes and wants of society, so that the method of applying them according to the laws of strength, durability, and consistency, may secure the greatest possible firmness and lastingness with the least possible cost of labour and material!" Commenting upon which very oracular definition, the Professor,—no doubt very rudely—remarks that if such be the case, a boot-jack is upon a par with a work of architecture, and that a tailor or shoemaker can fulfil all the conditions laid down by the *Ritter*, just as well as Ritter Von Klenze himself, or any other architect.—Klenze, it is well known, is the Don Quixote of Grecian architecture, and not a little Quixotic in his notions of it. According to him it is the only positive architecture; the meaning of which expression I must confess, I positively do not understand. There is, in my opinion, infinitely more good sense and valuable truth in the following remark by Wiegmann himself: "As studious disciples of ancient art the most important lesson we can derive from it is, to endeavour to work out for ourselves a style that shall be to us what their own was to the Greeks. It is only by being so understood and so applied that the beautiful art of classical antiquity can exercise a worthy and beneficial influence on our times; which it cannot do so long as it shall continue to be a lifeless model, for slavish—and he might have added, indolent—'imitation.'"

IV. It is possible, nay very probable, or I may as well say, once for all, very certain, that nobody in this country is acquainted with the writings of Gogol, notwithstanding that he is one of the living literary celebrities of St. Petersburg. Beyond that, and that he has the reputation of being one of the cleverest authors of his day, I myself know very little more of him than any one else; having only a few hours ago opened his two volumes entitled "*Arabeski*," when my attention was instantly arrested by an article headed "*On Architecture.*" That was sufficient to determine me where to commence an acquaintance with Gogol; yet I must confess that it was not without very great misgivings that I did so; for it was not at all likely, I thought, that I should meet with any thing particularly new, or rather, not particularly stale, on such a subject, in such a quarter. To my astonishment, however, I have found that it does contain much original thinking on the subject, much sound criticism, and many ingenious and clever remarks. I shall confine myself, however, at least for the present, to that passage where he expresses his discontent at the utter want of originality manifested in all modern works of architecture. In every other class of ornamental productions, he observes, invention is permitted to have free scope, the consequence of which is that forms and combinations, as tasteful as they are novel, are obtained, which but for such liberty would never have been thought of. It is thus that the artisan, the mere mechanic frequently surpasses his models, although they may be very good in themselves, and seem to require no further improvement: but the architect—the artist as he is pleased to style himself, durst not, for the very life of him, attempt any thing of the kind. Such privilege is denied to him. Innovation! heterodoxy! heresy! All his comrades would at once be up in arms against him who should attempt to alter, not the proportions of an order, but any of its decorative details, however true he might keep to its general character. I am afraid Gogol himself will be considered outrageously heterodox. What business has he to have an opinion at all upon the matter? Nobody ought to presume to understand architecture, but architects themselves; and then things would go on smoothly and quietly. It is all very well for other people to have just brains enough to admire and wonder, and nothing more.

New Projectile.—Very early on Thursday morning, the 4th ultimo, an experiment was made at Kingston with a new and formidable projectile, meant to supersede, not only cannon, but also the much more questionably vaunted hollow-shell, now a favourite in the French and Russian navies. The whole apparatus did not exceed twelve or thirteen pounds weight, and was enclosed in a very small compass. The projectile was launched by hand, from a distance, at a pleasure-boat. It proceeded noiselessly till it reached the aim, and the effect was then terrific. Catching the vessel a-midships, the force of the explosion fairly raised it above the stream and broke every single plank into splinters and small fragments, so that no idea of the vessel's form or use was left for the spectator. The splinters were carried in every direction, and many thrown into the neighbouring fields. The explosive power was only about two pounds, but exceeded the destructive energy of at least forty times that weight of gunpowder, as now used, in any shape. The percussion was tremendous and shook the houses for a considerable distance. It was attributed at Kingston to the explosion of a powder mill at Hounslow, and caused great excitement.—*Times.*

BURSTALL'S PATENT PNEUMATIC CARRIAGE SPRING RAILWAY BUFFER, AND ELASTIC DRAG.



The principal feature of this invention (as shown in the diagrams) consists in applying the elastic properties of the air for the springs and buffers of railway carriages, and is best performed by inclosing in a metal cylinder an air-tight vessel constructed of caoutchouc or caoutchouc and silk or cotton, such as the well known preparation of Mr. Mackintosh, or of some of the animal tissues, or any other flexible substance which can be made air-tight.

Fig. 1 in the plan shows a double cylinder, its pistons, buffers, &c., the cylinder being in section,) to indicate the situation of the air vessels.

Fig. 2, 3, 4, and 5 are plans and sections of part of a locomotive steam carriage frame, with four of the springs; the buffer, cylinder, and part of the frame, being in section as in fig. 1.

Fig. 6 is a plan of an elastic drag, and an improved method of connecting a train of carriages together.

The same letters of reference are used in the like parts in all the plans.

In fig. 1, AA are those parts of a cylinder (which is constructed with a partition in the centre to make it into two) in which the air vessels are to be placed; L L are two pistons for compressing the air vessels; C C the piston rods on which the cross heads B B are to be securely fixed; the outer ends of the piston rods C C being extended to the full length of the carriage for the purpose of fixing the buffers E E; the bars across the buffers with the holes P P P P are for the purpose of fixing drag chains to connect one carriage to the next in the train; the cylinder (as only one will generally be required) must be bolted by the four lugs D D D D to the centre of the carriage; the two cross heads B B are connected together by the side rods N N to cause the two pistons to act together, or as one is compressed against the one air vessel, the other will be relaxed according as the carriage is moved forward or backward, and as the buffers are fixed to the ends of the piston rods, the concussion will be received through them on the corresponding air vessel.

In fig. 2 and 5, F F, is part of the side frame of a railway steam carriage; fig. 5 being the plan, and fig. 2 the elevation, with part in section; H H H H are four cylinders, and may be seven to ten inches long, and five to seven inches diameter, two being shown in section and two in elevation; together they form a powerful carriage spring on the same principle as the above described buffer, with air vessels, pistons, and piston rods: the cylinders may be made of cast iron, cast in one piece, and must be bolted upon the top of the carriage frame; K is the axle of the carriage, with its brass bearing guided by the iron frame in the usual way, on this brass a strong iron bar I I is fixed, and on which the four piston rods of the springs stand so that the compression of the air vessels in the cylinders A A may produce the required elastic action.

In fig. 3 and 4, G G, is the end framing of a steam carriage, fig. 3 being a section of that, and a buffer to be placed at the end of the carriage, while fig. 4 is a plan; this buffer is constructed and acts on the principle before described, and is for the protection of the carriage, when either pushing a train before the steam carriage or when one carriage is propelled against another.

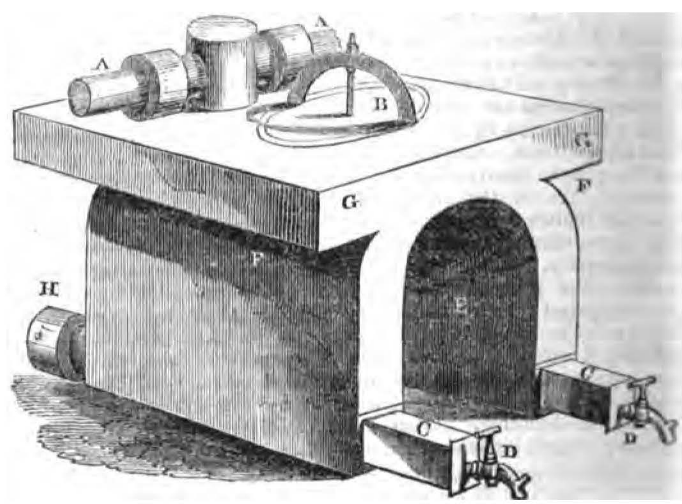
Fig. 6 is a plan of an elastic drag, on the same principle and construction as fig. 1, except, instead of the two buffers the elongated piston rods are provided with a socket joint and key to connect the train together, as at M 3 and 4, and two horizontal joints as at M 1 and 2; these joints being for the purpose of allowing the train of carriages, however long, to conform without stress or strain to any curve of the railway. By this plan the whole train will be locked together by what will be, in effect, a complete bar from end to end; while each carriage being only acted on through the medium of the elastic air vessels, will be freely at liberty to take its natural place on the railway bars, and any oscillatory motion which any individual carriage may receive, will end with itself, instead of as at present being propagated backwards and forwards from one end of the train to the other, while any sudden shock will be received on the air vessels the same as if provided with buffers.

As in this method of supporting carriages and forming railway buffers, advantage is taken of two of the most elastic substances in nature, it principally remains to show there are no practical difficulties in the way; this will be clear from the fact, that the air vessel is so completely supported by the cylinder, that a vessel made by expanding with a syringe one of the common caoutchouc bottles, sold by the stationers, weighing only one ounce, and enlarged till it was less than 1-40th of an inch thick, bore, without symptoms of failure, a gross weight of upwards of 300 pounds, equal to 50 pounds to the inch; which was likewise the case when a sheep's bladder of less than one quarter that weight was put into the cylinder.

In constructing the single buffer, as in fig. 3 and 4, it is recommended that they be made 7 or 8 inches diameter, or containing 50 to 60 circular inches section; this, if pressed by concussion to half its length, will give a resistance of about 700 pounds; if into 1-4th 2,000 pounds; or if into 1-8th, 5 to 6,000 pounds; but so long as the cylinder is strong enough, it can never be brought home.

In the elastic drag, fig. 6, cylinders of five inches diameter will be fully sufficient, as the utmost draught of each carriage may not exceed 100 pounds; and as each carriage will have its own independent spring, this will give a power of compression of four pounds only to each circular inch; while in case of any sudden stopping, as the air vessel may bear 100 pounds to the inch, a resistance of about 2,000 pounds may be received without any prejudice to the spring.

WILLIAMS' PATENT WROUGHT IRON BOILER.



A A the flow pipes. B man-hole. C C apertures of three inch square pipe, nine inch long with cocks D D fixed on to the front with a moveable flange, to clear out the dirt, &c., from the inside. E the fire-place F the outside of the boiler forming the side flues, where the fire passes round. G the top of the boiler. H the return-pipe.

The annexed engraving is a perspective view of a very compact and economic boiler; every advantage has been taken for economizing the heat, as well as taking every precaution for cleaning out the interior, for want of which most boilers on a small scale fail, in consequence of the sediment and impurities of the water forming a crust upon the internal surface, preventing the caloric passing speedily from the fuel through the metal to the water, and causing also the boiler to be quickly burned out. The boiler is made of wrought-iron, and is furnished with a man-hole at the top for the purpose of cleansing the interior, and there are also two apertures in front communicating with the bottom for the same purpose; these two apertures are closed with iron plates, fixed to flanges with nuts and screws and which are easily removed when required. The fuel is placed in the centre of the boiler, and the flame is made to divide at the back and pass round both sides, and again unite in front and pass over the top, to the chimney, by this means no part of the boiler is exposed to the cold atmosphere, but all is subject to the direct action of the fire. Instead of dividing the upper and side flues by a brick partition, as is usually the case in setting boilers, they are divided by a flange of the boiler filled with water, by this construction no part of the boiler contains more than 3½ inches in thickness of water, consequently the circulation through the hot water pipes is very rapid.

Some of these boilers were fixed last winter for the purpose of heating conservatories, and gave perfect satisfaction; a model of the boiler may be seen at the office of this Journal.

THE WELLINGTON MEMORIAL.

Sir—In the authenticated account of the proceedings at a meeting of the General Committee on the Wellington Military Memorial, some assertions were made that are calculated to create a prejudice which might not have been intended, and as Dr. Johnson observed, in questions of general concern, there is no law of government or rule of decency that forbids open examination and public discussion. The subscribers, who in the list of the committee read so many illustrious names, had a security that nothing would be done in opposition to the argument, and in defiance of right reason, yet it appears by the statement of Lord Hill, that two or three days after the meeting of the general committee he expressed an opinion against their proceedings, but he was told that it was too late, and a few days afterwards a written statement was made by several influencial members of the committee, not against the choice of the artist, but that due care had not been taken to obtain the best design; now as it seems by Mr. Croker's letter to Mr. Rice, "that he in common with others, entertained an opinion that some undue favour was intended for Mr. Wyatt, it was reasonable to suppose that the committee would have courted investigation instead of clinging to form for protection from discussion; and as a general meeting of the subscribers could not have impeded the work, it might have been useful as a proof that the committee had, in common with the subscribers, no object of private patronage in getting up the second memorial, but were actuated solely by an anxious and earnest desire to express their love and admiration of the immortal Wellington, by erecting the best military memorial that art could produce, and to obtain that object public opinion was in favour of competition; but in opposition to that feeling the Right Honourable J. Wilson Croker thought it requisite to taunt Lord Colborne with the failure of the Nelson competition, and said that it would have cured any body of the *principle* of competition. "That not one person of note offered, one single R.A., and one only, not one artist, sculptor, designer, or painter, whose names any one of us had heard before; and the result was that after all that competition, we selected a mere architectural *designer*, which we could equally well have done before the competition began, in short, that as producing any thing *good* or valuable in the way of art, I take upon myself to say that it was an utter failure." As the models and designs are exhibiting for the benefit of a charitable institution, to provide a home for the destitute sailor, this assertion was illtimed, and it was drawing largely upon the credulity of the members of the committee, to try to make them suppose that they had never heard the names of Bailey, R.A., Wilkins, R.A., Smirke, Campbell, Pistrucci, Beknes, Donaldson, Shaw, Fowler, Haydon, Britton, Salwin, Lough, Westmacott, Carew, Robinson, and many others who were competitors; Penrhyn Castle, the Conservatory at Carlton House, Dunkeld Margam, the Atlas Fire-office, and many other buildings have given some notoriety even to my humble name; but the models have been seen by many persons capable of appreciating works of art, whose opinions offer a triumphant refutation of Mr. Croker's aspersions. Marochettin, whose name has obtained such high distinction for his matchless equestrian statue, that it must have met the eyes or ears of Mr. Croker, withdrew his model after he had compared it with the works of the British artists, who have been so unjustly and unnecessarily repudiated and calumniated by Mr. Croker; although it might puzzle him to produce any work of art superior to Bailey's. Competitions carried out properly are the only channel to bring talented young men forward who have no patrons; but if according to Mr. Croker's doctrine, the name only is to be looked at, it is better to continue the parliamentary practice of a strong party struggle. The manly independent speeches of the Duke of Richmond, Lords Hill and Colborne, must gain honour and respect from all persons who feel any interest in the success of the arts, and their judicious conduct in avoiding a division cannot be too highly commended; in a matter of such importance there ought to be no bickering or division, and it was evident from the first that the ruling party were resolved to carry their object with a high hand (cote-à-cote). Mr. Croker stated that when he entered the committee, he found that a string of resolutions had been passed, ending with the appointment of Mr. Wyatt as the artist, but upon *his* objecting, the appointment was postponed, and that he afterwards agreed that Mr. Wyatt should be employed, provided the equestrian statue was placed on King George the 4th gateway arch to the Green Park; and he produced a drawing made by his direction to shew the proportion, and said that he understood from the architect that the arch was strong enough to support the weight of the statue, but it seems he was mistaken, as it now appears it will require to be strengthened and filled up, to be as firm as a single stone. Now as the use of the arch was made the condition of Mr. Croker's adhesion, the government of course thought it requisite to defer to public opinion, and they took the proper course to arrive at it, viz., by placing a model of the equestrian statue according to Mr. Croker's scale upon the arch, (the shouts of laughter and the derision with which it was treated was conclusive), and yet the committee persist, nor would they have called a meeting in all probability if Lord Melbourne had not had that respect for public opinion when properly expressed, that is becoming his exalted station, and required a proof that the majority of the subscribers were satisfied that with the large sum already paid in, and the sum that may be expected to be subscribed, nothing better could be produced in art than the completion of a gateway. The citizens of London may erect their equestrian statue on the top of the Mansion House, to show that their respect was greater for the warrior than for the minister; for if their statue is intended as a memorial of the illustrious Duke's services as minister, nothing can be more absurd than an equestrian statue, as it ought to be erected in his official robes, which are not certainly calculated for horseback. It is unfortunate that both in the Nelson and Wellington memorial such an utter disregard has been shown to public opinion. In the former, artists were invited to deliver designs and models, a sub-committee was appointed, seven of whom it is said met and resolved, it appears by Mr. Croker's account, to appoint a new architectural designer, which they could, as he says, have done just as well without any competition; the designs were afterwards exhibited and the general opinion was so strong against the selection of the column, that the general committee thought it right to pay the premiums, and allow the artists to alter their designs, and they or any other artists to send new designs, it was supposed for the purpose of obtaining the opinion of the public to guide the committee in their choice; yet by a mistaken restriction, but a small number of persons obtained a sight of the designs, the competitors felt the inconvenience so strongly, and were so desirous that the greatest possible publicity should be given to the designs, that they petitioned the committee to suspend their final adjudication until the design had been seen, and they offered to pay the cost of the room; their request was treated with silent contempt; a ballot-box was opened at the Thatched House Tavern, no discussion took place as to the merits of the designs, a resolution was passed that the sub-committee might alter the details of the chosen design, and as it was natural to suppose it would, the farce ended in there being more votes in favour of the column than of any one of the others; and it is possible the question was decided by a minority of the members of the committee. Mr. Croker, from his talents, acquirements and confidence, is of so much weight that it is to be regretted that he is not more careful in his assertions, witness his declaration in support of his opinion that he believed that in monarchial countries there is no instance of an esquestrian statue erected to a subject; when, in his way to Harley-street, if he passed through Cavendish-square, he must have seen the equestrian statue erected to the Duke of Cumberland, who was a subject to King George the 2nd. It is a melancholy consideration to reflect on, that two such glorious opportunities for the exercise of the highest qualities of the arts may be thrown away, merely because modern statesmen and warriors are not the best judges of art, and are too proud to consult those who are. The report states that the sum subscribed is 22,820*l.*, and the sum paid is about 17,920*l.* I thought that to subscribe was to pay, surely there are none who have not paid, but we ought to know if there be any names on paper alone.

Connaught Terrace. THOMAS HOPPER.

WOODEN PAVEMENT.

Sir—Observing a number of blocks of wood lying in the Old Bailey, evidently prepared for forming a wooden pavement for the carriage way opposite the Session House, and noticing the blocks to vary greatly in dimensions, I measured several of them, and found some only eight inches and a half long, while others were nine inches and three eighths. They generally approximate to the figure of regular hexagonal prisms; some of them, however, are a little conical, but the diameters vary so much that it will be impracticable to fit them together without leaving interstices between them so great as to render the outer parts of the blocks liable to be chipped off by the feet of the horses, and the wheels of the carriages passing over them.

The surfaces too of the ends of the blocks, each of which ought to be cut off exactly at right angles to the axis of the prism, form, in many cases, oblique angles with that axis, and consequently when the blocks are placed with the grain upright, one side will be higher than the other, and thus the pavement will necessarily have an uneven surface, and much of the value of the wooden pavement be lost.

Having attentively watched, for about four years, from 1827 to 1831 the effect of much travelling over a piece of wooden block pavement, well executed in the principal gateway of Vienna, and observed that it appeared to wear away much less than any other kind of pavement. I frequently on my return to England in 1831 mentioned to our engineers the superiority of a roadway thus formed, and took every opportunity to recommend the universal adoption of this excellent material.

But the goodness and durability of such a road will depend on the workmanship; the blocks ought all to be cut exactly to one gauge, and laid down on an even bed; I should consider a difference of a tenth of an inch in either length or breadth sufficient to digrace any engineer who would permit such blocks to be laid down contiguously. How great then must be my disgust at observing near an inch difference in the lengths, and more than an inch in the breadths of those blocks about to be used in the Old Bailey.

Being thoroughly satisfied that neither comfort nor durability can possibly result from such excessively bad workmanship, and apprehensive that the numerous benefits and great economy of wooden pavements will for a length of time be lost to the community, if such a wretched specimen be allowed to influence public opinion, I deem it my duty to warn all those concerned against a proceeding which can only produce disappointment and public injury.

I am, Sir, your obedient servant,
John Isaac Hawkins,
Civil Engineer and Patent Agent.

Quality Court, Chancery Lane.
July 24, 1839.

RUNNING GAUGE.

Sir—In your last number you affixed the initials A. C. to the description of my Running Gauge for a Railway; as I should not like to appear a plagiarist on A. C, or A. C. to appear a plagiarist on me, will you be kind enough to state that the initials ought to be E. C.

It is natural for the men who lay down the rails to lay them too wide rather than too narrow; it is for this reason, that the carriages *will* run on rails that are a little too wide, but will *not* run on rails that are too narrow. In the latter case the inconvenience falls on the workmen, who are obliged to take up the rails and relay them, but in the former case the inconvenience is felt by the passengers in the side motion of the carriages; but the running guage affords a ready means of examining them.—Bramah and Fox are manufacturing these gauges.

Your's sincerely,
Edward Cowper.

Painted Glass Window.—A very splendid painted glass window, designed to be placed in one of the new churches in Cambridgeshire, is now being exhibited at the rooms of Mr. Denew, No. 30, Charles Street, Berkeley Square. It is painted by Messrs. Hoadley and Oldfield, who are well known in this branch of art, under the direction of Messrs. Hancock, Rixon, and Dunt. The crayon drawings for the designs are by Mr. Wood, and the architectural portion of the window is by Messrs. Buckler. The window contains three compartments, besides the canopies. The centre compartment is a copy from Spagnoletti's celebrated picture, "The Descent from the Cross." The compartment to the left hand of the spectator is from the altar piece by Morales, in the chapel of Magdalene College, Oxford, a picture of extraordinary merit, and known to most persons from the repeated eugraving of the original. The right hand compartment is a copy of the altar-piece by Raphael Mengs, in the chapel of All Souls, Oxford, which is also well known. These pictures, with some allowances for the compression of the side compartments, are very faithful copies in all respects of the originals. These are beautifully coloured; there is very extraordinary vividness and brilliancy both in the flesh tints and in the draperies; the blues are peculiarly fine. The canopies are taken from originals in Fairford Church, Gloucestershire. The falling of the manna, the flowing rock, the commandments, and the cloven tongues, are from the representation in King's College, Cambridge. The crowns of immortality, and other devices, are original. These paintings are reflective of much credit on all persons connected in producing them. The artists have increased their already established reputation, and much praise is due to Messrs Hancock. for their liberal direction of the talent they have employed. They are painted on large pieces of crown glass, not plate glass, crown glass being considered to imbibe colour better than plate glass, and to be more brilliant in effect of tone. The pieces are kept together by metal bands, grooved like the fromes of a casement window. It has caused no little trouble to put these pieces together, and will not be the work of less than several weeks to separate them previous to their being sent to their ultimate destination, and to put them again together. In a word, this is a very noble window.—*Times.*

Discovery in the Arts.—One of the most important discoveries is the one applicable to the reprinting of books, or reproduction of engravings. M. Dupont, a very industrious printer, was seeking the means of saving the expense of stereotyping. With the assistance of a particular ink he was already enabled to avoid the preservation of the *cliches*, which require many materials, and much place and money, by the means of the preservation of a mere printed sheet, which lithography afterwards reproduced whenever it was wanted; but doubting whether the ink used upon that sheet would retain in the course of time the same properties, he consulted his brother, a very intelligent lithographer, and the latter found what neither ventured to expect. This new process is applicable not only to fresh printed sheets, but likewise to the oldest engravings, to the oldest books, and, what is of far more interest, to Greek, Chinose, and Hebrew books. It consists in two operations. Over the page or engravings of which you want a copy you lay a particular composition. It is placed upon the lithographic stone and pressed, and the stone reproduces, with scrupulous precision, the original engraving or book. This impression could not, however, serve such as it is. It is itself covered with the same preparation, and it may then print thousands of copies by the ordinary process of every sort of lithography. Five minutes suffice for both operations. The original engraving may be restored to the portfolio which has supplied it, for it has not been injured; the book, thus wholly reprinted, may undergo another binding, and then honourably resume its place in your library. This new process admits of a reduction of seventy-five per cent. upon the expense of printing; and as for engraving, that which on copper would cost one hundred francs, will now cost but twenty francs! What consequence will not this discovery yield. It threatens the graphic arts, engraving and printing, with a complete revolution. A man of the greatest talent in the art lays claim to priority in this discovery, as is always the case—when success has been obtained claimants come in. The wisdom of the central jury and patent laws must decide the question. In the meantime MM. Duponts are manufacturing, which is always a great point. On Monday the King, Queen, Madame Adelaide, and Princess Clementine visited again the exposition, and examined the lythotypographic produce of the brothers. His Majesty observing an engraved head of Albert Durer, of 1527, which was wanting in his collection of the Palais Royale, ordered a copy of it, and congratulated M.M. Duponts upon a discovery whereby there would be no longer any scarce engravings or books.—*Paris Periodical for June.*

Cloth Making without Spinning or Weaving.—Among the many extraordinary and truly wonderful inventions of the present times is a machine for the making of broad and narrow woollen cloths without spinning or weaving; and from our acquaintance with the staple manufacture of this district, after an inspection of patterns of this cloth, we should say there is every probability of this fabric superseding the usual mode of making cloth by spinning and weaving. The machines are patented in this and every other manufacturing nation. The inventor is an American, and appears to have a certain prospect of realising an ample fortune by the sale of his patent right. We understand patterns of this cloth, as well as drawings of the machinery, have been shewn to many of our principal merchants and manufacturers, none of whom have expressed a doubt but that the machinery appears capable of making low cloths which require a good substance. Should it succeed to anything like the expectations of the patentees, its abridgment of labour, as well manual as by machinery, will be very great. We find that means are already taken to introduce this machinery among our continental rivals; a company of eleven gentlemen in London have deposited five thousand pounds with the patentees, who have ordered a machine for them. when finished they are to try it one month, and if at the end of that month they think it will succeed, they are to pay twenty thousand pounds for the patent right in the kingdom of Belgium, and it will, of course, be worked there. We are therefore bound in duty to our country and her manufacturing interests to adopt such facilities as will prevent us falling into a position below our rivals in other countries. We are informed the necessary machinery for the production of this patent woollen felted cloth will be tried here in a week or two, under the superintendence of the inventor, by a cloth merchant who has an exclusive license, but is about to associate with him twenty other respectable business men, for the purpose of sharing the expenses of giving the invention a fair trial. It is calculated one set of machinery, not costing more than six hundred pounds, will be capable of producing six hundred yards of woollen cloth, thirty-six inches in width, per day of twelve hours.—*Leeds Mercury.*

TESTIMONIAL TO ROBERT STEPHENSON, ESQ.—The subscribers to the testimonial to be presented to Robert Stephenson, Esq., civil engineer, having determined that it shall consist of a handsome dinner service of plate, with a candelabrum, or other centre-piece, of appropriate and characteristic design, a committee of taste was appointed to select the design, representing every class of the subscribers, viz., Sir John Guest, M.P., and Mr. Crawshay, the iron trade: Mr. Bramah and Mr. Maudsley, the engine manufacturers; Mr. W. Freeman, Mr. Bagley, and Mr. White, the stone and cement trade; Mr. Dowsan and Mr. Holland, the timber trade; Mr. David M'Intosh and Mr. Thomas Jackson, the operative railway contractors. The committee met on Tuesday at Rider's hotel, Salisbury Square, and, from several designs submitted for their consideration, all possessing more or less of merit, they unanimously decided in favour of the one furnished by Mr. Benjamin Smith, of Duke Street, Lincoln's Inn Fields. It consists of a superb candelabrum, with a triangular base, surmounted by three figures, one at each angle, descriptive of Wisdom exhibiting to Genius and Philosophy the application of steam to the purposes of locomotion. At the corresponding points of the base are three groups of boys; one is occupied with the origin of the steam-engine, another with the ordinary stationary engine, and the third holding up a shield bearing upon it the perfect locomotive engine, shown in perspective, travelling upon a railway, and modelled after Mr. Stephenson's latest improvements. To this object Minerva is directing the attention of the group, as the triumph of science and the mechanical arts in the application of this mighty power. One of the compartments of the pedestal will be appropriated to the inscription, another to Mr. Stephenson's arms, richly embossed, and the third to a *bas relief* descriptive of the progress of a railway in its several stages of construction. The stem is composed of three vine branches, gracefully intertwined as they ascend, carrying nine branches for lights, and surmounted by a basket composed of the leaves and fruit of the vine. The branches have moveable tops, for the occasional substitution of cut glass for fruit or flowers, when lights are not required. The height will be about twenty-eight or thirty inches, the weight between seven hundred and eight hundred ounces, and cost 550*l.* About 500*l.* remains to be applied to the dinner service, the details of which have not yet been decided upon. It is understood that the testimonial will be presented at a public dinner, to which Mr. Stephenson will be invited, about the first week in October.—*Railway Times.*

THE NELSON MEMORIAL.—On Monday, the 8th ult., the members of the Nelson memorial assembled at the Thatched House Tavern, St. James's Street. Mr. Railton, the architect, was also in attendance. The following is a correct list of the noblemen and gentlemen appointed to form the sub-committee to superintend the erection of the monument:—The Duke of Wellington, the Duke of Northumberland, the Marquis of Lansdowne, Lord Colborne, Mr. S. Rice, Mr. Herries, Mr. Croker, Sir R. Inglis, Sir J. Barrow, Mr. Wood, the Duke of Buccleugh, and Sir G. Cockburnr. On the following morning the sub-committee were occupied in consulting Mr. Railton on his design, which the general committee had determined should be adopted.

NOTICE OR ALARM GONG.—A very ingenious instrument has been invented by Captain George Smith, R.N., intended to give warning of the approach and to announce the course a steamer is sailing on in a fog. It consists of a gong, on which a hammer is made to strike, every ten seconds a certain number of blows, by a very simple machinery, according to the course the vessel is sailing on. For example, if she be sailing north, the gong is struck once; if east, twice; if south, thrice; and if west, four times every ten seconds. By this systematic method, the position, course and proximity of a steamer will be clearly announced to any other vessel. In, rivers Captain Smith proposes the vessel to emit single sounds every ten seconds, which would be sufficient to give warning.

REVIEWS.

Experimental Essays on the Principles of Construction in Arches, Piers Buttresses, &c., by WILLIAM BLAND, Esq., with wood-cuts. London Weale, 1839.

These essays originally appeared in the Architectural Magazine., and are now republished in a collected form. The experiments exhibit much ingenuity, but the means of correcting them and ensuring their applicability has not been given.

The distinction between the properties of Roman and Gothic arches is well marked, and shows the principles which led to the development of Gothic architecture. The latter part of the work is devoted to an examination of several churches and chapter-houses, principally in the south of England, and contains much matter worthy of perusal.

The work is got up in a portable and convenient form, with many illustrations, and may be advantageously referred to as throwing much new light on the theory of this important subject.

A Practical and Theoretical Essay on Oblique Bridges, by GEORGE WATSON BUCK, M.I.C.E. London, John Weale.

This work has been long looked for by the profession; but the author very properly deferred its publication, "in consequence," he observes "of finding that his knowledge of the subject was daily increased by the experience afforded in the construction of a variety of bridges." This delay has given Mr. Buck a better opportunity of laying before the profession complete instructions on this important branch of engineering. During his engagement on the London and Birmingham railway, and his subsequent occupation on the Manchester and Birmingham railway, he had charge of several bridges of this description confided to his care. These being of brick, stone and iron, have offered him excellent opportunities to see how far his theoretical calculations were verified by practice, of which he was so far satisfied as to feel confidence in publishing his experience for the benefit of his brother engineers; he has reduced the subject to formulæ as simple as it would allow, and from the instructions and drawings given, an engineer of common practice will be able to construct an oblique or skew arch without any difficulty.

A Practical Treatise on Railways, by LIEUT. PETER LECOUNT, R.N., F.R.A.S., C.E. Edinburgh, Adam and Charles Black.

This treatise originally appeared in the seventh edition of the Encyclopædia Britannica, and is now published in a distinct volume, with very considerable additions. Lieut. Lecount is well known as being one of the resident engineers of the London and Birmingham railway, and from his connection with that work during its progress from the commencement to the conclusion, is peculiarly fitted for such a task. He has collected a vast mass of valuable information, both practical and theoretical, rendering the volume well deserving of the attention of the engineering student.

We have not time to enter more fully into this treatise, but will take an early opportunity of again referring to it.

Hosmer's Tables. London, John Weale.

We are by no means favourable to the use of tables for simply finding superficial or cubical quantities, as we feel convinced from our own experience, that they are to be found equally as quick by mental operation, if the mind be kept in constant and wholesome practice. To those, however, who are not of the same opinion, we recommend these tables as deserving of their attention. The author has given two tables, one for the land surveyor, and the other for the engineer or surveyor, they are each concentrated in a circle 10 inches diameter, and composed of a series of circles and an index. By the first table any quantity of land may be found in acres, roods and perches, and by the other table any superficial quantities in feet or yards.

The Principles and Practice of Levelling, By EDWARD JONES, Architect and Civil Engineer. London: Williams, 1839.

This work is a useful compilation, but by being too condensed is rendered difficult to the learner. It is open also to the objections which we had occasion to make in noticing another work on this subject on a previous occasion.

LITERARY NOTICES.

We have been favoured with the Introductory Lecture for 1839, of Mr. Baltard, Professor of the Theory of Architecture in the Royal Academy of Fine Arts at Paris. The professor is a vehement classic, and inveighs sorely against the Gothic and the present rage for the medieval styles. He shews very strong symptoms of the old regime, and his lecture, if not a sermon, seems directed to very little boys. It is quite French, and little more. The professor gives some licence to the Italian, but makes a just distinction between its best specimens and its decline. His observations on the progress of architecture in France since the Gothic era, afford, however, some just and interesting criticisms on the modern buildings of Paris.

Among the additions to the professional press may rank the new periodical which is on the point of appearing in Paris, under the title of Revue Generale de l'Architecture et des Travaux Publics (General Review of Architecture and Public Works). It is to appear monthly with engravings and lithographs, and reckons among its promised contributors Chevalier Leon Delaborde, Labrouste, Lemoyne, Albert Lenoir, Polonceau, Raoul Rochette, Texier, and many other French and English architects, engineers, and antiquarians. The chief editor is M. Cesar Daly.

THE DESIGN ACT, CAP. XVII. 2 VICTORIA.

AN ABSTRACT OF *an Act to secure to Proprietors of Designs for articles of manufacture the copyright of such Designs for a limited time.* 14*th June* 1839.

1. Enacts, that every proprietor of a new and original design made for any he following purposes, and *not published* before the 1st day of *July*, 1839,

shall have the sole right to use the same for any such purpose during the term of *twelve calendar months*, to be computed from the time of the same being registered according to this Act; and the following are the purposes referred to:

First.—For the pattern or print, to be either worked into or worked on, or printed on or painted on, any article of manufacture, being a tissue or textile fabric, except lace, and also except linens, cottons, calicoes, muslins, and any other article within the meaning of the Acts mentioned in the Schedule hereto annexed:

Second.—For the modelling, or the casting, or the embossment, or the chasing, or the engraving, or for any other kind of impression or ornament, on any article of manufacture, not being a tissue or textile fabric:

Third.—For the shape or configuration of any article of manufacture, except lace, and also except linens, cottons, calicoes, muslins, and any other article within the meaning of the acts mentioned in the schedule hereto annexed:

Provided always, that every proprietor of a new and original design made for the modelling, or the casting, or the embossment, or the chasing, or the engraving, or for any other kind of impression or ornament on any article of manufacture, being of any metal or mixed metals, shall have the sole right to use the same during the *term of three years*, to be computed from the time of the same being registered according to this act; but no person shall be entitled to the benefit of this act unless the design have before publication been registered according to this act, and unless such person he registered according to this act as the proprietor of the design, and unless after publication of the design every article of manufacture published by him, on which such design is used, have thereon the name of the first registered proprietor, and the number of the design in the register, and the date of the registration thereof: and the author of every such new and original design shall be considered the proprietor, unless he have executed the work on behalf of another person for a valuable consideration, in which case such person shall be considered the proprietor, and shall be entitled to be registered in the place of the author; and every person purchasing for a valuable consideration a new and original design, or the exclusive or the partial right to use the same for any or more of the above-mentioned purposes, in relation to any one or more articles of manufacture, shall be considered as the proprietor of the design for all or any one or more of such purposes, as the case happens to be.

2. Enacts, every person purchasing a new and original design may enter his title in the register hereby provided; and any writing purporting to be a transfer of such design, and signed by the proprietor thereof, shall operate as an effectual transfer; and the registrar shall, on request, and the production of such writing, insert the name of the new proprietor in the register; and the following may be the form of such transfer, and of such request to the registrar:

Form of Transfer and Authority to register.

'I *A. B.*, author [*or* proprietor] of design number having 'transferred my right thereto [*or if such transfer be partial*] so far as regards the making of [*describe the articles of manufacture with respect to which the right is transferred*] to *B. C.* of do 'hereby authorize you to insert his name on the register of designs accordingly.'

Form of Request to register.

'I *B. C.*, the person mentioned in the above transfer, do request you to 'register my name and property in the said design, according to the terms of such transfer.'

III. During the existence of such exclusive or partial right no person shall either do or cause to be done any of the following acts in regard to a registered design, without the licence or consent in writing of the registered proprietor thereof; (that is to say,)

No person shall use for the purposes aforesaid, or any of them, or print or work or copy, such registered design, or any original part thereof, on any article of manufacture, for sale:

No person shall publish, or sell or expose to sale or barter, or in any other manner dispose of for profit, any article whereon such registered design or any original part thereof has been used, knowing that the proprietor of such design has not given his consent to the use thereof upon such article:

No person shall adopt any such registered design on any article of manufacture for sale, either wholly or partially, by making any addition to any original part thereof, or by making any subtraction from any original part thereof:

And if any person commit any such act he shall for every offence forfeit a sum not less than *five pounds* and not exceeding *thirty pounds*, to the proprietor of the design in respect of which such offence has been committed.

IV. Enacts that the party injured by any such act, may recover such penalty, which is done by summoning the offender before two justices of the peace in England or Scotland, and if convicted, the penalty to be recovered by distress and sale of the goods of the offender.*

In *Ireland*, such penalty to be recovered either by action in a superior court of law at *Dublin*, or by civil bill in the Civil Bill Court of the county or place where the offence was committed:

No action or other proceeding for any offence under this act shall be brought after the expiration of six calendar months from the commission of the offence; and in such action or other proceeding every plaintiff or prosecutor shall recover his full costs of suit, or of such other proceeding.

V. Enacts that the lords of the committee of privy council for the consideration of all matters of trade and plantations may appoint a person to be a registrar of designs for articles of manufacture, and if they lords of the said committee see fit, a deputy registrar, clerks, and other necessary officers and servants; who shall hold their offices during the pleasure of the lords of the said committee; and the Commissioners of the Treasury to fix the salary or remuneration of such registrar, deputy registrar, clerks, officers, and servants; and to make rules for regulating the execution of the duties of the office of the said registrar; and such registrar shall have a seal of office.

VI. Enacts that the said registrar shall not register any design unless be be furnished with *three copies or drawings* of such design, accompanied with the name and place of abode of the proprietor thereof; and the registrar shall register all such copies from time to time successively as they are received by him for that purpose, and on every such copy he shall affix a number corresponding to such succession, and he shall retain two copies, one of which he shall file in his office, and the other he shall hold at the disposition of the lords of the said committee, and the remaining copy he shall return to the person by whom the same has been forwarded to him; and in order to give ready access to the copies of designs so registered, he shall keep a classified index of such copies of designs.

VII. Enacts that upon any original design so registered, and upon every copy thereof received for the purpose of being registered, or for the purpose of such registration being certified thereon, the registrar shall certify under his hand that the design has been so registered, the date of such registration, and the name of the registered proprietor; and such certificate made on every such original design, or on such copy thereof, and purporting to be signed by the registrar or deputy registrar, and purporting to have the seal of office of such registrar affixed thereto, shall, in the absence of evidence to the contrary, be sufficient proof, as follows:

Of the design, and of the name of the proprietor therein mentioned, having been duly registered; and
Of the commencement of the period of registry; and
Of the person named therein as proprietor being the proprietor; and
Of the originality of the design, and
Of the provisions of this act, and of any rule under which the certificate appears to be made, having been complied with:

And any such writing purporting to be such certificate shall (in the absence of evidence to the contrary,) be received in evidence without proof of the handwriting of the signature thereto, or of the seal of office affixed thereto, or of the person signing the same being the registrar or deputy registrar.

VIII. Enacts that the Commissioners of the Treasury shall fix the fees to be paid to the registrar.

IX. Enacts that if the registrar or any person employed under him demand or receive any gratuity or reward, except salary or remuneration authorized, he shall forfeit for every offence fifty pounds to any person suing for the same, in the Court of Exchequer, and he shall also be liable to be either suspended or dismissed from his office, and rendered incapable of holding any situation in the said office, as the Lords of the Treasury see fit.

X. Enacts that all letters and packets transmitted by post, either too or from the office of registrar of designs, relating solely to the business of such office, shall be exempt from postage.

SCHEDULE.

DATE OF ACTS.	TITLE.
27 Geo. 3. c. 38. (1787.)	An act for the encouragement of the arts of designing and printing linens, cottons, calicoes, and muslins, by vesting the properties thereof in the designers, printers, and proprietors for a limited time.
29 Geo. 3. c. 19. (1789.)	An act for continuing an act for the encouragement of the arts of designing and printing linens, cottons, calicoes, and muslins, by vesting the properties thereof in the designers, printers, and proprietors for a limited time.
34 Geo. 3. c. 23. (1794.)	An act for amending and making perpetual an act for the encouragement of the arts of designing and printing linens, cottons, calicoes, and muslins, by vesting the properties thereof in the designers, printers, and proprietors for a limited time.
2 Vict. (1839.)	Any act passed during the present session of parliament, "for extending the copyright of designs for calico printing to designs for printing other woven fabrics."

The Art Union of London.—A general meeting of the members of this society was held at Mr. Rainy's gallery, Regent-street, on Tuesday, the 4th ultimo, the Right Hon. Lord Prudhoe in the chair. In the absence of the honorary secretary, Mr Goodwin, jun., F.R.S., read the third report of the committee, from which it appeared that the number of subscribers has this year increased from 568 to 1,058. The total amount of subscriptions received is £1,295. The committee then proceeded to distribute the several prizes, varying in amount from £10 to £150; and John Ivatt Briscoe, Esq., M.P.; H. T. Hope, Esq., M.P.; B. Bond Cabbell, Esq., F.R.S.; W. Jones, Esq., and others, having addressed the chair, the meeting was dissolved.

* How is the penalty to be recovered from a *man of straw?* If he have no goods, he will escape punishment, as the act does not authorize imprisonment.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 30. The PRESIDENT in the Chair.

E. Cottam was elected a Graduate, J. Dodds and E. Cressy were elected Associates.

A paper was read "*On the Supply of Water from Artesian Wells in the London Basin, with an account of the sinking of the Well at the Reservoir of the New River Company in the Hampstead Road,*" by R. W. MYLNE, which was given in the last Journal.

In March, 1835, an excavation, twenty feet in diameter, and twenty-three feet deep, was made; the sides were supported by wooden curbs, with puddle at the back, so as to shut out the land-springs. A brick shaft was then carried up to the surface of the ground, and the excavation was continued for fifty-nine feet through clay. The brick shaft was supported at every eight feet by rings of greater exterior diameter than the shaft, so as to project a few inches into the clay. Three sets of iron cylinders, each of less diameter than the preceding, were introduced, as the unequal settlement of the ground rendered it impossible to sink the preceding set any further. By means of these, the well was sunk to the total depth of one hundred and eighty-three feet. The cavities formed at the back of the cylinders by the pumping out of the sand, caused such extensive settlements, that the works were stopped, until the plan of continuing the sinking with the water in the well was adopted. To this communication was appended a report from Mr. Simpson, in which he details the difficulties which had been met with, and particularly the extensive subsidence of earth caused by the removal of the sand. This far exceeded the quantity due to the contents of the well at the lower sand stratum, and the subsidence proceeded most rapidly when the water was pumped out of the well. The experience of wells near the metropolis shews that the springs in the chalk are much more abundant than in the sand, but in order properly to avail ourselves of these, there must be adits driven to unite the water from the fissures in the cavernous structure of the chalk. The report proceeds to speak of certain methods of securing the present works, and of prosecuting them, by either driving an iron pile curb, or sinking iron cylinders cast in entire circles. The former cannot be recommended, as a considerable further subsidence would be the consequence, and the shaking of the ram would endanger the works. The latter is performed with common boring rods and tools, the shells or buckets are fitted with valves opening upwards, and the material is raised by them with the greatest ease. When the cylinders become set, or when they do not sink in proportion to the material removed, they are slightly jarred by a heavy sledge hammer. The advantages of keeping the water in equilibrium inside and outside the cylinders is very great, and the method has been in many cases most successful. The paper was accompanied by a section of the works and the strata, and by drawings of the various tools employed.

May 7. The PRESIDENT in the Chair.

J S. Russell was elected a Graduate, and H. C. Bingham an Associate.

"*The Sewage of the City of Westminster described and delineated,*" by J. E. JONES.

In the earlier statutes and writings on this subject the word sewage, or sewerage, is identical with drainage, as appears particularly from the act of Henry the Eighth, which is the general Sewage Act by which the Commissioners of Sewers are now guided, being for the most part applicable to fen land drainage. The metropolis and adjacent districts, comprehended within a distance of ten miles from the Post Office, are divided into seven distinct and independent trusts, whereof five are administered by local acts, the other two by the general Sewage Act first alluded to. The sewers falling into the Thames within two miles of London, are, by the 3rd of James the First, placed under the Commissioners of Sewers, and the 47th of George the Third defines and declares the powers given by the act of James. This statute, passed in 1807, was not acted on to any extent till 1813, the interval being employed by the commissioners in requisite arrangements. The principles of drainage, or conducting the superfluous waters to their proper outlets, are few and simple; but in the drainage of a town, the masses of buildings of all ages and all kinds of various levels, the concentrated mass of filth and the numerous conflicting interests, conspire to make the establishment of an efficient system of sewage one of the most difficult, as it is one of the most important, objects to which the skill of man can be directed. One great difficulty has arisen from the commissioners not being invested wiih powers enabling them to originate new lines of sewers, but being confined to improving those that exist, and controlling the construction of new ones. A large portion of Westminster is below the level of high water, and the drainage of buildings being optional on the part of the builder, there consequently exist insulated houses and districts of loathsome filth for want of sufficient compulsory powers on the part of the commissioners. The obvious remedy for these evils is, to give powers to the Commissioners of Sewers within their districts to compel every person to drain his property in an effective manner under their approval, and to form such new main lines as circumstances may render necessary, and to impose general rates for their maintenance. A large plan or map was exhibited of the city of Westminster, compiled from original surveys in the possession of the Commissioners of Sewers, and laid down to a scale of one inch to two hundred feet; the boundaries of the city and of the several parishes, of the main lines of sewers, and of the collateral sewers, were marked with different coloured lines; also a Book of Sections, consisting of more than one hundred sheets of tables and drawings, showing the districts drained by the main sewers, plans and sections on an enlarged scale of all the main sewers, with the elevations of their several outlets or falls into the Thames.

Professor Wallace exhibited a pentograph of a novel construction, by which drawings may be copied or reduced and etched with great facility. Mr. Macneill bore testimony to the advantages of this construction over every other which he had seen, and stated that he had been enabled to finish a plan in three hours and a-half, which could not have been done by an ordinary pentograph in less than twelve hours.

May 14. The PRESIDENT in the Chair.

The Right Hon. the Earl of Orkney, and E. Lomax, were elected Associates: and W. Tooke, as an Honorary Member.

"*A Des ription of the Coffre Dam round the thirteen and fourteen feet piers of Westminster Bridge,*" by Lieut. F. POLLOCK.

It was the intention of Labelye, the builder of Westminster Bridge, that none of the foundations of the piers should be at a less depth than five feet below the surface of the bed of the river, but the effect of the removal of old London Bridge, and of the increase of the average difference between high and low-water, had in 1836 lowered the bed near the pier, on the eastern side to within eighteen inches of the platform, being three feet lower than in 1829! and but for the works done under Mr. Telford's direction by Mr. Swinburne, and those which are now going on under the directiou of Mr. Walker and Mr. Burges, the piers would have soon become undermined. Labelye is supposed to have been deterred from attempting to lay the foundations by a coffre dam, from the difficulty of keeping it dry and of reaching the bottom; this is, however, now shown to be a groundless alarm, as one has been constructed which is so tight that two men can keep it perfectly dry. The coffre dam, the construction of which forms the subject of this communication, is formed round the thirteen and fourteen feet piers at the west end of the bridge, for the purpose of securing the foundations and repairing the damaged arch stones. Previous to the commencement of the work fender piles were driven ten feet into the bed of the river, and are five or six feet higher than Trinity high-water mark; a trench was then dredged in the intended line of the coffre dam to the level of the highest caisson; the first guage pile was driven on the 14th of July, and the first sheeting pile on the 24th, and the water stopped out, or the coffre dam completed, in the short space of seven months. The author details the dimensions of the timbers and the construction of the various parts of the dam, as represented in the drawing accompanying the communication. There are about 40,000 cubic feet of timber in the dam. The mean depth of the mud in the dam, the water being let out, was from four to five feet; underneath the mud, at about three or four feet above the caisson, is a stratum of red gravel of an average depth of fifteen feet, and below this is clay. The weight of the piers has bent down the caisson (as shewn in a drawing), but the timbers are still sound and good. The pressure against the dam, at an average high tide, is 1,775 tons.

The President remarked that there was frequently considerable ambiguity in the use of the term *rise of the tide*, and misconception as to the effect of the removal of old London Bridge upon the rise and fall of the tides. The water falls lower by three or four feet, that is, by the height of the sill which was removed, but the difference of level of high-water is very small, not more than a few inches. Theo ld London Bridge caused a sort of weir, varying from eight to eighteen inches, as the water ran up, but depending in a great measure on the quantity of upland water which was coming down, and sometimes there was scarce any difference of level on the two sides of the bridge.

The following premiums have been awarded by the council of the Institution of Civil Engineers during the present session:—

A Telford Medal in silver and 20 guineas to John Edward Jones, for his paper and drawings on the sewage of Westminster. A Telford Medal in silver to Charles Hood, for his paper on warming and ventilating buildings. A Telford Medal in silver to Charles Wye Williams, for his paper on the properties and application of turf and turf coke. A Telford Medal in silver to Edward Woods, for his paper on the forms of locomotive engines. A Telford medal in bronze and books suitably bound and inscribed, to the value of three guineas, to Lieutenant Frederick Pollock, Bengal Engineerst for his description and drawings on the coffre dam at Westminster Bridge. A Telford Medal in bronze and books suitable bound and inscribed, to the value of three guineas, to R. W. Mylne, for his communication on the well sunk by the New River Company, at their reservoir in the Hampstead Road. A Telford Medal in bronze, and books suitably bound and inscribed, to the value of three guineas, to John Buldry Redman, for his description and drawings of Bow Bridge.

The following are the subjects announced for Telford premiums for the ensuing year:—

1. The nature and properties of steam, especially with reference to the quantity of water in a given bulk of steam in free communication with water at different temperatures, as deduced from actual experiment. 2. An account and drawings of the original construction and present state of the Plymouth Breakwater. 3. The ratio, from actual experiment, of the velocity, load, and power, of locomotive engines on railways: 1st. Upon levels; 2nd. Upon inclined planes. 4. Drawings and description of the outfall of the King's Scholar's Pond Sewer, and of other principal outfalls of the Westmin-

ster sewage; also, the inclination, dimensions, and forms of the sewers, and the observed velocities of water in them. 5. Drawings and descriptions of the sewage under the commission for Regent street, especially of the outfall at Scotland Yard. 6. Drawings and description of the best machine for describing the profile of a road, and also for measuring the traction of different roads. 7. The alterations and improvements in Blackfriars Bridge. 8. The explosion of steam boilers—especially a record of facts connected with any explosions which have taken place; also, a description, drawings, and details of the boiler, both before and after the explosion. 9. Drawings, sections, and descriptions of iron steam vessels. 10. The comparative advantages of iron and wood as employed in the construction of steam vessels. 11. The advantages and disadvantages of the hot and cold blast in the manufacture of iron, with statements of the quality and quantity of materials employed, and produce thereof. 12. The causes of and means of preventing the changes in texture and composition which cast iron occasionally undergoes when in continued contact with sea water. 13. The properties and chemical constitution of the various kinds of coal. 14. A memoir of Sir Hugh Middleton, with an account of his works. 15. A memoir of Arthur Woolf, with an account of his works. 16. An account of the various methods lately employed for preserving timber from dry rot and other sources of decay. 17. On the best guage for the width of railways, with the result of the experience furnished by existing railways.

It is not the wish of the council to confine the Telford premiums to communications on the above subjects; other communications of distinguished merit and peculiarly deserving some mark of distinction, will be rewarded.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Monday, July 8. Decimus Burton, V.P., in the Chair.

The Rev. Richard Burgess, B.D., author of various works on the Antiquities of Rome, was elected an Honorary Member; Mr. J. H. Browne, of Camden Road Villas, was elected an Associate.

A paper was read descriptive of a bridge of wood erected over the river Aln, in Alnwick Park, Northumberland, by Mr. William Barnfather, accompanied by a model, and communicated by his Grace the Duke of Northumberland, Honorary Fellow. Robert Addams, Esq., delivered the first of a series of three lectures on Acoustics—subject, on the divergence and propagation of sound, reflexion of sound, opinions as to the forms of rooms for phonic and acoustic purposes..

July 22. Earl de Grey, President, in the Chair.

Mr. John Green, of Newcastle-upon-Tyne, was elected a Fellow.

Various donations were laid upon the table, amongst which the following were announced:—The Duke of Serradifalco, "Del duomo di Monreale, &c." presented by the author; Mons. Thiollet, various works published by him in Paris; Dr. Moller, Honorary and Corresponding Member, "Memorials of German Architecture," by the donor.

A letter was read from Mr. Harcourt, descriptive of his artificial granite. Also a letter from the Cav. Canina, Honorary and Corresponding Member.

Mr. Clerichew, M.A., Associate, was announced as the author of a series of Mr. Richardson's lectures on Geology, and entitled to the prize offered for the same, consisting of "Phillips's Lectures on Geology," 2 vols. The prize was presented to Mr. Clerichew by his lordship the President.

Mr. Addams delivered his concluding lecture on Acoustics—subject, on the cause of reverberation, and the means to be used to lessen or prevent it; interference of sound waves; effects of recesses, doorways, &c.; wainscotted apartments, wood panels for ceilings, drapery, and other adjunctive ornaments, when and where allowable.

This evening concluded the session.

The meeting of this evening was one of the best attended of the season, and certainly the most interesting. Being the last meeting, it was selected as an appropriate occasion to express to the late Honorary Secretary, Thomas Leverton Donaldson, Esq., the feelings of gratitude which the members of the institute entertained for the indefatigable and ably-directed exertions of that gentleman during five years. A candelabrum, subscribed for by the members individually, was chosen as the best testimonial of the personal feelings of the subscribers, and its presentation in a public manner invested it at once with all the *eclat* of a mark of public approbation and private esteem.

Earl de Grey, the President, attested his interest in the proceedings of the evening by his attendance, and addressed Mr. Donaldson in an eloquent speech, which we regret to be unable to report. He reminded the members present that the Institute, which although only of recent date has assumed a high rank both at home and abroad, which was supported by the talents of the highest members of the profession here, and recognised as an equal by the most distinguished foreign academies. His lordship then presented the testimonial amidst the enthusiastic applause of the members and visitors.

Mr. Donaldson, with deep emotion, acknowledged the present in an appropriate speech, which was responded to by the warm greetings of the audience.

The testimonial was manufactured by Mr. Benjamin Smith, of Duke Street, Lincoln's Inn Fields. It consists of a superb candelabrum in frosted silver, standing on a triangular base, with feet enriched with the honeysuckle ornament; two of the compartments of the pedestal contain the arms of the institute and Mr. Donaldson, the other compartment contains the following appropriate inscription:—

INSCRIPTION.
From his professional Brethren,
Members of the
Royal Institute
of British Architects,
to
Thomas Leverton Donaldson,
on his retirement from the
office of Honorary Secretary;
a tribute of personal esteem,
and an acknowledgment
of his efficient and constant services
towards establishing the Institute and
in promoting its welfare.
July, MDCCCXXXIX.

On the top of the base is an ornament representing the fabulous origin of the Corinthian capital, from which rises a stem surmounted with a richly cut glass dish for flowers or fruit, and branching from the top of the stem are also four richly entwined foliage brackets, each carrying a light or a cut glass dish, so that the testimonial may be used either as a candelabrum or epergne.

MANCHESTER ARCHITECTURAL SOCIETY.

FIRST CONVERSATIONE OF THE SEASON.

The first conversatione of this society, during the present season, was held on Wednesday evening, the 3d ult., in their rooms, Cooper Street, the walls of which were hung, on this occasion, with a number of oil-paintings, water-colour drawings, engravings, &c., not only exhibiting architectural designs and fine edifices, but also landscapes, marine views, &c. On the table was a choice collection of books and engravings.

The chair was taken by Andrew Hall, Esq., president of the society, who, after expressing a hope to see these conversationi still more numerously attended in the longer evenings of the coming autumn and winter, stated that since the last season several improvements had been effected in the society. A museum had been determined on, which was to consist chiefly of specimens of building materials, such as various kinds of stone and wood, bricks of different forms, qualities, and make, sections of iron beams, &c., and indeed any thing interesting as a material entering into the construction of buildings, as well as casts of ornamental architecture. He trusted that each member would do his best to obtain contributions, and in every way to improve the advantages offered to students by this society. After the members had balloted for and unanimously elected Mr. Robert M'All, son of the late Dr. M'All, as a member, two or three subjects were discussed as having an indirect bearing on the importance and utility of the profession generally. It appeared that the society had through its secretary, Mr. J. W. Hance, suggested to the building committee for the St. George's Hall, Liverpool, the desirableness of a public exhibition of the competing designs for that edifice, previously to the announcing of their reward. To the letter conveying the resolution of the society, no reply had been received. It was also stated that the reason assigned by the St. George's Hall committee for not extending the time for furnishing designs, in compliance with the request of various architects, was, that it was necessary to have the drawings before them, and to decide on the one to be adopted within two months, so as to commence the work without delay. After some conversation, the secretary was requested again to write to the secretaries of the St. George's Hall committee, requesting an answer to his former letter.

The President next drew the attention of the society to the late strange conduct of the Gresham committee, in reference to the printed instructions to architects, issued by them, as to plans for the new Royal Exchange of London. It appeared that the committee had merely given the dimensions of the various rooms, without having at all indicated the purposes for which they were required; though surely the object and use of an apartment ought to have something to do with the design for its interior, its embellishment and style of finish. It was at first supposed that this had been an accidental omission, and the Royal Institute of British Architects and the London Architectural Society accordingly applied for this information, and the reply was to the effect, that the Gresham committee, having sent out their instructions to architects, could not alter what had been done, except to say that the rooms were required for three distinct companies. To the application of the British Institute, they also replied that they could not grant an extension of the time for furnishing plans. After some discussion, it was resolved, with one or two dissentients, "That this meeting feels bound to protest against such conduct as that recently exhibited by the Gresham committee for the erection of the Royal Exchange, in reference to the inquiry made of them by the Royal Institute of British Architects, and the London Architectural Society, as tending at once to degrade the profession, to deteriorate the public taste, and to injure the utility and object of the edifice in question. "Thanks were voted to the editor of the *Civil Engineer and Architects' Journal* for having left a plan of the Royal Exchange, and the committee's instructions (for which the committee charged 1*l.* to architects) for free inspection in his office, and thus spiritedly resisting the unfair attempt to impose a tax upon architects, as the price of permission to compete for plans for the erection of a public edifice. The council recommended to the society (for consideration and adoption at its next meeting) the establishment of a class of younger members, to be called associates, at a lower rate of admission—to have the use of the library and casts and the museum, but to be ineligible to the council, and to have no vote.—*Abridged from the Manchester Guardian.*

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This association has issued the usual circular for the ninth meeting at Birmingham, and fixed for the week commencing on Monday, the 26th of August, on the evening of which day the Rev. Vernon Harcourt, the president elect will take the chair. It is requested that members who may have reports, original memoirs, apparatus, models, or other communications to lay before the association, will forward the same before the 10th of August, and state their general nature and probable extent, in letters, addressed to the Assistant General Secretary of the British Association, Philosophical Institution, Birmingham. A room has been provided for the exhibition of philosophical apparatus, models, machinery, specimens of natural and artificial products, manufactured articles, &c.; and it is especially requested that those who desire to take advantage of this arrangement will be careful to send, with the objects which they exhibit, an exact description of their fabrication and use. Information for members, on their arrival, is to be given at the Free Grammar School, New Street, at which place there will be an attendance of proper persons for that purpose during the week of the meeting and the preceding week. Every accommodation which this commodious and magnificent edifice affords will be given to the philosophers. Thomas Knott, Esq., one of the most valuable public men in Birmingham, is bailiff of the school this year.

STEAM NAVIGATION.

Steam Ships.—We learn from the *Army and Navy Chronicle* that the two steam-ships which have been ordered to be built (one here, and the other at Philadelphia), are to be constructed upon the same model, and are intended to be as near alike as possible, with the exception of the engines. To test the comparative advantages of the two descriptions of engines adopted, one of the steamers is to be fitted with inclined engines, of ten-feet stroke; the other vessel to have two vertical engines of the same power of seven-feet stroke. The dimensions of the hull are reported at

	Feet.	Inches.
Length between perpendiculars	220	0
Moulded beam	39	0
Depth of hold	23	6

Tonnage by Custom House measurement, 1,650 tons.—*New York paper.*

Steam Navigation between Boston and England.—The arrangements have been completed for establishing three steamers on this line, of 1,000 tons each, and the British Government have contracted for eight years to pay the proprietors 270,000 dollars every year, for the transportation of the mails in these ships. They will ply once a fortnight, after the first of May, 1840, calling at Halifax and Nova Scotia.—*Boston Traveller.*

Steam Communication with America.—We learn from Paris that M. Conte, director of the post-office, has presented to the government a project for the establishment of steam-packets between Bordeaux and New York. According to this scheme twelve packets, of 450 horse-power, are to be employed upon this service. The packets might promptly be transformed into ships of war. A wet dock is to be opened at Pacillac in order to receive them. A steamer of 150 horse-power will be employed to tow up to Bordeaux such of the packets as may come and take their cargoes there, so as to prevent accidents to their machinery. This fine scheme will require an outlay of 22,000,000f. It appears to have been received by government with great favour. M. Comte has been ordered to present his plan on the opening of the next session.—*Courrier de Bordeaux.*

The Iron Steam-Boat, Bridegroom, was launched on the 13th of June, and on the 16th was running with passengers on her station, two days and a-half only being occupied in fixing and completing the boiler and engines. On the 17th she ran with the Naiad (a boat built on the diagonal board plan, and hitherto said to be the lightest possible mode of building), and beat her in the distance from Blackwall to Woolwich half the length of the dockyard, although the Naiad was one-third her superior in power, and allowed to be the fastest boat upon the Woolwich station.

The Iron Steam Vessel, Orwell, of 326 tons, and 80 horse-power, built for the Ipswich Steam Navigation Company, was launched from Messrs. Ditchburn and Mare's ship-building yard, Blackwall, on Thursday, June 27.

Launch of an Iron Steamer.—On Saturday, 1st July, there was launched, from the building-yard of Mr. John Laird, North Birkenhead, an iron steam vessel, called the *Duchess of Lancaster.* She is about 220 tons, and 90 horse power, and is intended to ply between Liverpool and Lancaster, with goods and passengers. She will be of light draft of water with a full cargo.—*Manchester Advertiser.*

PROGRESS OF RAILWAYS.

Manchester and Leeds Railway.—The first portion of the line from Manchester to Littleborough, was opened on Thursday, 3rd ult., and a great number of persons travelled between those towns. The journey from Halifax to Manchester, which used to occupy, on the average, three hours and three-quarters, is now performed in little more than two hours. When the mail bags are sent by the railway to Littleborough, an arrangement which will, we hope, be soon adopted by the post-office authorities, the Halifax letters will arrive an hour earlier than at present.—*Halifax Express.*

Birmingham and Derby Railway.—This railway, it is stated, will be opened to the public on Monday the 12th inst.

North Midland Railway.—Mr. Jackson, of London, contractor for the works on the line of the North Midland Railway, from Bull Bridge to Belper, has taken the contract for the station at Derby. The estimate is about 79,000*l.*; the works to be completed in six months.

Edinburgh and Glasgow Railway.—The works on this important railway are making very great progress, and when completed will compete with any similar undertaking in the kingdom, both in execution and extent of profits. The three extensive viaducts over the Doon, the Redburne, and the Almond valleys, consisting of 20, 15, and 36 arches, of from 50 to 60 feet span each, have been contracted for by men of skill and great experience, considerably under the parliamentary estimates. This will make the average per mile, including for land and rails, not exceeding 20,000*l.* When these works are compared with others of a similar nature executed in this country, the directors are justly entitled to a very considerable degree of credit, for the attention they have devoted to the interest of the shareholders, for the result of their labours will be without a parallel in the history of railways. The whole line will be completed in 1841. We understand that the south end of the Glasgow, Paisley, Kilmarnock, and Ayr Railway will be opened in July. From the nature of the country, and the price of labour and materials being so much cheaper in Scotland than in England, this work will be completed for 11,000*l.* per mile. The Edinburgh, Leith, and Newhaven Railway Amended Bill has passed the House of Lords, and is now only waiting the royal assent. The establishment of this line of communications, by means of a tunnel under the new town of Edinburgh, with the sea coast, is of the utmost importance to all the Scotch railways; for thus, as their *termini* they have seaports in the Frith of Forth, the Clyde, and the Ayrshire coast and connecting the whole manufacturing district of Scotland, with the facility of steam-boat communication, will, in a very short period, improve the commercial prosperity of this valuable portion of the British empire, and amply repay the shareholders for their enterprising spirit in promoting works of so important a character.—*Glasgow paper.*

Glasgow and Paisley Joint Railway.—The key-stone of the railway bridge over the river Cart, in Paisley, was set by Mr. Errington, the engineer, on Saturday, amid the cheering of the workmen. The bridge was designed by Joseph Locke, Esq., and we extract the following description of its dimensions from the *Paisley Advertiser*:—"As this is the largest arch on the whole line, we may state two or three particulars regarding it. The span is 85 feet. The top of the abutments, from which the arch *appears* to spring, is 25 feet 4 inches above the bed of the river. The additional height to the lower part of the arch, or, as it is called, the rise, is 18 feet. The total height from the bed of the river to the top of the parapet will be 54 feet 2 inches. The breadth over the parapets will be 28 feet. We have said that the arch *appears* to spring from the abutments, but the truth is it springs from the foundation, eight feet below the bed of the river, and is carried up with the same radius all the way. A line, stretching from the foundation on the one side, over the arch, to the foundation on the other side, measures 182 feet. The depth of the springers, which weigh from two and a half to three tons each, is six and a half feet. The depth of the other stones decrease as they approach the top, by the following gradations:—5 feet, 4 feet 8 inches, 3 feet 8 inches, and 3 feet. Exclusive of the springers, there are 63 stones forming the arch, each measuring in breadth nineteen and a-half inches. The smallest stones used in the arch contain 18 cubic feet, and weigh from 27 to 28 cwt. The stones in the two abutments weigh about 2,200 tons, and those in the arch itself weigh about 900 tons. The way in which this bridge has been erected, has drawn expressions of approbation from almost every beholder, scientific, practical, and ordinary. The supports in the river were put up with great strength, and on the most improved principle, so as to remove every sensation of fear, either from workmen or spectators. The stones were all conveyed to the crown of the arch on a temporary railway, and in witnessing, from the Old Bridge, the trucks moving upwards, they looked like a huge land turtle creeping up a hill with a sheep on its back. Every thing was done in a quiet, calm way, which would have led one to suppose the operation one of the most ordinary description. The arch will be a standing monument to Mr. Lyon's credit, and we congratulate him on the safe placing of its last key-stone."—*Greenock Advertiser.*

Railway from Florence to Leghorn.—We learn from an esteemed correspondent, that the promoters of this railway have submitted to the imperial government, for its sanction, a report upon the project which they have received from Robert Stephenson, Esq., the eminent engineer, who has lately returned to this country after a personal inspection of that part of Italy. The line determined upon by Mr. Stephenson will commence at Leghorn, near the new dock, pass near the city of Pisa, and thence proceed towards Pontedera, almost parallel to, and in the immediate vicinity of, the royal posting road. It will then keep to the left of the Arno, passing near Empoli and Montelupo, and, crossing the river, proceed along its right bank as far as Florence, where it will terminate within a short distance of the Porta al Prato. Mr. Stephenson states that the proposed line can be constructed at small cost, as it traverses a district almost perfectly level, there being only two points at which works of any magnitude will occur. Mr. Stephenson is of opinion that the sum required for the completion of the railway, including land, compensation, and the necessary establishment of engines and carriages, will be about fifteen millions of Tuscan livres, and that the whole may be finished in four years from the commencement of the works. He recommends that the line be undertaken in four distinct sections, the first being that from Leghorn to Pisa, which he thinks might be finished in fifteen months, and which would give the contractors and other parties employed a practical insight into the requisite details.—*Railway Times.*

Railway from Venice to Milan.—One of the most stupendous works of modern times is a projected railroad from Venice to Milan, connecting the seven richest and most populous cities of Italy with each other, Venice, Padua, Vicenz , Verona, Mentua, Brescia, and Milan ; the most gigantic portion will be the bridge over the Lagoons, connecting Venice with the main land. The length of the railroad will be 166 Italian (about the same in English), miles, passing through a population of three and a half millions, the seven, cities having alone a population of half a million, viz., Venice, 120,000, Padua 44,000, Vicenza 50,000, Verona 46,000, Mantua 34,000, Briscia 42,000, and Milan 180,000 inhabitants, to which may be added 20,000 foreigners in Venice and Milan.—*Foreign Quarterly Review.*

Brighton Railway.—A half yearly meeting of the proprietors was held on the 18th ult. at the London Tavern, when a very satisfactory report of the Directors and of the Engineer, Mr. Rastrick, was read; the report of the latter contained a full account of the progress of the railway on the whole length of the line, which is divided into 18 contracts; we regret that we have not space to give this report, but must confine ourselves to the following extract.

The following is a summary of the earthwork removed and to be removed on the line, and of the men and horses employed on the works :

No. of contract.	Quantity of earth-work removed.	Quantity of earthwork to be removed.	Number of Men.	Number of Horses.
1	115,000	94,425	277	39
2	328,000	138,494	228	34
3	297,000	290,203	290	18
4	Tunnel just begun.	....	290	25
5	398,000	441,381	680	65
6	147,000	245,873	280	50
7	148,523	354,876	177	12
8	Tunnel just begun.	....	204	20
9	125,143	310,982	294	34
10	The Viaduct.	....	208	54
11	100,410	448,999	420	57
12	27,000	526,710	120	12
13	320,000	400,000	440	60
14	Tunnel just begun.	....	178	11
15	50,000	662,000	300	21
16	Not begun.	341,121		
17	230,000	60,000	203	31
18	130,000	112,000	180	27
	2,416,076	4,427,064	4,769	570

The Directors will perceive from the foregoing summary that one-third of the whole of the earthwork has been excavated, and this has been done in a period of eight months; from which it might appear that sixteen months more would be required to remove the remainder; but as at the commencement of the works upon every contract it requires a considerable time to stock it with materials, wagons, horses, &c., the above period is no criterion of time necessary to complete the remainder. I trust, therefore, you are satisfied with the progress of the works; and I have only to add, that the whole of the railway can be opened to the public within eighteen months.

GREAT WESTERN RAILWAY—THE BOX TUNNEL.

One of the greatest obstacles to the accomplishment of this stupendous undertaking was found to exist in Box Hill, a large extent of elevated ground lying directly between, and about equi-distant from, Chippenham and Bath. This hill, the highest part of which is about four hundred feet above the proposed level of the rail-road, could not be avoided; to make an open cutting through it was impossible, and to perforate it was thought by many equally so. Nevertheless Mr. Brunel, with that boldness for which he is so celebratd, adopted the latter plan, and accordingly it was determined that a tunnel, one mile and three quarters in length, forty feet in height, and thirty feet in width, should be made through the hill. The extraordinary attempt of boring through this immense mass, consisting in great part of solid beds of free-stone, was commenced in the summer of 1836, and will, it is hoped, be completed in 1841. The difficulties that have stood in the way of the performance of this great work, particularly that part of it on the east, or Chippenham side, have been appalling; but hitherto they have been surmounted by the enterprise, skill, and perseverance of Mr. Brewer, of Rudloc, and Mr. Lewis, of Bath, the gentlemen who contracted with the directors for the completion of that portion of the work. Their contract extends from shaft No. 8, which is sunk at the proposed mouth of the tunnel on the east side, to a point three hundred yards towards Shaft No. 6, and altogether 2,418 feet from the entrance at the Chippenham end, this portion Messrs. Brewer and Lewis confidently expect to be able to finish in January next.

Independent of the difficulties arising from the laborious nature of the undertaking, the constant flow of the water into the works from the numerous fissures in the rock has been constantly most annoying, and in the rainy season so formidable as almost to destroy all hope of being able to contend with it. In November, 1837, the steam-pump then employed being quite inadequate to the task of making head against it, the water increased so fearfully, having filled the tunnel and risen to the height of fifty-six feet in the shaft, as to cause the total suspension of the work till the July following. This would have caused may persons to have abandoned the work in despair, but Messrs. Brewer and Lewis determined to fulfil their contract if possible, erected a second pump, worked by a steam-engine of fifty-horse power, and had the satisfaction of vanquishing their enemy and resuming their work. A few months afterwards (in Nov. 1838) the works were again stopped by an influx of water, which, however, was got under in ten days, the engine discharging 32,000 hogsheads of water a day.

The tunnel between Shafts No 7 and 8 (1,520 feet in length) is entirely finished at the roof, and for six feet below it, where the base is fourteen feet wide; but half-way between the two shafts there still remain about three hundred and fifty feet of cutting to be done, which is expected to be cleared away some time next month. In this portion of the work Messrs. Brewer and Lewis commenced their operations at each end, working towards the centre; and when the two cuttings closely approximated, much anxiety was felt lest a straight line should not have been kept, and the union of the two portions of the work should not have been true; but on breaking through the last intervening portion of the rock the accuracy of the headings was proved, and to the joy of the workmen, who took a lively interest in the result, and to the triumph of Messrs. Brewer and Lewis's scientific working, it was found that the junction was perfect to a hair as to the level, the two roofs forming an unvarying line, while at the sides, the utmost deviation from a straight line was only one inch and a quarter. This, in a cutting of 1,520 feet in length, begun, at opposite ends, and worked towards a common centre is, perhaps, unexampled in the annals of tunnelling.

The cutting on the Chippenham side has hitherto been, and it has already extended two thousand feet, through one solid bed of freestone or superior oolite, in many places one hundred and thirty feet thick, and lying upon a bed of fuller's earth, or clay, one hundred and twenty feet in thickness; under which blue marl, resting upon lias clay, is found. So uninterrupted and compact is the rock through which this end of the tunnel passes, that no masonry is required in any part of it, the stone itself forming sides and roof, and nothing being required at the bottom but the rails on which the carriages will run·—*Abridged from the Wiltshire Independent.*

A large statue of a female figure representing France, clothed in flowing drapery, and bearing a crown of stars, is now in process of termination in one of the ateliers of the Institute. It is to be placed in the centre of the Place du Palais Bourbon, in front of the Chamber of Deputies, and this square will henceforth bear the name of the Place de France.

The President, &c., of Columbia College, New York, have agreed to place the gilded crown, which formerly adorned the cupola of the college previous to the revolution, upon the figure-head of the British Queen steamer, expected at New York during the summer. This superbly made crown has remained in their library since 1777.

Organic Remains.—In excavating for the Great Western Railway, a few days since, a remarkable fine tusk of the Mammoth was discovered lying on a bed of new red sandstone, about seven feet below the surface, between the Bristol Cotton Works and St. Philip's Bridge. The tusk, together with some very beautiful specimens of iron and lead ore, found near the same spot, have been kindly brought to the Philosophic Institution by Dr. Fairbrother for the inspection of the members aud their friends.—*Cambrian.*

Russia.—At a general meeting of the shareholders in the Zarskojeselo railroad, held at St. Petersburgh at the end of last month, it appeared by the report of the directors, that the cost of the formation of the road and its materiel had amounted to 5,281,667 roubles. The original calculations were founded upon the anticipation of 300,000 passengers within the year, but, during the preceding twelve months, the number of travellers between the capital and Zarskojeselo had amounted to 500,000, and the number which passed along the whole line to and from Paulowsk was 707,091. The receipts amounted to 920.237 roubles. At the end of the first nine months the receipts exceeded the expenditure by 316,976 roubles. Of this balance 90.000 roubles were applied in paying the interest and reimbursing the loan from the crown; and 140,000 roubles to the payment of interest on shares; 15,848 rcubles were divided, according to the statutes, among the directors; 1,555 roubles were paid to the chief engineer; and 69,572 roubles were carried to the reserved fund.

The experimental paving of Oxford-street.—Another of the specimens of asphalte paving—viz., that laid down by the Scotch Asphaltum Company, has given way (although repaired since it was first laid) under the extraordinary traffic of Oxford-street. The specimen was 50 feet by the width of the road, containing 210 square yards, and when laid down, with what was considered by the asphalte and bitumen companies most extraordinary and unparalleled expedition, the work occupied 11 days. The road was stripped on Thursday night, 4th ult., by the parish workmen, under the direction of Mr Scaice, the surveyor of Marylebone, of the Scotch asphaltum contained in the above-mentioned space, and nearly the whole repaved with Aberdeen granite, grouted, and completed during the following day, the road being open to the public to the extent of about two-thirds of its width early in the afternoon of Friday. The only specimens of the experimental paving now remaining in this great thoroughfare are those laid down by the Val de Travers Company, the Bastenne and Gaujac Bitumen Company, a portion of granite paving filled up and cemented together by Claridge's asphalte, and the wooden blocks. Among these specimens no material alteration has taken place.—*Times.*

PROCEEDINGS OF PARLIAMENT.

Hous of Commons.—List of Petitions for Private Bills, and progress therein.

	Petition presented.	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour . .	Feb. 6.	Feb. 27.	Mar. 12.	Apr. 15.	..
Aberdeen Harbour . .	Feb. 8.	Mar. 15.	Apr. 15.	..	..
Ballochney Railway . .	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 1.
Barnsley Waterworks . .	Feb. 21.	..	..	..	..
Bath Cemetery . . .	Feb. 22.	..	..	..	..
Belfast Waterworks . .	Feb. 22.	..	..	..	..
Birmingham Canal . .	Feb. 20.	Mar. 15.	Apr. 12.	June 13.	July 1.
Birmingham & Glos. Rlway.	Feb. 21.	Mar. 15.	Apr. 1.	..	..
Bp. Auckland & WeardaleRa.	Feb. 22.	Mar. 18.	Apr. 15.	..	..
Blackheath Cemetery . .	Feb. 22.	Mar. 18.	..	..	..
Bradford (York) Waterworks	Feb. 21.	..	..	..	..
Brighton Gas . . .	Feb. 21.	Mar. 18.	..	May 31.	..
Brighton Cemetery . .	Feb. 21.	Mar. 18.	May 28.	..	..
Bristol & Gloucestershire Ra.	Feb. 21.	Mar. 7.	Mar. 19.	May 13.	July 1.
British Museum Buildings .	Feb. 22.	..	Apr. 12.	May 3.	..
Brompton New Road . .	Feb. 22.	Mar. 18.	Apr. 30.	..	..
Cheltenham Waterworks .	Feb. 22.	Mar. 12.	Mar. 22.	..	..
Commercial (London and Blackwall) Railway . .	Feb. 14.	Mar, 8.	Mar. 21.	June 20.	..
Dean Forest Railway . .	Feb. 19.	..	..	..	..
Deptford Pier . . .	Feb. 22.	Mar. 18.	May 28.	June 21.	July 19.
Deptford Pier Junction Rlwy.	Feb. 22.	Mar. 20.	May 28.	..	July 19.
Deptford Steam Ship Docks	Feb. 22.	..	..	..	..
Edinburgh, Leith, and Newhaven Railway . . .	Feb. 19.	Mar. 11.	Mar. 27.	May 30.	July 1.
Eyemouth Harbour . .	Feb. 12.	..	Apr. 8.	May 28.	..
Fraserburgh Harbour . .	Feb. 20.	..	Apr. 8.	Apr. 16.	..
General Cemetery . .	Feb. 20.	Mar. 11.	Mar. 21.	June 7.	..
Gravesend Gas . . .	Feb. 21.	Mar. 18.	..	..	..
Great North of England Ra.	Feb. 18.	Mar. 13.	Mar. 25.	May 3.	June 14.
Great Western Railway .	Feb. 14.	Mar. 4.	Mar. 13.	May 1.	June 4.
Great Central Irish Railway	Mar. 12.	..	..	..	..
Herefordshire and Gloucestershire Canal . . .	Feb. 20.	Mar. 13.	..	..	June 4.
Herne Gas	Feb. 22.	..	..	..	..
Liverpool Docks . . .	Feb. 21.	..	..	..	..
Liverpool Buildings . .	Feb. 21.	..	May 28.	..	..
Liverpool and Manchester Extension Railway . .	Feb. 14.	Feb. 28.	Mar. 12.	May 13.	June 14.
London and Birmingham Ra.	Feb. 8.	Feb. 22.	Mar. 6.	May 30.	June 14.
LondonBridgeApproaches,&c.	Feb. 19.	Apr. 11.	Apr. 26.	..	..
London & Croydon Railway	Feb. 19.	Mar. 18.	Apr. 8.	May 3.	June 4.
London Cemetery . .	Feb. 19.	Mar. 18.	..	..	..
London & Greenwich Rlway	Feb. 21.	Mar. 18.	Apr. 8.	May 3.	June 4.
London and Southampton (Guildford Branch) Rlwy.	Feb. 22.	..	..	..	..
London and Southampton (Portsmouth Branch) Ra.	Feb. 6.	Feb. 25.	Mar. 7.	May 3.	..
Manchester & BirminghamRa.	Feb. 18.	Mar. 18.	Apr. 23.	..	July 4.
Manchester and Birmingham Extension(Stone&RugbyRa	Feb. 11.	May. 1.	May 14.	..	..
Manchester & Leeds Rlway.	Feb. 18.	Mar. 8.	Mar. 19.	May 30.	July 1.
MaryleboneGas & CokeComp.	Feb. 22.	Mar. 18.	..	..	..
Monkland & Kirkintilloch Ra.	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 4.
Necropolis(St.Panc.)Cemetry	Feb. 21.	Mar. 15.	..	..	..
Newark Gas . . .	Feb. 14.	Feb. 28.	Mar. 11.	Apr. 18.	..
Newcastle-upon-Tyne & N. Shields (Extension) Rlwy.	Feb. 18.	Mar. 15.	..	..	..
Northern & Eastern(1)Rlwy.	Feb. 22.	Mar. 18.	Apr. 16.	June 4.	July 19.
Northern & Eastern(2)Rlwy.	Feb. 22.	Mar. 27.	Apr. 16.	June 4.	July 19.
North Midland Railway .	Feb. 11.	Mar. 4.	Mar. 14.	May 1.	July 1.
North Union Railway . .	Feb. 22.	..	..	..	..
NottinghamInclosure & Canal	Feb. 19.	Mar. 18.	..	..	..
Over Darwen Gas . .	Feb. 21.	..	Apr. 12.	June 3.	..
Perth Harbour & Navigation	Feb. 14.	..	..	May 2.	June 4.
Portishead Pier . . .	Feb. 22.	..	..	..	..
Preston Gas . . .	Feb. 6.	Feb. 20.	Mar. 6.	Mar. 19.	..
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	July 1.
Preston and Wyre Railway, Harbour, and Dock . .	Feb. 21.	Mar. 18.	Apr. 12.	Mar. 15.	July 1.
Redcar (No. 1) Harbour . .	Feb. 19.	—	—	—	—
Redcar (No. 2) Harbour .	Feb. 22.	Mar. 27.	Mar. 30.	—	—
Rishworth Reservoirs . .	Feb. 21.	Mar. 6.	Mar. 26.	May 30.	..
Rochdale Waterworks .	Feb. 7.	Feb. 21.	Mar. 6.	May 6.	..
Rochester Cemetery . .	Feb. 22.	Mar. 18.	..	..	..
Sawmill Ford Bridge & Road	Feb. 21.	Mar. 18.	..	June 10.	..
Slamannan Railway . .	Feb. 12.	Mar. 18.	Mar. 27.	May 28.	July 1.
South Eastern Railway .	Feb. 11.	..	Mar. 25.	May 15.	June 14.
S. Eastern (Deviation) Ra. .	Feb. 22.	May 6.	May 30.	June 19.	July 19.
Teignmouth Bridge . .	Feb. 21.	..	..	..	..
Tyne Dock	Feb. 22.	Mar. 15.	May 7.	June 13.	July 1.
Tyne Steam Ferry . .	Feb. 21.	..	..	..	..
Walsall Junction Canal .	Feb. 22.	..	..	..	..
West Durham Railway .	Feb. 21.	Mar. 18.	Apr. 8.	May 14.	July 4.
Westminster Improvement .	Feb. 21.	..	..	..	..
Wishaw & Coltness Railway	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 1.
Wyrley and Essington and Birmingham Canal . .	Feb. 18.	..	..	..	..

ENGINEERING WORKS.

The Patent Rotative Disc Engine.—Mr. Whishaw having been requested to examine and report on the principle of construction of the Rotative Disc Engine, and to institute a comparison between it and those of the reciprocating kind, devoted a week to the purpose, and examined six different engines, the whole of which were represented by the parties at whose works they are in use, to have performed their duties most satisfactorily. One of these engines (Mr. Whishaw observes) has been working for fifteen months, and has only required during this period the expenditure of three shillings for repairs. Mr. Whishaw continues :—" The advantages to be derived from a rotative engine of simple construction, yet producing a mechanical effect equal to one on the reciprocating principle, at much less original cost, and with less expenditure of fuel, must be obvious to every one. Such a machine has long been a desideratum amongst engineers. The attempts which have hitherto been made to accomplish this desirable object, so far as my knowledge extends, have failed, either from the motion of the various parts of the machine being such as to produce so great an amount of friction, and, consequently, of rapid destruction; or from the engines requiring a greater supply of steam to effect a given amount of work. In my examination, therefore, of this invention, I have particularly directed my attention to these two important points. As regards the first, I find the moving parts of this engine are so few in number, and their motion so uniform and regular, that the amount of friction must be very materially reduced; the wear, therefore, of these moving parts, and their liability to derangement, will be reduced in a proportionate degree. This opinion is fully borne out by the examination I have made of several engines, which have been in operation for a considerable time; some of these were taken to pieces in my presence, for the purpose of ascertaining the wear of the moving parts, the amount of which appeared so small as to be inappreciable. With respect to the second, viz., the quantity of steam required to perform a certain amount of work—I have made several trials with an engine of this construction at the works of the British Alkali Company, near Bromsgrove, which is applied to a great variety of work, but as a considerable portion of the duty performed consists of pumping, I was thus enabled to make such a comparison between the different portions of the work, as to obtain an accurate indication of the whole duty performed. The result of these trials is, that the work done by this twenty-four inch Disc Engine, working with steam at 29 lbs. pressure, is equal to tweuty horses' power, after making ample allowance for friction; and the consumption of fuel (common Staffordshire coal) is equal to *two hundred weight* per hour, or rather more than *eleven pounds* per horse per hour. This engine is worked by high-pressure steam, which, after performing its duty, passes into the atmosphere; and, during the experimental trials, I found, by the mercurial steam guage, that the average pressure was equal to 29 lbs. on the inch; but in order to work this engine to the greatest advantage, the pressure should be considerably increased. I am informed, that this engine was fixed upwards of twelve months ago, at which time the patentees had not acquired the experience in its construction which they now possess. Taking all these circumstances into consideration, viz., the want of experience, the disadvantageous pressure at which the engine is working, the inferior quality of coal used, and the amount required per horse power, and, moreover, that this amount does not exceed the quantity consumed for a high-pressure reciprocating engine of equal power, I am of opinion, that Rotative Disc Engines, constructed with all the advantages necessarily to be obtained by experience, will be found to be decidedly economical rs regards the consumption of fuel. This engine, which I find to be equal to twenty-horse power, with steam at 29 lbs. would, with steam at 43¼ lbs., be equal to thirty-horse work. It occupies a space equal to four feet square by seven feet high, and its whole weight, including the frame, is 41 cwt. 3 qrs. 16 lbs., but as the frame of this engine is too light, an additional weight will be necessary for giving steadiness to the machine, which would probably increase the weight to 2¼ tons; whilst, I am informed, that the weight of a high-pressure reciprocating engine of equal power would not be less than twenty tons. The foundation of this engine consists of brick-work occupying four feet square by five feet deep."—*Abridged from the Mid. Count. Herald.*

Devonshire.—An iron bridge of three arches, each 30 feet span, is to be erected over the river Otter, near Newton Poppleford, under the directions of Messrs. Green and Son, of Exeter.

Rochester.—We are informed that the foundation stone of the new bridge over the river Dove, will be laid on Thursday, the 8th day of August next, at 12 o'clock at noon; and that the commissioners and their friends dine together at four o'clock on the same day, at the Black Swan Inn, Uttoxeter. The stone will be laid with masonic honours.

Worcester and Birmingham Canal.—At the last half-yearly meeting of proprietors, held at Worcester, it was stated that the company had engaged a dredging machine, for the purpose of taking out the shoals in the Severn below Worcester, with a view to remove those impediments to trade which now exist. The operation is expected to be commenced in about two months.

Ribble Navigation Improvement.—We are enabled to state, from the best sources of information, that the operations of the Ribble Improvement undertaking are proceeding most satisfactorily. The construction of the coffer-dam is completed, and everything is in readiness for commencing the dislodgement of the water on Monday next; the engine and all the pumping apparatus being quite in readiness for work. As soon as the water is pumped out, a number of masons, as many as there will be room for, will commence the excavation, so as to clear out the rock in the shortest possible time. Everything has hitherto gone on most favourably; and should the autumn turn out to be a dry season, the directors have very confident expectations of finishing this year the removal of all the rock required for the accomplishment of that department of the projected deepening. The excavation will be effected in three separate portions, that comprised in the present coffer-dam being the most difficult length. It is most gratifying to add, that, unlike most of the great undertakings which mark the enterprise of the day, it is computed that, as regards the excavation of the rock, considered, originally, the most formidable part of the Ribble Improvement, the actual cost will be considerably below the estimates. Simultaneously with the excavation, the dredging process will be actively carried forward, as the steam dredging vessel will be perfectly ready for commencing operations on Tuesday next.—*Preston Chronicle.*

Glasgow.—On Friday, 12th ult., a section of about 200 feet in length of the breastwork of Port Glasgow Wet-dock gave way, and sunk about 10 feet.—*Scottish Guardian.*

Hereford and Gloucester Canal.—We understand that the company of proprietors of the Herefordshire and Gloucestershire Canal Navigation will shortly call a meeting, for the purpose of fixing the mode of raising the money for the completion of the canal from Ledbury to this city. Our readers will recollect that the company, previous to obtaining their act of the present session of parliament, offered to the new shareholders a priority in the receipt of the dividends to the amount of five per cent.; but so convinced are many of the proprietors of old shares, that seven per cent. priority will be, on reaching the supply of water, practically the same thing as five per cent. priority, that we doubt not a proposition guaranteeing a priority of seven per cent. per annum to the new shareholders will be acceded to at the intended meeting. We learn th t materials are in preparation for the purpose of commencing the work immediately after the meeting above mentioned, and that other measures are being taken to effect the speedy completion of the canal. As this undertaking cannot but be of the utmost interest to all our readers connected with the city and county of Hereford, we trust they will be glad to be informed occasionally how the works are going on, and we shall endeavour to obtain such intelligence on the subject as will from time to time give a general idea of the company's progress.—*Hereford Journal.*

NEW CHURCHES, &c.

St. Saviour's Church.—The ceremony of laying the first stone for the new edifice about to be erected as an enlargement of St. Saviour's Church, in the Borough of Southwark, took place on 26th June. The new portion of the church will be united to the present choir in which the service is performed. The new building will, when completed, be used for the performance of divine service on Sundays, but the part of the building in which the service is now performed will be retained for the burial, christening, and marriage services. The new building will contain sittings for 2,000 persons, one-third of which sittings will be free. It will be 103 feet in length, by 65 in width. The design is Gothic, and, as far as an opinion may be formed from the drawings and elevations in the vestry, it will be a very elegant and commodious building.

Christ Church, New North-road, Hoxton.—This church, built and endowed by the Metropolis Churches Fund, was on Saturday, the 22d ult., consecrated by the Bishop of London. It is a plain but spacious edifice, designed by Mr. Blore, in the Norman style, and will contain nearly 1,200 persons, almost one-half of the seats being free for the use of the poor.

Rotherhithe.—The first stone of the third church, to be called "All Saints," was laid on Monday, July 15, by Major-General Sir W. Gomm, K.C.B., who gives the site, which is on the Lower Deptford-road, about two miles from London-bridge. The inscription on the foundation stone is as follows:—

"The first stone of this Church was laid
By Major-General Sir William Gomm, K.C.B., July 15, 1839.
The site was given by Sir William Gomm.
Rev. Edward Blick, M.A., Rector of Rotherhithe.
Thomas Simpson, Esq.,
John Beatson, Esq., Churchwardens.
S. Kempthorne, Esq., Architect.
Messrs Piper and Son, Builders."

The church is calculated to hold 1000 sittings, of which one-third are free, one-third secondary seats, to be let at a low rate, and the remainder pew sittings. The design is Gothic of the early English style, with a tower 59 feet high, and spire 50 feet additional. The building is to be faced with white bricks, and to have dressings of Bath stone; the internal dimensions are 63 feet in length, 43 feet in breadth, and 37 feet in height, the contract is 3,412*l*, without the spire, and 300*l*. extra if the spire be executed.

New Independent Chapel, West Bromwich.—On Wedn sday, the 5th ultimo, this chapel was opened for divine worship. It is considered a very chaste and elegant specimen of architecture, in the Doric style, and contains about 1,000 sittings; of this number 410 are free, namely, 160 for children, and 250 for adults. Mr. Rogers, late of Birmingham, is the architect, and Mr. Fisher of West Bromwich, the builder of the chapel, the whole cost of which will exceed 2,200*l*.

An elegant new chapel, called "Wesley Chapel," was opened in Nottingham, on Thursday, the 20th June. It will hold 2,000 persons, and has been erected at an expense of 9,000*l*.

Uckfield Church.—This church is about to be partially rebuilt under the direction of Mr. Moseley; the tower of the old church, and part of the Chancel being in a good state, are to remain; the nave is to be rebuilt of the country stone, in the same style as the old church, that of the period of the 14th century, the internal dimensions of the part rebuilt being 80 feet by 48 feet 6 in. The timbers of the roof are exposed, as there is no ceiling, and the hight to the tie-beam is 28 feet 6 inches,—the old Tower is to be raised and surmounted by a timber spire. There are two side galleries, and accommodation for 915 sitting, of which 479 will be free. Messrs Cheal and Markwich of Uckfield are the builders, amount of contract 2,406*l*.

Horsham.—A Chapel of Ease is to be erected in this town under the direction of Mr. Moseley, for which a plot of land has been given, and a grant of 300*l*. has been made towards the erection by the Incorporated Society, and 200*l*. by the Diocesan Church Building Society. The style of the building is the early English. It is to be built of the country stone, and will afford accommodation for 980 sittings, one-half of which will be free. The dimensions of the interior are 70 feet by 45 feet, and the height to the tie-beam, the timber of the roof being open as in the preceding church, is 25 feet. There is a gallery on each side of the chapel. Estimate 2,500*l*.

Kingston.—A new church is to be erected under the direction of Messrs Scott and Moffat.

Warwickshire.—The Society for promoting church accommodation within the Archdeaconry of Coventry have made a grant of 600*l*. towards the erection of a new church at Harnall, Warwickshire.

Metropolis Churches Fund Society.—The annual general meeting of the subscribers to this fund took place on Friday, 21st June, at the Christian Knowledge Society's office, No. 67, Lincoln's Inn Fields. His Grace the Archbishop of Canterbury in the chair. The following report was read:—"The committee reported that the whole of the sum placed at their disposal, after the instalments payable on the fourth year shall have been received, is either expended or pledged; but they feel convinced that when the subscribers to the fund are acquainted with the method in which it has been applied, they will find both a cause of gratitude for the past, and a stimulus to increased exertion for the future. The Bishop of London, in 1836, contemplated the erection of at least fifty new churches, and for the accomplishment of this purpose it was estimated that a sum not less than 300,000*l*. must be raised. The sum hitherto subscribed did not amount to half that sum, yet they are enabled to hold out the prospect of forty-one new churches being built, either wholly or in part, from the funds of this society. In the above number of forty-one churches there are included ten which it is proposed to build in the parish of Bethnal Green. The sum already subscribed specially for the parish of Bethnal Green, including the grant from this society, amounts to 22,991*l*. 17*s*. The sum subscribed for endowments amounts to no more than 736*l*.

"The total number of churches now completed, or in progress, amounts to	20
"Churches to which the fund was before pledged	6
"Churches to which the fund has been pledged during the past year	15
Total	41

The amount of subscription up to the 1st of June last, is 132,728*l*. 13*s*. 6*d*., showing an increase during the last year of 5,604*l*. 0*s*. 3*d*." The report was favourable received and adopted.

Fulham.—On Saturday, 13th ult., a meeting was held of the inhabitants of the districts of All Saints, in this parish, in order to consider of the expediency of enlarging the church, an object which for some time has been greatly wanted. The Bishop of London was in the chair. It appeared, however, that the estimates prepared for the work were so expensive in proportion t the increased accommodation that would be gained, and the difficulty was so great of removing many of the inconveniences of the present building, that the general opinion of the meeting was adverse to the measure; and it was agreed, on the proposal of the Bishop (who headed the subscription with a liberal offer of 500*l*.), to attempt to raise a fund adequate to the erection, on the same site, of a new, and larger, and more commodious church. The old and justly admired tower will remain. Before the meeting was adjourned, 1,630*l*. had been subscribed, and there is good reason to hope that within a short time the whole sum required will be obtained without having recourse to any rate.

New Churches in the Potteries.—The District Committee for the Newcastle and Potteries, appointed by the Diocesan Society of Lichfield, since their appointment, have already received, in donations and subscriptions, 700*l*. The District Committee have submitted to the Lord Bishop, and with his permission to the inhabitants of the Potteries generally, the following outline of a plan for extending church accommodation within its limits:—1. That measures be taken for erecting, in the rst instance, not fewer than five additional churches, within the parishes of Stoke-upon-Trent, Buralem, Wolstanton, or the Liberty of Normacott, in the parish of Stone. 2. That each church contain from 200 to 1,000 sittings, according to the present or prospective wants of the locality for which it shall be provided. 3. That a district, with cure of souls, be attached to each church, with the requisite contents. 4. That an endowment of 1,000*l*., together with a parsonage house, be provided for each, in addition to the fund required by 1 and 2 Wm. IV., cap. 38, for repairs. 5. That the patronage of each church so built and endowed be, with the bishop's consent, vested in the person or persons to whom it may be assigned, by 1 and 2 Wm. IV., cap. 38, sec. 2.—The sub-committee, appointed to obtain statistical information respecting the sites, &c., of the five proposed churches, have adopted the following resolutions.—1. That in consequence of an application made to R. E. Heathcote, Esq., for a site at Green Dock, Longton, and acceded to by him, the sub-committee recommend Green Dock as an eligible situation for an additional church. 2. That the sub-committee, being encou aged to expect liberal assistance from Messrs. Minton, in the erection of a church between Penkull and Hartshill, recommend this situation also. 3. That John Smith, Esq., having consented to supply a site for a church at Northwood, in Hanley, this situation also be recommended. 4. It having been stated that some of the principal inhabitants of Burslem, have formed a wish and intention to erect a new parish church, and it having also been suggested that it would be advisable to retain the present church as a district chapel; the sub-committee are of opinion that such arrangement would be the most eligible method of accomplishing the views of the Diocesan Society in that part of the Potteries, and as such recommend them to encourage and assist it to the utmost of their power. 5. That the sub-committee are of opinion that an additional church is much needed in the southern part of Tunstall, but have not yet obtained any facilities to obtain them precisely in the choice of a site.—*Staffordshire Mercury.*

A Catholic Church was opened at Everingham in a style of splendour unequalled in England. The building cost 30,000*l.*; and the procession of bishops and clergy, with the Pope's banners and the host elevated, was more splendid than ever witnessed before in modern days in this country.—*Sheffield Iris.*

Wolverhampton.—The Duke of Sutherland, with the liberality which characterises all his proceedings, has, we understand, determined upon restoring the Leveson Chancel, in the Collegiate Church of Wolverhampton. The plans, which are already drawn, include the restoration of the fine table monument which was concealed in the old vestry, beneath a rude desk; and also the removal of the fine statue of Admiral Leveson from the Dean's Chancel into his own. The decorative railing which will surround these is of the most chaste design, and in excellent taste. Our readers are, perhaps, aware that the Duke also gave 105*l.* to the general interior alteration. John Newton Lane, Esq., has, likewise, given the authorities 25*l.* to expend in cleaning the interesting monuments in Lane's Chancel.—*Wolverhampton Chronicle.*

Incorporated Church Building Society.—On Thursday, 18th ult., a very full meeting of the committee was held, at which several applications for grants were registered. The Bishop of London was in the chair. Amongst other business transacted, grants were voted and confirmed towards

Building a chapel at Tamworth, Warwickshire.
Building a chapel at Scarborough, Yorkshire.
Building a chapel at Coates, Whittlesey, Cambridgeshire.
Building a church at Kiln Down, Goudhurst, Kent.
Building a church in the Ville of Dunkirk, Kent.
Building a chapel at Lanne's Gwennap, Cornwall.
Rebuilding the church at Llansantfraid, Cardiganshire.
Enlarging by rebuilding the church at Grinshill, Salop.
Rebuilding the church at Llanelly, Carmarthen.
Rebuilding the body of the church at Llannon, Carmarthen.
Enlarging and repairing the chapel at Farlow, Herefordshire.
Enlarging by extending the west end of the chapel at Cornhill, North Durham.
Repewing the church at Winterborne Stoke, Wilts.
Repewing the church at Llandegwning, in Carnarvonshire.
Building a gallery in the church in Cholesbury, Bucks.
Enlarging by extending the east end of the chapel at Finthwaite, Lancashire.
Repairing the chapel at West Mitton, Powerstock, Dorset.
Increasing the accommodation in the church at Nuttall, Nottinghamshire,
Repairing the church at Toxteth Park, Lancashire.
Enlarging the church at Womborne, Staffordshire.
Enlarging the church at Butley, Gloucester.
For rebuilding the old, and the erection of a new gallery in the church at Tornhill, Yorkshire.
Repewing the church at Colerne, Wiltshire.
Re-arranging the pews and building a gallery in the church at Chipping Nor on, Oxon.
Repairing the church at Weston, Herefordshire.
Enlarging the church of St. Mary's, Gateshead.
Building a chapel at Daventry, Northampton.
Building a chapel at Timperly, parish of Bowden, Chester.
Building a church in the parish of St. Mary, Taunton, Somerset.
Building a chapel at Emsworth, Warblington, Southampton.
Building a chapel at Wreetsham, Farnham, Surrey.
Building a chapel at Bradford, Wiltshire.
Building a church at Barton's Village, Whippingham, Southampton.
Rebuilding the nave of the church at Uckfield, Sussex.
Enlarging by rebuilding the church at Llangelynin, Carnarvon.
Rebuilding the church at Egremont, Carmarthen.
Building an additional aisle to the church of Llechryd, Cardigan.
For erecting a gallery in the church of Eardisland, Hereford.
Repewing the church at Llanvythid, Glamorganshire.
Enlarging the church at Llantrythid, Glamorganshire.
Enlarging the church of St. James's, Islington.
Being 43 grants, several of which are for building or rebuilding entire churches.

Warwickshire.—On Friday, 19th ult., the first stone of a new church at the Quinton, in the parish of Halesowen, near the fifth mile stone from Birmingham, was laid by the Right Hon. Lord Littleton, accompanied by the Rev. R. B. Hone, the vicar, and other gentlemen. The day was extremely inclement.

Staffordshire.—A general meeting of the subscribers to the testimonial to Earl Talbot was held on the 2nd instant, at the Swan Hotel, Stafford, Edward Monkton, Esq., in the chair. The sub-committee appointed for the purpose of preparing plans having reported that they had ascertained it was his lordship's intention previously to the subscription being opened, to erect a church upon some part of his estate, and the meeting being desirous of co-operating with his lordship without interfering with his plans, it was resolved that the subscription should be closed on the 31st of December, 1839; and that the amount of subscriptions at that time received be placed at his lordship's disposal, either for the erection of a church, or the endowment of the same, as his lordship may determine.—It is stated that the subscription already amounts to 1,313*l.*

PUBLIC BUILDINGS, &c.

The Royal Stables at Windsor.—The grant of £70,000 for the erection of stables and a riding-school at Windsor Castle having been agreed to, they will be commenced under the superintendence of Sir Jeffery Wyattville forthwith. The Queen's arrival at Windsor Castle is not expected to take place until the end of August next, at which time, short though it may be, it is contemplated that the riding-school will have so far progressed as to enable her Majesty to take equestrian exercise there, should the state of the weather require the riding-school to be resorted to for that purpose.

Harrow School.—The governors have adopted the plan of Mr. Decimus Burton for re-building in a handsome manner the head master's house, destroyed by fire October 22, 1838, in the same style as the school building and the new chapel, now nearly completed, for the use of the school.

Monument to the Memory of the late Sir Pulteney Malcolm.—On the 29th June last, a meeting of the subscribers to the fund for erecting a monument to the memory of the late Admiral Sir Pulteney Malcolm, was held at the Thatched House Tavern, in St. James's Street, to receive the report of the committee appointed at the last general meeting of the subscribers, Earl Powis in the chair. The secretary read the report, which stated that the list of subscriptions already received amounted to £756, including £103 remitted from India, but exclusive of the subscriptions to the local memorial in Eskdale, amounting to nearly £200, which will be sufficient to erect a handsome tablet in the parish church of the Malcolm family at Westerkirk; and that on a reference to Mr. Bailey the sculptor, the committee had ascertained that a handsome marble monument might be erected to the memory of the late Admiral Sir P. Malcolm in the metropolitan Cathedral of St. Paul's for the sum of £1,000. The committee therefore recommended that as soon as the subscriptions should amount to that sum, Mr. Bailey be requested to submit designs for the intended monument for the approbation of the committee, and that he be authorised to execute a monument according to such of the designs as should be approved of by the committee.

The Projected College at Bath.—The plan for the erection of the new Protestant College at Bath, to be called Queen's College, has been decided on. It is a very beautiful specimen of the Elizabethan style of architecture, with an elegant square tower in the centre. Lord Powerscourt has given another donation of £50 towards the erection.—*Bath Gazette.*

Improvement in the Old Bailey.—On Monday, the 15th ult., workmen commenced the alteration agreed to by the Common Council, of laying down a wooden roadway in lieu of the stone pitching hitherto employed. By the alteration, much noise from the carriages passing through the Old Bailey, during the sitting of the Central Criminal Court, will be prevented, without the nuisance and expense of straw, which has hitherto been laid down on the above occasions.

The Sutherland Monument.—During the storm of Tuesday the 15th June, the monument erected to the late Duke of Sutherland, on Lilleshall Hill, Salop, was struck by the electric fluid, and sustained considerable injury. A chimney belonging to a steam engine at Aston, was knocked down by the lightning.

Finsbury.—A spacious building is about to be erected for the Finsbury Savings Bank, under the direction of Mr. Bartholomew.

District Surveyors.—At a meeting of the Magistrates for the county of Middlesex, on the 10th ultimo, Mr. Edmund Woodthorpe was elected surveyor to the Limehouse and Ratcliffe District, and Mr. Davies for the district of Mile-end, Old Town.

Wellington Memorial.—At the last general meeting of the committee, it was resolved, on the motion of the Duke of Cambridge, that the resolutions of June 9, 1838, appointing Mr. Wyatt as the artist should be confirmed. Here, therefore, the matter ends.

Nelson Memorial.—A minute was on Saturday, 13th ult., signed by the Lords of the Treasury giving their assent to the design for the monument of Lord Nelson, selected by the committee, The committee cannot, however, proceed to the erection of the monument until the Commissioners of Woods and Forests shall have determined upon the necessary arrangements as to its site, or rather as to the alterations which the erection of the monument may render necessary in Trafalgar-square.—*Observer.*

St. George's Hall.—On the 18th and 19th ult., the exhibition-rooms in Post-office-place were opened to the subscribers to St. George's Hall and their friends, for the purpose of inspecting the numerous designs sent in by the different architects competing for the erection of that building. The elevations and interior views were hung around the walls, and produced a very striking effect. The successful design is, we believe, by Mr. Elmes, of London. It is of very pure Greek architecture, the principal front being a portico of grand proportions, and enriched with bas-reliefs, on the execution of which, however, much depends. Perhaps within the limits of their resources (30,000*l.*) the committee could not have made a more judicious selection, the insuperable objection to many designs, from their extent and elaborate detail much more captivating to the eye, being that the expense of executing them would far exceed the funds at the disposal of the committee.—*Liverpool Standard.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 27TH JUNE TO 25TH JULY, 1839.

RICHARD HODGSON, of Salisbury-street, Strand, Gentleman, for "*Improvements in the forms or shapes of materials and substances used for building and paving, and their combination for such purposes.*" Communicated by a foreigner residing abroad,—June 27; six months.

MOSES POOLE, of Lincolns Inn, Gent., for "*for improvements applicable to wheeled carriages and in springs.*" Communicated by a foreigner residing abroad.—June 29; six months.

HENRY PAPE, of Little Newport-street, Leicester-square, musical instrument maker, for "*certain improvements on stringed musical instruments.*" July 2; six months.

HENRIK ZANDER, of North-street, Sloan-street, Gent,, for "*improvements in the manufacture of paper.*"—July 2; six months.

CHARLES OSBORNE, of Birmingham, cork-screw manufacturer, for "*a certain improvement, or certain improvements, in the construction of cork-screws.*—July 2; six months.

ALEXANDER COCHRANE, of Arundel-street, Strand, Gent., for "*an improved lock.*"—July 3; six months.

ALEXANDER CRUCKSHANKS, of Liverpool-street, New Road, for "*certain improved methods of producing or manufacturing certain inflammable substances, and of applying the heat and light obtained from certain inflammable substonces to various useful purposes.*—July 3; six months.

JAMES YATES, of the Effingham Works, Rotherham, iron founder, for "*certain improvements in making, forming, or producing raised or projecting letters, mouldings, figures, or other ornamental work for external decorations of buildings and other purposes.*—July 3; six months.

THOMAS FRENCH BERNEY, of Morton Hall, Norfolk, Esq., for "*certain improvements in cartridges.*—July 6; six months.

EDWARD JOHN JONES, of Paulstone House, Hereford, Gent., and JOHN HAM of the City of Bristol engineer, for "*an improved process of manufacturing cider and perry.*"—July 6; six months.

GEORGE PHILCOX, of Southwark-square, watch maker, for "*certain improvements in chronometers, watches, and other time keepers.*—July 6; six months.

JOHN ERICSSON of Cambridge Terrace, civil engineer, for "*an improved steam-engine, particularly applicable to locomotive purposes and steam navigation.* July 6; six months.

JOHN FARRIE, of Church-lane Whitechapel, sugar refiner, for "*improvements in making and refining sugar.*—July 6; six months.

PETER ROTHWELL JACKSON, of Great Bolton, Lancaster, engineer, for "*a new and improved method of mangling, calendering, glazing, and finishing cotton, linen, wollen, and other goods and manufactures, and certain machinery to effect the same.*"—July 8; six months.

EDWARD FRANCOIS JOSEPH DUCLOS, of Clyne Wood Works, Swansea, Gent., for "*improvements in the manufacture of sulphur, sulphuric-acid, and sulphate of soda.*"—July 11; six months.

WILLIAM WOODLEY, of Observatory House, Stoke Newington, Captain in the navy, for "*improvements in propelling vessels and carriages, and other machinery.*"—July 13; six months.

THOMAS BELL, of St. Austel Cornwall, hotel keeper, for "*improvements in obtaining copper from copper slag.*"—July 13; six months.

JAMES YATES of the Effigham Works, Rotherham, iron founder, for "*certain improvements in the construction of cupola furnaces, for melting metals.*"—July 13; six months.

DANIEL RAMEE, of Charlotte-street Bloomsbury, for "*improvements in paving roads, and such like ways.*" Communicated by a foreigner residing abroad.—July 15; six months.

JOHN HEMMING, of Edward-street, Cavendish-square, Gent., for "*improvements in gas meters.*"—July 16; six months.

JOHN REYNOLDS, of Bridge-street, Blackfriars, Esq., for "*certain improvements in the manufacture of salt.*"—July 16; six months.

JOHN GEORGE SHUTTLEWORTH, of the Mount, near Sheffield, soap boiler, for "*a new mode of obtaining a rotatory motion, from the rectilinear motion of the piston-rod of a steam or other the like engine.*'.—July 18; six months.

EDWARD BROWNE of Lyme Regis, Dorsetshire, ironmonger, for "*improvements in apparatus in cooking,*"—July 20; six months.

THOMAS NICHOLAS RAPER, of Bridge-street, Blackfriars, Gent., for "*improvements in rendering fabrics and leather waterproof.*"—July 20; six months.

MOSES POOLE, of Lincoln's Inn Fields, Gent., for "*improvements in casting for printing purposes.*" Communicated by a foreigner residing abroad.—July 20; six months.

PETER ROBERT DRUMMOND LORD WILLOUGHBY DE ERESBY, for "*improvements in compressing peat.*"—July 20; six months.

DAVID JOHNSTON, of Glasgow, manufacturer, for "*certain improvements in the manufacture of hinges.*" Communicated by a foreigner residing abroad.—July 20; six months.

ALEXANDER SOUTHWOOD STOCKER, of the Union Rolling Mills, Birmingham, and THOMAS JOHNSON of Ridgacree Irom Works, Stafford, for "*certain improvements in machinery for manufacturing shoe-heels, and toe-tips.*"—July 20; six months.

JOHN CHARLES SCHWIESO, of Albany-street, Regent's Park, harp maker, for "*certain improvements in the construction of locks.*"—July 20; six months.

CHARLES FLUDE, of Liverpool, chemist, for "*certain improvements in the the manufacture of white lead.*"—July 20; six months.

JOHN FREDERICK MYERS, of Albemarle-street, Piccadilly, musical instrument make, and JOSEPH STORER, of Bidborough-street, New Road, musical instrument maker, for "*certain improvements in the construction of certain musical instruments, part of the said improvements being applicable to those of the kind commonly called piano fortes, and part of those of the kind commonly called seraphines, and to certain descriptions of organs.*" Partly communicated by a foreigner residing abroad.—July 20; six months.

JOSHUA CROCKFORD, of Litchfield-street, Soho, Gent., for "*an improved mode of applying cotton and other wicks to tallow, and other the like substances used for candles, in order to consume the same.*"—July, 20; six months.

JOHN HANSON, of Rashcliffe, York, patent lead pipe manufacturer, for "*certain improved apparatus for measuring and registering the quantity of gas, water, or other fluid passed through the same.*"—July 24; six months.

JAMES KAY, of Pendleton, near Manchester, cotton spinner, of an extension for the term of three years from the 26th July, 1839, of an invention for "*a new and improved machinery for preparing and spinning flax, hemp, and other fibrous substances by power.*"—July 24; six months.

JAMES TEMPLETON, manufacturer in Paisley, and also WILLIAM QUIGLAY, weaver in Paisley, for machinery for "*a new and improved mode of manufacturing silk, cotton, woollen, and linen fabrics.*—July 25; six months.

TO CORRESPONDENTS.

G. W. R.—*We are fearful of again trespassing on our pages on the subject of railway curves, having already devoted considerable space and discussion to that purpose, we must rest for a short time, and if hereafter we should be deficient of matter, we will again find room for some more communications we have received on the subject. Respecting the other portion of* G. W. R.'s *letter, we would recommend him, as well as other engineers, to study algebra, at least the rudiments; he will then find the advantages of it, and* see *the impossibility of us, or any other scientific work being able to abandon the use of it, and in answer to the latter part of his letter, "which is the best and most simple treatise on the locomotive engine," we recommend Mr. Robert Stephenson's scientific treatise and Pambour's work, more particularly the first.*

Lieut.-Col. T.'s *communication on brick ovens will appear in our next number.*

Mr. G.'s *drawings of boilers were received too late for this month; they will appear in the next Journal.*

The British Association.—*We shall feel obliged for copies of any papers that may be read before the next meeting at Birmingham.*

We shall feel obliged if our correspondent at Bristol will favour us with his communications early *in the month.*

Norris's Locomotive Engine.—*Can any of our subscribers favour us with some* facts *connected with the performances of these engines since they have been introduced in England, stating the distance run in a given time, the quantity of fuel consumed, and the gradients of the railway. Also inform us what are the dimensions of the engines and their peculiar construction, or where they differ from our own engines; we do not wish the performances of the engine to be confined to one trip, but to* several *trips,*

The notices of several books sent for review are unavoidably postponed until next month.

The Editor will feel obliged to country subscribers if they will forward any account of works in progress, or any newspapers containing articles or paragraphs connected with the objects of the Journal; it will also be doing a great service if engineers and architects will cause all advertisements connected with contracts to be inserted in the Journal.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster or to Mr Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, please to direct it to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts earlier), and advertisements on or before the 23d instant.

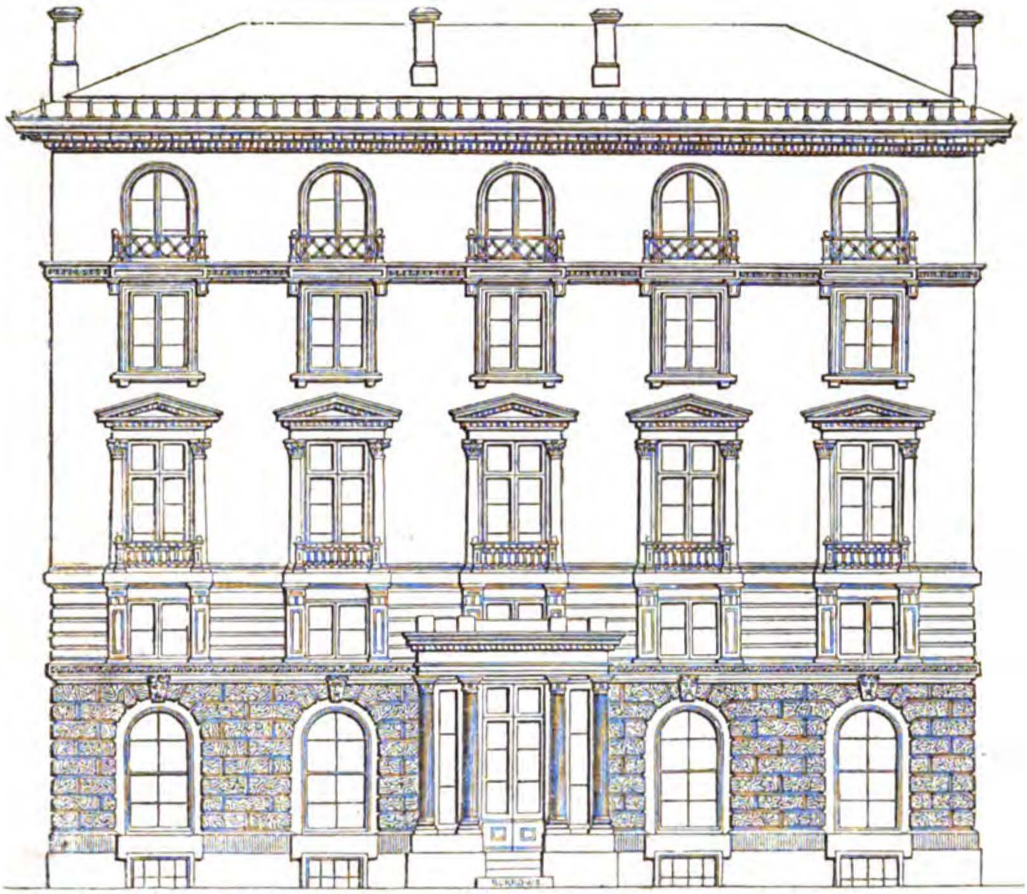
THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD. PRICE 17s.

ERRATUM.

By accident pages 296 and 297 of the present number have been transposed; it was not discovered until the sheet had been printed off. The contents of page 297 should be page 296, and the contents of page 296 should be page 297.

CLUB CHAMBERS.—REGENT STREET.

ARCHITECT—DECIMUS BURTON, Esq.



Scale of Feet.

10 5 0 10 20 30

In consequence of the great scarcity of chambers for residence in the immediate vicinity of the Club Houses, several gentlemen, principally subscribers to the Clubs, formed themselves into an Association for the purpose of supplying the want. Fortunately, at this time, the mansion occupied by the late Mr. Blicke, in Regent Street, between Pall Mall and Piccadilly, was to be sold; a better situation than which for the purpose, in the whole metropolis could not have been selected. The Association immediately entered into an agreement for the purchase of the property, together with the freehold ground in the rear, and upon obtaining possession, they decided upon pulling down the premises, and engaged Mr. Decimus Burton, the eminent architect, to make designs for a new building, which were submitted to the committee and approved; a contract was then entered into with Mr. Hicks, the builder, for erecting the present mansion for the sum of 26,000*l*. The contractor commenced operations for erecting the new building in August last year, and agreed to have it finished in the present month.

By reference to the annexed engraving, it will be seen that the elevation of the present edifice is of the Italian style of architecture; it occupies a frontage next Regent Street of 76 feet, and consists of a ground story, rusticated and terminated by an enriched lace band or string course, enriched with the Vitruvian scroll; this story forms a basement to the upper part, containing the principal story, and a second and third story, surmounted by a bold and enriched cornice, the main characteristic feature of the Italian style. Between the principal story and the ground floor an entre-sol is introduced, the windows of which are placed between the panelled pilasters, supporting the consoles of the bold projecting balconies to the windows above.

A plan of the ground floor is given in the annexed engraving, which is fully explained by the reference; it is approached in the centre by a portico, projecting forward with coupled Doric columns on each side, and recessed back to give depth; it opens into a grand entrance hall, the height of the ground story and entre-sol. The four upper stories are similarly divided as the ground floor, except as to the room C, and adjoining room, over which there is no story, and with the exception that on all the stories above the entre-sol there will be an apartment over the entrance-hall.

The building will contain 77 chambers; 27 are provided with alcoves or recesses for the bed, and 50 without; some of the rooms are so planned that two or three may be formed into one suite instead of being engaged separately. The basement story is occupied by the kitchen and domestic offices of the establishment, likewise rooms for gentlemen's servants. This story is arched over with flat brick arches, supported by iron girders, rendering it perfectly fire-proof, The two staircases are of stone, and all the corridors have stone floors. and enclosed within brick walls, which is a great security against the extension of fire in any part of the building.

In the interior the architect has displayed considerable ingenuity in providing for what is so very essential to a building possessing so many inmates, that is, warmth and ventilation, the means of effecting which we shall next proceed to describe.

The ventilation is provided for in the following manner:—on each side of the principal staircase, on the basement story, is a furnace with an iron pipe or flue 12 inches diameter, fixed in the centre of a vertical brick chamber, rising through the several stories and roof, where it is terminated by a cowl. These vertical chambers communicate on each story with horizontal chambers, formed between the ceiling and floor of the corridors, as we shall presently describe. Each room is or can be furnished with a ventilator near the ceiling, opening into the horizontal chamber just described; when the fire is lighted in the furnaces, it heats the iron pipe or flue, and rarifies the circumjacent air within the vertical chambers, and causes the air to rise and pass off, through the cowl at top, with considerable rapidity. To supply the partial vacuum which would be created by the escape of the rarified air, the air within the rooms flows through the ventilators, and passes by the horizontal to the vertical chambers, thereby keeping up a constant circulation.

The horizontal chambers are thus made, over the corridors on each story, an inch rubbed slate slab set with a close joint forms the ceiling, and a 4 inch Portland stone landing forms the floor of the corridors above, leaving a vacancy for the chamber of 18 inches in height, between the slate slab and stone landing.

The warming of the building is effected by the patent hot water apparatus of Mr. H. C. Price, of Bristol, erected under the superintendance of Mr. Manby, a drawing and description of which is given in the first volume of the Journal, p. 237, the apparatus for the present building is erected on the basement story, on the north side of the principal staircase, the hot air chamber or vault is immediately behind, the top of which is nearly on a level with the ground floor, as shown in the annexed plan; a supply of cold air flows through a trunk, the mouth of which is furnished with gauze wire to filter the air, into the vault where it passes upwards between the vertical iron chambers filled with hot water and becomes heated, the warm air then escapes through apertures in the top of the vault, and is distributed throughout the principal staircase and corridors. Before we have done with the apparatus for warmth and ventilation, we must not omit to notice, that the corridors and water closets are lighted with gas, and the light enclosed in glazed lanthorns, furnished with tubes leading from the top to the external part of the building, thus preventing the possibility of any heat or effluvia escaping within the building.

On the basement story, a well has been sunk to the depth of 150 feet, and afterwards bored 100 feet more down to the chalk stratum, for supplying the premises with pure spring water, which is lifted to the top of the building by means of a steam engine of 3 horse power, which is also employed for raising coals, furniture, &c., up the well-hole of the back staircase.

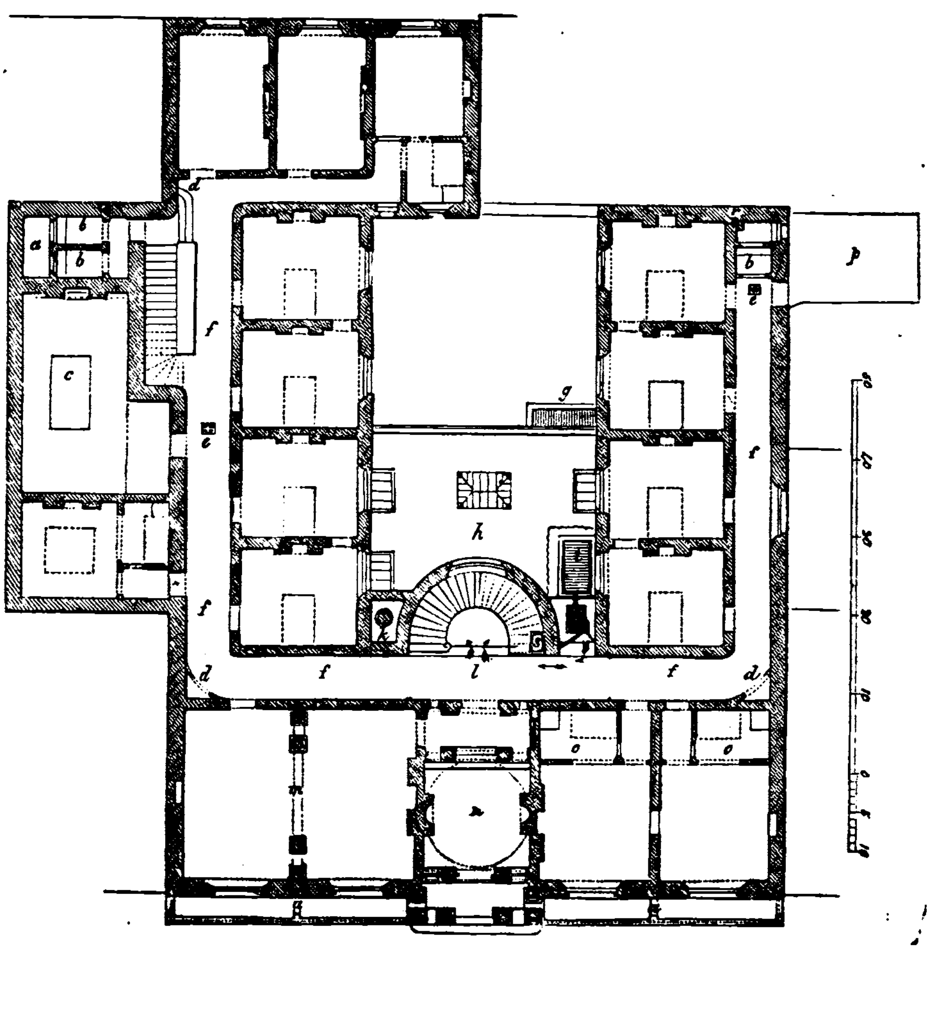
Every alcove, or recess for the bed, is furnished with hot and cold water, and pipes trapped and communicating with the drains for a water-closet, if the tenant should wish to have one.

From this brief description, it will be seen, that the architect has not forgotten the essential comforts of the numerous occupants of these extensive premises, and that no exertion has been omitted to insure for this valuable association, the support of the subscribers to the club houses in the vicinity.

GROUND PLAN.

REFERENCE.

a, open area; *b*, water closet; *c*, dining room; *d*, gas burner and cases for pipes; *e*, ventilators; *f*, corridors; *g*, entrance for cold air to warm water apparatus; *h*, lead flat part of which is removed to show the apparatus *i*; *k*, ventilating chamber; *l*, grand staircase, the arrows show the current of warm air passing through the horizontal chamber, and distributed into the staircase; *m*, coffee and reading room; *n*, entrance hall; *o*, alcoves or bed recesses; *p*, house maids closet.



THE DAGUERROTYPE.

THE secret process of this important discovery for prod... tographic plates, was revealed to the French public at th... the "Académie des Sciences," on Monday, 19th ultimo; the att... at the meeting was very numerous, so much so, that upwards o... persons were unable to obtain admittance. M. Arago commenced h... observations by referring to the process of M. Niepce, the first discoverer of the art, and the subsequent improvements made by M. Daguerre. He then proceeded to explain the great discovery, of which the following is an extract from a report in the *Journal des Débats*.

M. Arago stated that, according to M. Daguerre's process, copper plated with silver is washed with a solution of nitric acid, for the purpose of cleansing its surface, and especially to remove the minute traces of copper, which the layer of silver may contain. This washing must be done with the greatest care, attention, and minuteness. M. Daguerre has observed, that better results are obtained from copper plated with silver, than from pure silver; whence it may be surmised, Arago observes, that voltaic action is connected with this phenomenon.

After this first, preparation, the metallic plate is exposed, in a well-closed box, to the action of the vapour of iodine, with certain precautions. A small quantity of iodine is placed at the bottom of the box, with a thin gauze between it and the plate, as it were, to sift the vapour, and to diffuse it equally. It is also necessary to surround the plate with a small metallic frame, to prevent the vapour of iodine from condensing in larger quantities round the margin than in the centre; the whole success of the operation depending on the perfect uniformity of the layer of ioduret of silver thus formed. The exact time to withdraw the sheet of plated copper from the vapour, is indicated by the plate assuming a yellow colour. M. Dumas, who has endeavoured to ascertain the thickness of this deposit, states that it cannot be more than the millionth part of a *millimètre*. The plate thus prepared, is placed in the dark chamber of the camera obscura, and preserved with great care from the faintest action of light. It is, in fact, so sensitive, that exposure for a tenth of a second is more than sufficient to make an impression on it.

At the bottom of the dark chamber, which M. Daguerre has reduced to small dimensions, is a plate of ground glass, which advances or recedes until the image of the object to be represented is perfectly clear and distinct. When this is gained, the prepared plate is substituted for the ground glass, and receives the impression of the object. The effect is produced in a very short time. When the metallic plate is withdrawn, the impression is hardly to be seen, the action of a second vapour being necessary to bring it out distinctly: the vapour of mercury is employed for this purpose. It is remarkable, that the metallic plate, to be properly acted upon by the mercurial vapour, must be placed at a certain angle. To this end, it is enclosed in a third box, at the bottom of which is placed a small dish filled with mercury. If the picture is to be viewed in a vertical position, as is usually the case with engravings, it must receive the vapour of mercury at an angle of about 45°. If, on the contrary, it is to be viewed at that angle, the plate must be arranged in the box in a horizontal position. The volatilization of the mercury must be assisted by a temperature of 60° of Reaumur = 167° F.

After these three operations, for the completion of the process, the plate must be plunged into a solution of hypo-sulphite of soda. This solution acts most strongly on the parts which have been uninfluenced by light; the reverse of the mercurial vapour, which attacks exclusively that portion which has been acted on by the rays of light. From this it might perhaps be imagined, that the lights are formed by the amalgamation of the silver with mercury, and the shadows by the sulphuret of silver formed by the hypo-sulphite. M. Arago, however, formally declared the positive inability of the combined wisdom of physical, chemical, and optical science, to offer any theory of these delicate and complicated operations, which might be even tolerably rational and satisfactory.

The picture now produced is washed in distilled water, to give it that stability which is necessary to its bearing exposure to light without undergoing any further change.

After his statement of the details of M. Daguerre's discovery, M. Arago proceeded to speculate upon the improvements of which this beautiful application of optics was capable. He adverted to M. Daguerre's hopes of discovering some further method of fixing not merely the images of things, but also of their colours: a hope based upon the fact, that, in the experiments which have been made with the solar spectrum, blue colour has been seen to result from blue rays, orange colour from orange, and so on with the others. Sir John Herschel is sure that the red ray alone is without action. The question ...hether it will be possible to take portraits by this method? ... disposed to answer in the affirmative. A serious diffi-..., presented itself:—entire absence of motion on the ...t is essential to the success of the operation, and this ...e obtained from any face exposed to the influence of ... M. Daguerre, however, believes that the interposi-... would in no way interfere with the action of the ... plate, while it would protect the sitter suffi-ci... of the light. The head could be easily fixed by m... apparatus. Another more important desideratum is, ... rendering the picture unalterable by friction. The substan... ...ne pictures executed by the Daguerrotype is, in fact, so little sond—is so slightly deposited on the surface of the metallic plate, that the least friction destroys it, like a drawing in chalk: at present, it is necessary to cover it with glass.

From his numerous experiments on the action of light on different substances, M. Daguerre has drawn the conclusion that the sun is not equally powerfully at all times of the day, even at those instants when his height is the same above the horizon. Thus, more satisfactory results are obtained at ten in the morning than at two in the afternoon. From this, too, it is evident, that the Daguerrotype is an instrument of exquisite sensibility for measuring the different insensities of light, a subject which has hitherto been one of the most difficult problems in Natural Philosophy. It is easy enough to measure the difference in intensity between two lights viewed simultaneously, but when it is desired to compare daylight with a light produced in the night—that of the sun with that of the moon, for example—the results obtained have had no precision. The preparation of M. Daguerre is influenced even by the light of the moon, to which all the preparations hitherto tried were insensible, even when the rays were concentrated by a powerful lens.

In physics, M. Arago indicated some of the more immediate applications of the Daguerrotype, independently of those which he had already mentioned in Photometry. He instanced some of the most complex phenomena exhibited by the solar spectrum. We know, for example, that the different coloured rays are separated by black tranversal lines, indicating the absence of these rays at certain parts; and the question arises whether there are also similar interruptions in the continuity of the chemical rays? M. Arago proposes as a simple solution of this question, to expose one of M. Daguerre's prepared plates to the action of a spectrum; an experiment which would prove whether the action of these rays is continuous or interrupted by blank spaces.

The description of the process appeared to excite great interest in the auditory, amongst whom we observed many distinguished persons connected with science and the fine arts. Unfortunately the locality was not adjudged suitable for the performance of M. Daguerre's experiments, but we understand that arrangements will be made for a public exhibition of them. Three highly curious drawings obtained in this manner were exhibited; one of the Pont Marie; another of the M. Daguerre's atelier; and a third of a room containing some rich carpeting, all the minutest threads of which were represented with the most mathematical accuracy, and with wonderful richness of effect.

MORE GOVERNMENT JOBBING.

THE tocsin of alarm has been sounded by an influential Whig marquis for another Government enquiry into the causes of accidents on railways; and doubtless an attempt will be made to issue a commission similar to that on "Steam Vessel Accidents," which we noticed very fully in our last number. No doubt the Commission will be issued with the sinister understanding that a similar report is to be recommended, for the appointment of Government *Inspectors*, to superintend the working and construction of railways, and that no locomotive engine shall be allowed to run without a license from these *Obstructors*.

It behoves all manufacturers to unite and act firmly in resisting these encroachments on British enterprise, for if Government once can obtain an act for such a purpose, it will be carried to other branches of our Manufactures and commerce.

The Railway Companies have already united themselves into an Association, and thereby resisted very serious encroachments attempted to be made on their rights; a similar association we again advise ought at once to be formed by the Steam Boat proprietors and builders, for if they leave it till next Session of Parliament, they may depend upon it, that attempts will be made to levy such arbitrary laws and restrictions on their proceedings and profits, that they will not be able, without considerable difficulty, to get them again repealed or altered.

DESCRIPTION OF VICTORIA BOILERS.

Fig. 1, Elevation of Boiler.

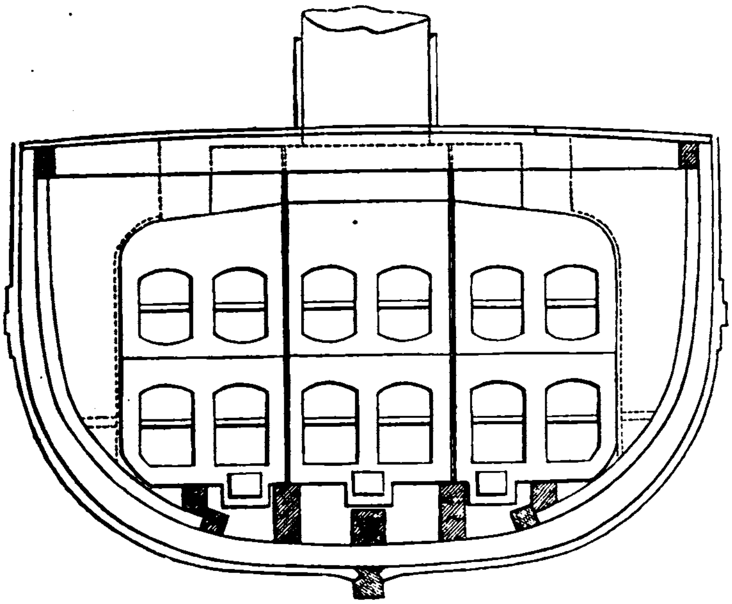


Fig. 2, Sectional Plan.

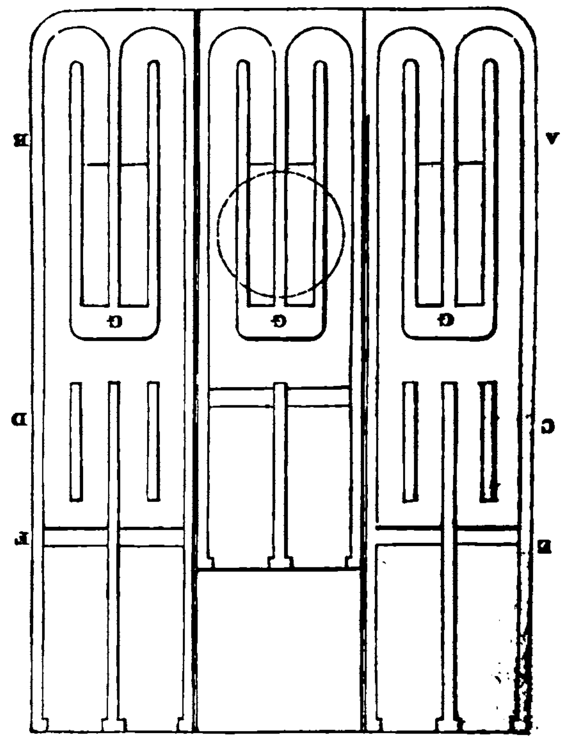
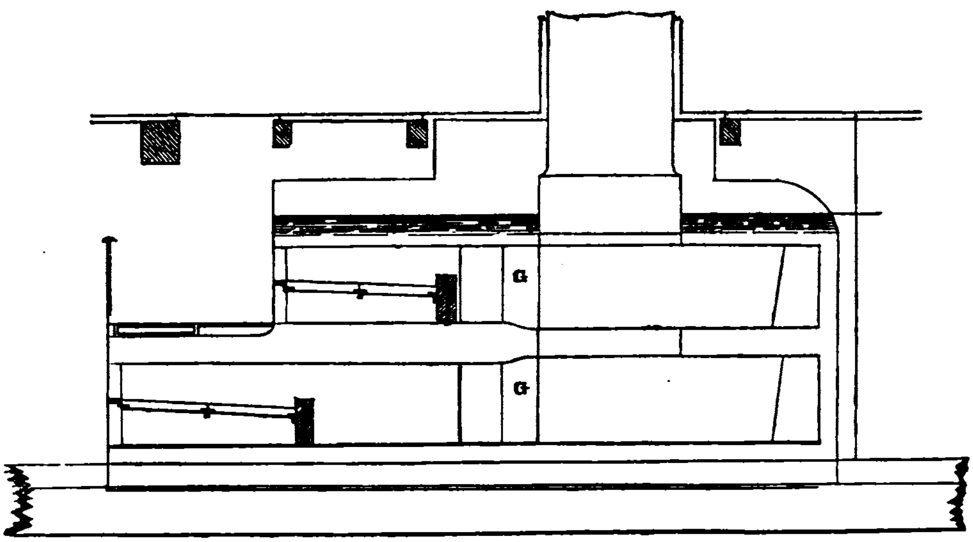


Fig. 3, A Longitudinal Section.



Scale of Feet.

30 25 20 15 10 5 0

Fig. 4, Transverse Section.

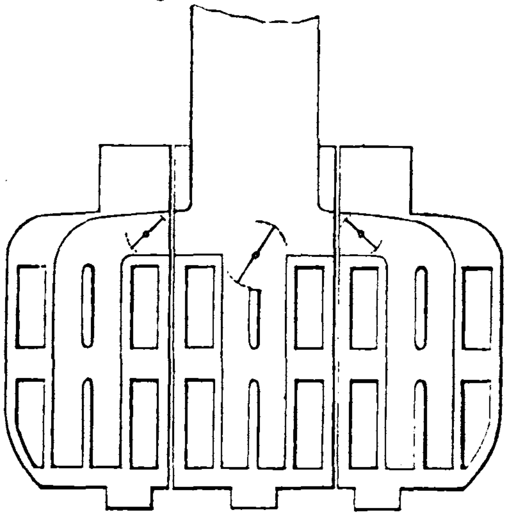
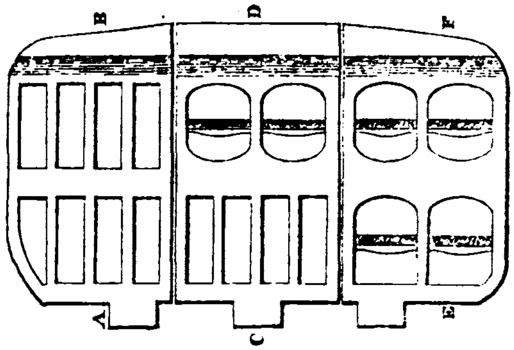


Fig. 5, Transverse Section.



DESCRIPTION OF THE NEW BOILERS OF THE VICTORIA HULL STEAM SHIP.

Manufactured by the Butterley Company from the Plans of JOSEPH GLYNN, F.R.S., M.INST.C.E., &c. &c.

The Civil Engineer and Architect's Journal presented to its readers a complete description, illustrated by engravings of the former boilers of this vessel, which, it will be remembered, exploded twice. The loss of life occasioned by these accidents gave rise to a lengthened inquiry, during which several engineers of reputation furnished most interesting professional evidence, that was fully reported in the Journal; more especially that of Mr. Ewart, from whose drawings those engravings were taken. After this inquiry had been concluded, the Victoria was removed from London to Hull, and the boilers were taken out and condemned. Application was then made to the Butterley Company, who had been mentioned during these proceedings as having for many years manufactured marine engines and boilers, both for the navy and for private service, without an instance of the slightest accident on board any of the vessels propelled by their machinery. The owners of the Victoria were therefore induced to order the new boilers to be made at their establishment near Derby, and Mr. Glynn, whose works have been noticed in the former volume of this Journal, was requested to examine the vessel, and to determine what was best to be done under all the circumstances.

The engines were not at all injured, neither were the cabins; and it was desirable to avoid moving the engines, which, from their peculiar construction, are connected with the deck and sides, as well as the floor, of the vessel, and also as far as possible to save the cabins, and to preserve the trim of the ship, by keeping the centre of gravity in its proper position.

The former boilers were long and cylindrical, they projected aft underneath a range of bed-cabins; these dangerous sleeping-berths were without hesitation condemned and taken down, and the main mast, which passed through those cabins, was shifted nearer the stern of the ship. The "fire-hole," which might well be called so, was only four feet in length from the front of the boilers to the engines; although the grates to be stoked were nine feet long, and the chimney was placed in the middle of this contracted space. Such it may be remembered was the situation of the boilers in the first instance; the reader is referred to the former engravings (Vol. I. p. 285,) for other particulars. The engravings now given show Mr. Glynn's arrangement of the new boilers, in which there is considerable novelty. The vessel is very narrow for her tonnage, being a long sharp-built ship, so that there is not room to put fires of convenient length, even in the whole width of the hold. In order to make the grates of moderate length, and yet of sufficient area to raise steam for these powerful engines, two heights of furnaces have been constructed, with two ranges of flues, so that it may be said that there are two sets of boilers, the one above the other; the lower set of boilers having no top, and the upper set having no bottom.

The lower set of boilers is seven feet longer than the upper set, giving that space for the stokers to manage their fires; there is the same distance between the lower boilers and the engines; the men who work the fires of the lower set stand in the hold of the vessel. The platform on which the higher tier of stokers stand is made hollow, like a venison dish, but the space below the men's feet is constantly supplied with cold water from the sea, and they are protected by a rail or balustrade from falling from the platform when the ship rolls or pitches. There are three safety-valves, each ten inches in diameter, loaded to five pounds on the square inch, by a weight equal to the whole pressure resting upon each valve, so that there are no levers which can be tampered with, and all three safety-valves are inaccessible to the men; but by a very simple apparatus the whole of the steam, the boilers contain, may be immediately discharged into the air. The pressure of steam is indicated by a mercurial gauge, on which it acts like a barometer, placed in front of the boilers, and graduated in inches of mercury, so that any person may know the force of the steam at a single glance. Each boiler has three gauge cocks, showing the height of water above the flues, so contrived as not to be affected by ebullition in the boilers; the lowest gauge cock shows nine inches of water on the flues, the highest eighteen inches, the water level in regular work being midway between them. There are also glass tubes to show the height of water in each boiler, and there are three reversed valves to prevent the possibility of collapse by atmospheric pressure.

The water for feeding the boilers is supplied to them through sluices of brass placed in front, and raised or lowered by a screw, with an index to each showing whether the slide be open or shut.

The cylinders of the Victoria's engines are 64½ inches in diameter, having a stroke of 6 feet 4 inches; her wheels are 26 feet in diameter, making from 16 to 18 revolutions per minute.

The steam pipes are fitted with stop valves, so that any one of the boilers may be disused, and the engines worked for a time in case of need by the other two. Each boiler has a damper moved by a wheel and pinion, to regulate or stop the draft through the fires, and to check them when the engines are stopped. There are channels or watercourses 18 inches square below the flues, for the purpose of cleaning out the boilers, and also for bringing a current of water from the after part to supply the rapid evaporation from the furnaces in front.

Figure 1 shows a front view or elevation of the boilers and steam receivers, which are immediately below the deck, with a section of the ship and the coal boxes at the sides.

Figure 2 is a sectional plan, the middle compartment showing the upper central boiler, the side compartments showing the lower wing boilers.

Figure 3. A longitudinal section through the furnaces, flues, chimney, and steam receivers, showing a portion of the deck, the kelson and the sleepers on which the boilers rest. The backs or bridges of the furnaces are built of fire-bricks, with a plate of iron in the middle to prevent air from passing through the joints of the brickwork. It also shows a section of the platform on which the firemen stand, with the space for cold water below their feet.

Figure 4 is a cross section through the chimney and steam receivers, showing the position, form, and action of the dampers. The water spaces, it will be observed, are narrow flat chambers six inches wide, and their sides are held together in every direction by numerous pillar-bolts and screws; so that the boiler plates, it may be said, are stitched together like a mattrass.

Figure 5 shows cross sections at the three points marked AB, CD, and EF on the plan, with the grates in some of the furnaces.

The arrangement and the details of these boilers will be interesting to professional and practical engineers, who will find Captain Bell willing to afford them all the information he can give, and to permit them to inspect the boilers and engines, which are now fitted with machinery designed by Mr. Glynn for starting, stopping, and reversing their motion, so that one man can now manage each engine, and obey the orders of the captain or pilot with all the promptitude and certainty that can be wished; whereas it required to do this with much labour, confusion, and delay, often causing mischief to the shipping in a crowded river.

There are various other alterations of less importance, all contributing in some degree to the economy of labour and fuel, and the general security of the machinery.

The Victoria took her station in the beginning of July, and is now running between London and Hull.

THE CHURCHES OF LONDON.

The Churches of London, by GEORGE GODWIN, *Architect*, F.R.S., and F.S.A., *assisted* by JOHN BRITTON, Esq., F.S.A. *London, C. Till*, 1839.

THE churches of London afford a subject, upon which hitherto no perfect work has appeared, although as an important feature of the giant metropolis they are deserving of the highest attention. Who can stand on one of the city bridges and look behind him, and not think of the many tales which the clustering spires call to his memory? The crowd of masts below the bridge do not bear the flags of more nations than the mute towers of the city record traditions of former ages. The dome of St. Paul's reigning in majesty over the subject turrets, calls back to our imaginations the Roman temple, the Italian's missionary, the aspiring tower of the structure of the middle ages, the conquest of nations, the destruction of cities, the fleeting joys and sorrows of many days. The Celt, Roman, Saxon, Catholic and Protestant have worshipped there, revolutions of mind, of man, and of matter stand before us in all the dread terror of human mutability and weakness. This is a scene unequalled in Europe, the breadth of the river, the circling amphitheatre, the forest of masts, the hum of steam boats, mock the Tiber and the Seine, richer in architectural pomp or palatial grandeur.

It is a sickly unnatural sentimentality which can induce us to view emotions of enthusiasm similar scenes abroad, and remain dull to all their influence here; it is the true nature of ignorance to neglect what is around us, and to be struck with wonder by the productions of distant climes. It is this which causes us to be dead to beauty and to foster vice, to treat genius with neglect, and to shower our honours on impudence, presumption and conceit, which purchases Vasari, and leaves England without a single work, in fine which elevates the glory of other countries and obscures our own. The architect reserves his admiration for Greece and Rome, and feels astounded that the public do the same; justly punished as he is, that his own works should be neglected from the spurious feeling which he himself has fostered and produced. If, however, he wish the public taste to be pure, if he wish native art to be protected, and England to hold a high rank both abroad and at home, he must show his fellow countrymen by his own example, that they have works worthy of attention, and edifices of which any nation might be proud. He must uphold the reputation of London, as foreigners do that of Paris or of Rome, and make every one feel interested in encouraging, and protecting that of which all participate in the glory. In the same manner as no one will allow an injury to a public museum in which he considers himself as having a property, so all will be ready to promote that in which they are considered as having an interest at stake. At Paris it is the public voice which has completed the Madeleine and the Pantheon, which has raised the Arc de l'Etoile from its ruins, and placed a monument at the Place de la Bastille. It was this which saved the Column from destruction, and replaced the statue of its founder, which has given Paris all its beauty, and daily urges such improvement. It would avail a minister less to strike off a tax from his budget, than to produce some new monument which might be an incentive to national pride, and gratify the popular demand for art. In England on the contrary, if St. Paul's were destroyed to-morrow, it is doubtful if the public would demand its restoration; it is certain that St. Saviour's has been mutilated, that competition for public edifices is a nullity, that the Parliament House and the Exchange have scarce yet a site on which to be built, that the British Museum is incompleted, and Trafalgar Square defaced. Here it is that churches are deformed with spikes, heroic statues adorned with pigtails, columns raised without an ornament, or to bear an incongruous one, national galleries built which are neither national nor a gallery, domes made which cannot be seen, and the monstrosities which elsewhere disfigure five hundred years here crowded into ten.

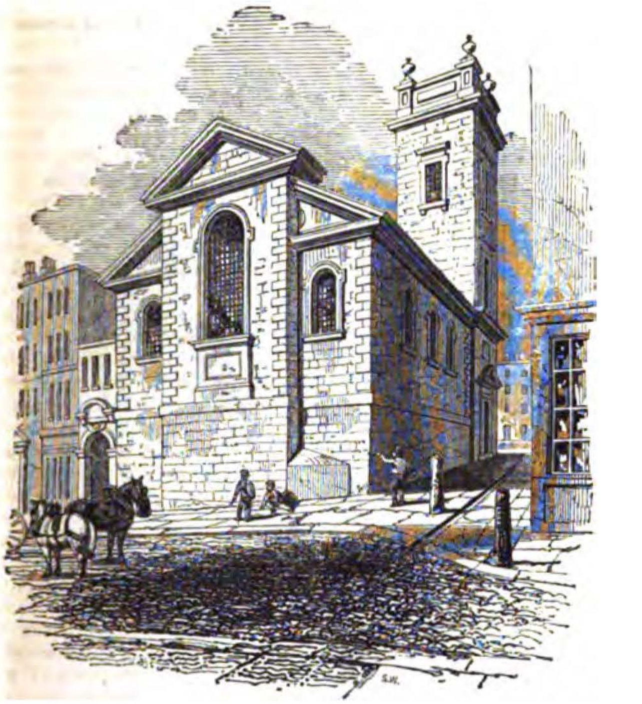
The way to remedy this is to cultivate the public taste, to give them an interest in the creation and maintenance of great works, to give architecture that strong hold on the public mind, which it can derive from history alone. A rough hewn stone is one of the best known monuments of London, it lives in the pages of the historian and in the traditions of the people, and is invested with a protection which ensures it from destruction and confers on it respect. Who passes London stone, and does not seem to hear Shakspeare whispering in his ear, "Now is Mortimer, lord of this city?" To take only the city and briefly enumerate the leading incidents which attach to its churches would take up more space than even respect for such a subject would allow us to afford, but we cannot refrain from reminding our readers of something of the interest which must be excited by the study of this subject. There is St. Paul's on the ruins of a Roman temple, in the great nave of which once was the resort of all the fashion of the city; there was the trader's mart and the fop's promenade, the tall steeple of which was used as a warehouse, and where an oven was built in a buttress; which is the noblest monument of our architecture, and one of the greatest stains on our national character, where the nation erects a pantheon to heroes—to give the church a two-penny show. To what does the fame of heroes fall when it is only commemorated to maintain a public imposition and a verger's fee. St. Bartholomew's, Smithfield, again, with its Saxon or Norman arches, looks down on the jousting field of lords, and the offering place of martyrs, unregarded in its obscurity as one of the few mouldering relics of our ancient styles. Its neighbour, St. Sepulchre's, has also its tale of interest. St. Peter's, in the Tower, hides the murdered corse of many a royal and noble victim, Queen Anne Boleyn and Catherine Howard, Thomas More and Thomas Cromwell. The Temple, with its round church, the monuments of the crusaders, and the tomb of Heraclius. All Hallow's, Barking, which has tales of the dreams of kings and the worship of angels, which had a special commission of defacement issued against it, and which records the names of the Earl of Surrey and Archbishop Laud. St. Andrew's, Undershaft, where apprentices led their may-day brawl, and poor John Star came with his licence to beg; where is the earliest instance of pews and book-cages, some of the latest relics of the age, which the innovation has supplanted. St. Bartholomew's, by the Exchange, (soon to give up its ancient tower,) heard the words of Miles Coverdale, the great translator of the bible. Allhallow's, Bread-street, in the parish where Milton was born. St. Olave's, Hart-street, near the palace of Whittington. St. Dunstan's, in the East, with its buttress spire, and St. Michael's, another gothic work of Wren's. St. Mary's, Aldermanbury, held the cursed bones of Jeffereys. St. Alban's, where the preacher told the progress of his sermon by the shifting hour-glass. St. Michael's, Wood-street, the tomb of the Scotch King, James IV. St. Giles', Cripplegate, near the birth-place of De Foe, with its walls covered with tombs and names, Milton and his father, Fox, the Martyrologist, Speed, and many more. St. Benet's, Paul's Wharf, where Inigo Jones reposed after all his glory. St. Catherine's, Cree Church, the tomb of Holbein, and the scene of Laud's consecration service, where he prepared the scaffold for himself and his prince, and desolation for his country. Christ Church, Newgate-street, holds the ashes of four queens. St. Helen's, Bishopsgate, a vestige of the middle ages, where the nun's grating is yet to be seen, and where Gresham and many other noble citizens repose. St. Andrew's, Holborn, where Sacheveral preached the kingdom into a flame, and where poor Chatterton lies undistinguished from the general mass. St. Mary's Le Bow, with its beautiful spire, and with the warlike tales of its old one, where the Norman crypt stands upon a dried up fen. St. Olave's, Jewry, the tomb of the distinguished Boydell, the promoter of the arts. St. Swithin's, sheltering in its walls the London-stone. The old church of Ethelburga. The pleasing spire of St. Bride's, and the tomb of Samuel Richardson. St. Mary's, Aldermary, with its gothic tower, and the tomb of the famous surgeon Pott. St. Stephen's, Walbrook, one of Wren's greatest glories.

These are but trifling among the points of interest which may be elicited, and they will merit extensive illustration. We are happy, therefore, to recognize the service which has been rendered to this cause by the publication of Mr. Godwin's work in a popular form, and we trust that he will be able to carry out his design of extending it n the other sections of the metropolis. We have too often praised this work during its progress to allow any remarks in its favour on this occasion, we can only say that the public and the profession owe to Mr. Godwin a large debt of gratitude for the production of a work so cheap, so excellent, so useful, and so interesting.

We now give some extracts, accompanied by a few of the wood engravings :—

ST. GEORGE'S, BOTOLPH LANE.

The annexed wood-cut represents the exterior of the church, which is plain and unpretending. It possesses, however, two characteristics of Wren's churches,—a tower rising at once from the ground, and a solid unbroken basement-story conferring stability in appearance on the whole edifice. The top of the tower is finished with a cornice and parapet; and has urns at the angles.



In the interior, the church is divided by Corinthian columns, (two on each side,) into a nave and aisles. The columns are very far apart, —so greatly so, indeed, as to produce an unpleasing effect: insomuch as the entablature and camerated ceiling above them appear to have no support. The church is lighted from windows in the ceiling, in the aisles, and at the east end. There is a gallery at the west end containing an organ.

ST. MARTIN'S, LUDGATE.

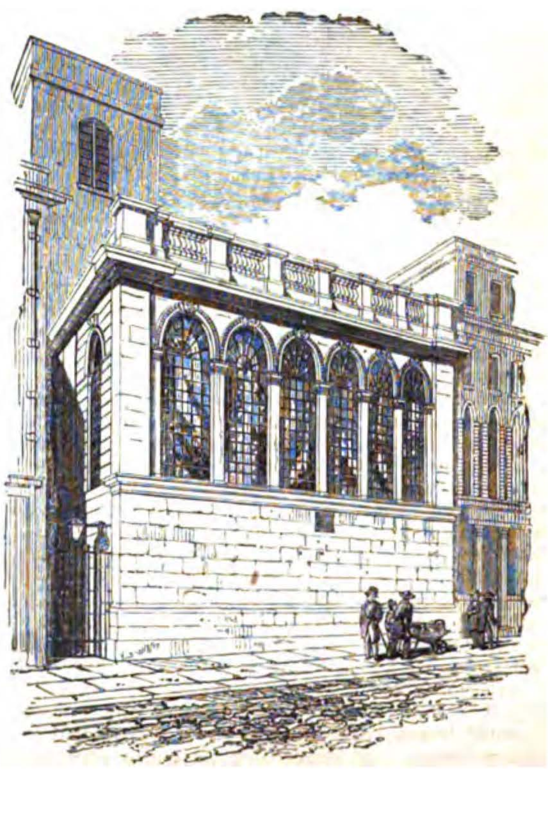
The following engraving affords a representation of the south front of the church as it was erected by Sir Christopher Wren, after the destruction of the old building by the fire of 1666. In order to widen the street, the church was set farther back, and all projections from the face of the building avoided. The elevation is not in any way remarkable for beauty.

The tower rising from the ground in the centre of the design is rendered pyramidical in its upper part, by the introduction of two large scrolls connecting with it the two side walls. A small cupola surmounts the tower with a gallery around the top of it, and from this rises a light spire supported upon arches.

Between Ludgate-street, and the body of the church, is an ambulatory, or lobby, the whole depth of the tower, and which has the effect of lessening within the church, the sound of passing coaches. The church itself is a cube of nearly equal sides. The length is 57 feet, the breadth 66 feet, and height 59 feet. The steeple is 168 feet high. The cost of the church was £5378 18*s*. 8*d*. Four composite columns within the area, standing on high plinths, and supporting entablatures which proceed from pilasters against the walls, form it into a Greek cross,—that is to say, a cross, of which the arms are nearly equal. The organ is in a small balcony at the west end; the altar-piece is plain, and consists of pilasters, entablature, and pediment, of oak.

ST. MATTHEW'S, FRIDAY STREET.

With the exception of the east end, which is represented in the following engraving, the building is entirely devoid of expression; indeed, this may almost be said of the part excepted, which, if it has any, certainly has no ecclesiastical character. Next to fitness, we hold expression of purpose to be the most essential quality in arch itectural design; tried by which canon, little can be said in praise of the edifice under notice.



The east end, as may be seen, presents a series of circular-headed windows on a lofty stylobate; and is surmounted by a bold cornice and balustrade. The material of this end of the edifice is of stone; the other walls, with the tower, &c. are of brick.

A plain room, of most uneven shape, about 60 feet long and 33 feet broad within the walls, with a plain flat ceiling, slightly coved at the sides, forms the church.

A gallery at the west end contains a small organ; the altar-piece at the east end displays some good specimens of carving. This latter, together with the table and rails, was the gift of James Smyth, Esq. in 1685; at which time, the church was rebuilt by Sir Christopher Wren.

ST. MARY MAGDALEN'S.

The church built by Wren is a substantial fabric, with a bell-tower at the north-west corner; the latter, however, as well as the north side and west end of the church, is shrouded by houses. The south side and east end of the edifice, display a series of circular-headed windows, at a considerable height from the ground, with trusses at the sides of each of them, supporting a continued cornice above. A stone balustrade of mean and insignificant character, terminates the design.

The tower has a bold cornice around the upper part of it, and is surmounted by five steps, forming a pyramid which supports a small stone belfry: the whole plain and simple, and productive of a better effect in the original than in a drawing.

Withinside the church, the ceiling is flat, (excepting immediately against the four sides, where it is coved,) and has a modillion cornice around it, and a large flower within a circular panel, in the centre. There are groined openings in the coved part of the ceiling, to admit the semicircular heads of the windows which light the church. Against the north wall is a gallery of oak, supported on iron columns: and at the west end is a similar gallery containing an organ which was erected by subscription in 1784. The pulpit, a good piece of workmanship, is affixed to the south wall.

THE THAMES TUNNEL SHIELD.

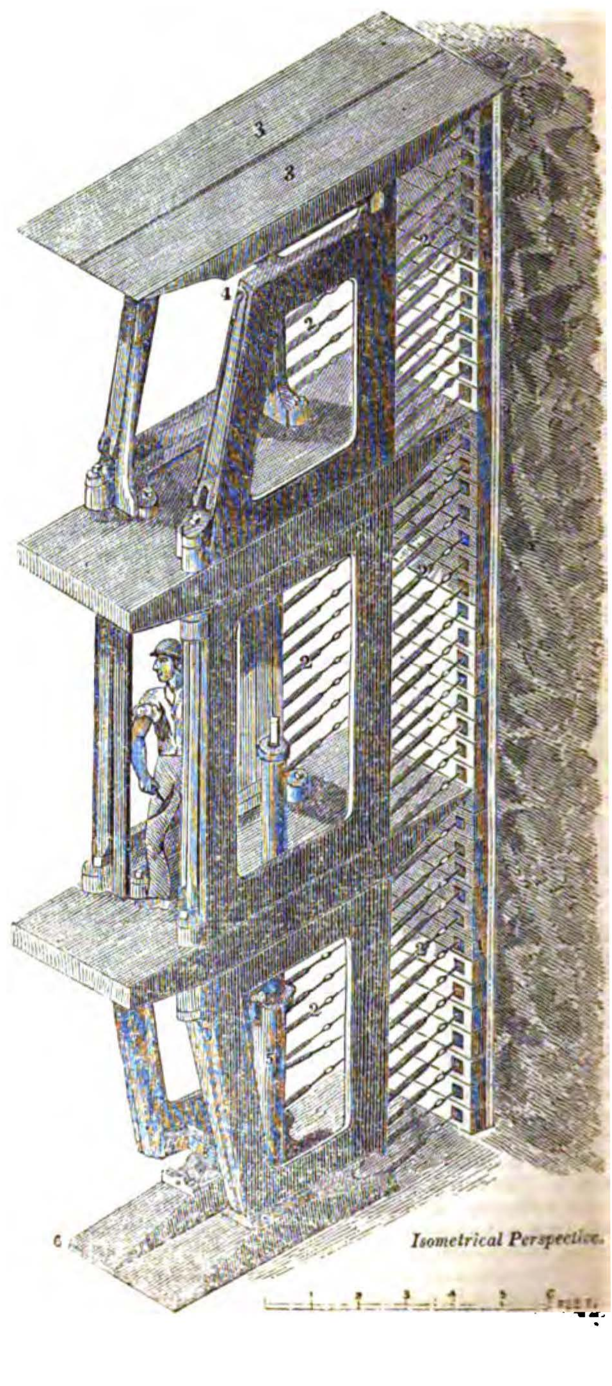
We are indebted to our highly respected contemporary, "The Mining Journal" for the following engraving and description of the Shield used in the construction of the Thames Tunnel, by Mr. Brunel.

The shield consists of twelve great frames, which, being independent of each other, may be advanced separately, by means which will be better understood on referring to the plate; each division, as is attempted to be shown, has boards in front, three feet long by six inches in breadth, and three and a half to four inches in thickness (known by the technical name of poling boards"), supported and kept in position by means of screws, which are lodged against the front iron frame; these boards, to the number of forty-four in each frame, are in succession taken down while the earth in front of each is excavated, the first board being always replaced before a second is removed, and thus forming a constant firm buttress. The several parts will be better understood by reference to the following numbers:—

1. Poling boards.
2. Poling screws.
3. The "top staves" covering the upper part of the excavation till the shield is succeeded by brick-work.
4. Screws to raise or depress the top staves.
5. "The legs," being jackscrews fixed by ball joints to the shoes 6, upon which the whole frame stands.

7 and 8. The sockets, where the top and bottom abutting screws are fixed to force the division or frames forward.

The design and organisation of this machine cannot be too much admired, and we only regret our inability to do it full justice.



Isometrical Perspective.

CANDIDUS'S NOTE-BOOK. FASCICULUS VIII.

I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please.

I. If any reliance may be placed upon what is said in an article in the 6th No. of the Art Union, on the "State of the Arts in New South Wales," architecture is looking up in that remote region of the globe. The Roman Catholic Cathedral at Sydney is there spoken of as being a building much superior to "most of the places of public worship in this metropolis," (London, we presume;) which it certainly may be without taxing admiration too largely. After all, however, the information positively afforded amounts to no more than that the building is of freestone, the interior "graced by splendid Gothic columns," and that it is capable of containing at least 3000 persons. Hence it may be supposed that it is in the Gothic style, but of what period or class we are not informed. As to that, we are left entirely to conjecture, and can therefore only guess that at any rate the interior is of an unusually rich character; for how else can we account for the splendour of the columns, which in themselves are hardly ever the most striking or decorated features in Gothic architecture. Again, the capacity of containing three thousand persons is but a very vague and unsatisfactory criterion as to dimensions; since it very much depends upon whether the congregation are packed together and piled up in galleries or not. I do not question the fact itself, but I certainly do question very strongly whether its being *made* to contain that number of persons, is not altogether fatal to the architectural effect. If not, they manage things very much better among the antipodes than they do here at home. The only other building expressly spoken of is Mr. M'Arthur's residence at Cambden, an "extensive and elegant villa, built in the best and chasest Italian style, with a large and graceful colonnade." Could we but know what are the writer's ideas as to elegance and gracefulness, and what he considers the best and chastest Italian style, we might be able to form some opinion as to the value of his commendation. At present we are wholly in the dark, his account being not a whit more luminous than the definition I have seen somewhere given of a horse, namely, that it is a creature with four legs and tail behind it, with a thing upon its back, called a saddle, for people to sit upon. "There are other fine buildings," the writer adds, "in the colony, but this certainly reflects the greatest credit on the architect." Why, then, I ask, is his name kept a profound secret;—almost as if it were one quite unmentionable—not fit to be even whispered to ears polite? Surely architects do not swarm already to that extent in New South Wales as to render it matter of great difficulty to ferret out the author of such a building.

II. There is one thing in respect to which almost all architectural works are more or less defective, some most deplorably so, and scarcely any perfectly satisfactory, namely, sections. Very few are to be met with of any of the buildings in the volumes of the Vitruvius Britannicus and most other works of that class; while in publications consisting of mere designs, it seems to be made a rule never to show anything whatever of the kind. One might therefore imagine that the interior of a building is of comparatively little, if any, importance, that it offers nothing for study with regard to design, decoration, construction, or contrivance; whereas the fact is, that without complete explanation by means of sections, there will be a great many particulars, as to which we must remain in doubt—perhaps be entirely at a loss. One of the most complete series of illustrations of any English building, is the second edition of Brettingham's work on Holkham House, the seat of the Earl of Leicester, and one of the most princely residences in this country. Yet although that monograph contains an unusual number of sections, several others are still required in order to explain various parts of it; among the rest, another transverse section on a line through the centre of the statue gallery and the two inner courts, and another through the state dining-room from north to south, to describe the alcove. Neither would it have been amiss had there been two more plans, one to show the mezzanine floor on the east side of the house, and over some of the rooms in the north front; another of the attic floor in the centre of each of the wings; besides which, a section through at least one of these latter would not have been superfluous. Again, though there is a plan of the attic in the roof of the body of the house, none of those rooms are shown in any of the sections, except one immediately above the tribune at the end of the hall, and which must be on a much lower level than the others, in fact, on that of the mezzanine floor. Owing to this omission, it is impossible to tell how those rooms are lighted—whether by dormer windows or not, since nothing of the kind appears in the external elevations. What renders the omissions of this kind the more provoking is, that they might have been supplied without at all increasing the number of the plates, because several of those of ceilings and chimney-pieces might have been very well retrenched, as might also some of those of the lodges, &c., which have scarcely any merit or interest whatever, certainly none in comparison with the particulars here mentioned, the latter being indispensable to a full explanation of the House itself. One extraordinary—indeed quite unaccountable—circumstance is, that the second edition of the work gives a totally different design of the interior of the chapel from that contained in the first one, and not only different but decidedly inferior also, and in quite another style from any other part of the interior, notwithstanding which, no notice is taken in the letter-press to that edition of this most singular discrepancy!

III. As to books of "Designs for Villas," *et hoc genus omne*, they invariably make it a point to *shirk* sections altogether. A mere elevation with a ground plan, generally of the most common-place description, is considered quite sufficient for a design, and indeed what is so shown is oftener than not of such quality as to extinguish all regret that no more of it is exhibited. One is puzzled to guess what class of persons they are who purchase the rubbish that has been published under the title of "Villas and Cottages in various styles,"—castellated included; things that absolutely make one sicken at the name of architecture, and almost ready to forswear it for ever. Look, again, at the samples of dowdiness and ugliness that have had their portraits taken because they happen to answer to the name of gentlemen's seats! Not one in fifty of things so shown are worth representation; yet, had the sums that have from time to time been squandered away upon many of them, been employed with economy and real taste combined, they might have been as beautiful as they are now the reverse. It is wonderful that people who are as anxious about the make and cut of a coat, as if it was intended to last them their whole lives, bestow no more study and foresight in selecting a design for a house, than if it was a thing that would be worn out in a fortnight.

IV. Or rather is not strange at all, but perfectly natural that such should be the case, seeing that people in general, even of that class, are perfectly ignorant of architecture as of fine art, and have never had the slightest taste for it instilled into them during their education. "Good heavens!" methinks I hear some fine lady mamma exclaim, "surely the fellow does not imagine that the children of people of fortune are to be educated as if they were to be house-builders?" Certainly not: I recommend no such thing. I do not desire to see people of fortune study building, yet I do wish to see them study architecture; nor even that as professional men, but as the gentleman, the man of education, and the man of taste ought to do. Such, however, are the odd misconceptions and the obstinate prejudices most persons labour under, that it is impossible to bring them to view the matter in such light. You may attempt to convince them and correct their misapprehensions, and after having reasoned with them two hours, find that their first notions are immovably fixed. The consequence is that out of a becoming horror lest their sons should be suspected of having ever talked with a carpenter or mason, they suffer them to associate with grooms and jockeys, who may initiate them into all the mysteries of the turf, and from the turf they proceed to the green of the gambling-table.

V. As part of liberal education, the study of architecture is not only beneficial as far as it tends to form the taste generally, but highly advantageous inasmuch as it furnishes a pursuit that is a never-failing resource. But it will be said that persons may employ their time quite as innocently and far more profitably both to themselves and to others than in any such pursuit, let the gratification be as great as it may. I am silenced: heaven forbid that with a view of recommending a pursuit as harmless as it is elegant, I should divest any one from employing his time, his fortune, his talents in any way that would immediately benefit society. All that I ask is why do not those who have both leisure and fortune, so employ them, instead of squandering away both, as too frequently happens, in pursuits disgraceful to themselves, and injurious both to themselves and to others? Why are there so many idle time-killers in that class of society—votaries to excitement, and victims to ennui! The man who has a sincere taste for architecture may at least defy the fiend Ennui.

RAMBLES BY PHILOMUSÆUS.—No. 2.

PARIS.

One of the first things which strikes the visitor to Paris is the rapid change in style which has taken place within the last two years. The Louis Quatorze and Louis Quinze have gone to the tombs of their fathers, and left scarcely a trace behind, and the restoration reigns in paramount splendour. The principal cafés and shops shine with gothic ornaments and arabesques, to the exclusion of the Louis Quatorze, and with only occasional instances of Pompeian. This latter style in some degree divides the empire with that of the restoration, and it is to to be hoped will maintain its ground, as it possesses greater purity, and makes greater use of the human figure. Scarcely one or two instances of old established cafés does the bastard French Greek remain at all undisturbed. The splendour of some of the restoration buildings is such as to be without parallel in London, and shows equally a more extended love of art among the Parisians, and readier means of availing themselves of it. The number of first rate decorators, which the quality of the work shows to have been employed, is such as to mock all the resources of our London artists, and forcibly to point out the advantage which the Parisians possess from the extension of artificial instruction. For practical purposes decoration in London is so dear and so difficult to be obtained, that it is out of the power of tradesmen to avail themselves of it. We are particularly deficient in artists who can draw well, and still worse off for such as can colour even decently. There is however a class of workmen from whom perhaps the decorators could draw recruits; the papier maché manufacture being now so much cultivated, that tolerable men for flowers and arabesque painting could be obtained for thirty shillings a week.

In Paris the taste for the restoration, like that for all other styles arises from political causes, and is the manifestation of the moral circumstances which affect the whole frame of society. Luxury and degeneracy of taste produced the styles of Louis Quatorze and his successor, and the wants of a predominant monied aristocracy led to its revival; the reign of Louis Sixteenth, the precursor of immense revolutions, first imitated the sober manners of the English, and then in its farther license fell back upon the Greek and Roman styles. The prevalence of the Egyptian style under the consulate is referable to the same elements, and in every instance we see the mind of the nation chronicling its successive phases in the remains of the several styles which are the outward figures and physical manifestation of the moral agitation within. We have nothing of that kind here, the influence of a style or a fashion is confined to a particular class, produces no effect on the nation at large, and leaves few monuments of its existence. In France the whole nation is agitated, every department of literature and art is called into active participation, and the style of the day is that of the whole nation. The novellist calls into life the personages and events of the middle ages; the dramatist exhibits them on the theatre, the periodical press swarm with illustrative publications, the painter and the sculptor seek no other source of inspirations, the engraver distributes their images among the people, the decorator gothicises the mansion, the architect repairs the old buildings, and even the cook and the barber participate in the general conflict. Thus in a few years the whole nation is physically and nationally metamorphorized. One general tone pervades society, and whether he will or no the artist must conform to it. With his hair and beard à la Raphael, he dines in a Gothic restaurant, finishes the evening at the Theatre de la Renaissance with a medieval drama, seals his billet with a seal like that of an old abbot, and warned by the notes of the cathedral like clock on his chimney piece, retires to sleep under a canopy carved in quatrefoil. Go into the Bibliotheque Royale, the print-room is filled with students of castles and cathedrals, the library with romaunt readers, and the museum with copyists of furniture and costume. It is evident that we can never compete with such a concentrated force of application, but at any rate by a better instruction of our workmen, we may become more efficient copyists, and avail ourselves to a greater extent of what is already done to our hands.

The most pleasing feature to an Englishman of this rage for the restoration, is the respect which is paid to gothic monuments, and the efforts which are making for their repair and preservation. The Archbishop's Palace which was demolished, being now converted into a Place, and the adjacent houses cleared away, Notre Dame towers over the Ile de la Cité with a majesty which has few rivals. The church of St. Germain l'Auxerrois, and other gothic buildings are also undergoing restoration and completion, and freed from the barbarisms of the pseudo classic artists they will possess a greater interest than ever.

THE THAMES TUNNEL.

This work now approaches completion, and people naturally ask what is to be its future destiny. That it will pay no one ever conceives, and that it is of any great utility is equally problematical. To climb down one pair of stairs and up at another, and to promenade in a catacomb is little inviting as a matter of pleasure, and rather too tedious for business, so that it will probably remain what it has hitherto been, more a kind of show, than productive of public advantage. It may however be well worth the consideration of its managers, whether by the use of a stationary engine, it could not be made a relatively convenient mode of passage, so that by a low rate of toll carriages might be induced to pass over. If too foot passengers could also be conveyed across in a car for a little higher toll than they could proceed alone, it would perhaps become a favourite source of amusement.

One of the most interesting propositions hitherto made respecting this great work, emanates from a destinguished foreign nobleman, the Count Hawks Le Grice, a member of several of the academies abroad, and eminent at Rome for his taste and his cultivation of the arts. He proposes that the tunnel should form a repository for busts of illustrious men, and that the entrances on the Middlesex and Surrey shores should be effected by two triumphal arches, one recording the achievements of the navy, and the other the heroic deeds of the army. That the public may be enabled to judge of the feasibility of this arrangement, and of the effect which it is calculated to produce, the Count has kindly offered to fit it up temporarily with a number of busts for this purpose, so that soon an opportunity may be afforded for bringing it into full operation. After alluding to the interesting features of this project as a national work, the Count observes, that "if we consider the grandiose style of the architecture, the massive and broad effect of the whole, and the form of the semi-elliptical arch which allows the eye to embrace the whole stupendous structure without being distracted by any details, we must say that it all goes to prove that the viaduct of the tunnel is singularly adapted for the exhibition of sculpture. To those who have had the high intellectual treat of seeing those chefs d'ouvre of art, the Apollo, the Laocoon, the Olympian Jupiter, the Minerva Medici, and the Ariadne in the Vatican by torchlight will at once acknowledge that the circumstance of the Tunnel being lighted with gas would greatly contribute to the effect of sculptural art. It is moreover known that artificial light is superior to daylight, as the contrast of light and shade is greater, and the effect of chiar'oscuro enhances the value and the beauty." The Count recommends that the busts should be semi-colossal, executed with more than usual spirit and boldness, the hair should be well massed, and in their execution should be that simple majesty of form, that solemn quietude and sedate expression, that dignity of gesture freed from ostentation, which is the distinguishing character of Greek art.

EXPERIMENTAL RESEARCHES UPON THE RELATIVE ILLUMINATING POWERS OF DIFFERENT LAMPS AND CANDLES, AND THE COST OF THE LIGHT AFFORDED BY THEM.

By Andrew Ure, M.D., F.R.S., &c. &c. &c.

Read before the Institution of Civil Engineers, 11th June, 1839.

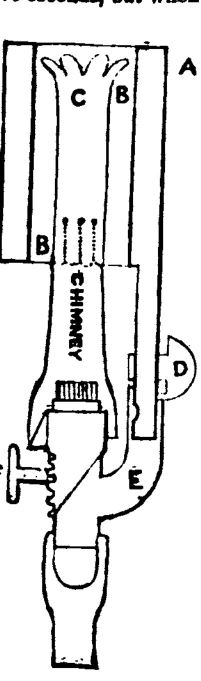
The production, diffusion, and economy of light are subjects of the highest interest both to men of science and men of the world; leading the former to contemplate many of the most beautiful phenomena of physics and chemistry, while they provide the latter with the artificial illumination so indispensable to the business and pleasures of modern society. The great cost of light from wax, spermaceti, and even stearine candles, as also the nuisance of the light from tallow ones, have led to the invention of an endless variety of lamps, of which the best hitherto known is undoubtedly the mechanical or Carcel lamp, so generally used by the opulent families in Paris. In this lamp, the oil is raised through tubes by clock-work, so as continually to overflow at the bottom of the burning wick; thus keeping it thoroughly soaked, while the excess of the oil drops back into the cistern below. I have possessed for several years an excellent lamp of this description, which performs most satisfactorily, but it can hardly be trusted in the hands of a servant; and when it gets at all deranged, it must be sent to its constructor in Paris to be repaired. The light of this lamp when furnished with an appropriate tall glass chimney is very brilliant, though not perfectly uniform; since it fluctuates a little, but always perceptibly to a nice observer, with the alternating action of the pump-work; becoming dimmer after every successive jet of oil, and brighter just before its return. The flame, moreover, always flickers more or less, owing to the powerful draught, and rectangular reverberatory shoulder of the chimney. The mechanical lamp is, however, remarkable for continuing to burn, not only with unabated but with increasing splendour for seven or eight hours, the vivacity of the combustion increasing evidently with the increased temperature and fluency of the oil, which, by its ceaseless circulation through the ignited wick, gets eventually pretty warm. In the comparative experiments made upon different lights by the Parisian philosophers, the mechanical lamp is commonly taken as the standard. I do not think it entitled to this pre-eminence: for it may be made to emit very different quantities of light, according to differences in the nature and supply of the oil, as well as variations in the form and position of the chimney. Besides, such lamps are too rare in this country to be selected as standards of illumination.

After comparing lights of many kinds, I find every reason to conclude, that a large wax candle of three to the pound, either long or short, that is, either 12 or 15 inches in length, as manufactured by one of the great wax-chandlers of London, and furnished with a wick containing 27 or 28 threads of the best Turkey cotton, is capable of furnishing a most uniform, or nearly invariable standard of illumination. It affords one-tenth of the light emitted by one of the Argand lamps of the Trinity House, and one-eleventh of the light of my mechanical lamp, when each lamp is made to burn with its maximum flame, short of smoking.

The great obstacle to the combustion of lamps, lies in the viscidity, and consequent sluggish supply, of oil, to the wicks; an obstacle nearly insuperable with lamps of the common construction during the winter months. The relative viscidity, or relative fluency of different liquids at the same temperature, and of the same liquid at different temperatures, has not, I believe, been hitherto made the subject of accurate researches. I was, therefore, induced to make the following experiments with this view.

Into a hemispherical cup of platinum, resting on the ring of a chemical stand, I introduced 2000 water-grain measures of the liquid whose viscidity was to be measured, and ran it off through a glass syphon, ⅛ of an inch in the bore, having the outer leg 3¼ inches, and the inner leg 3 inches long. The time of efflux became the measure of the viscidity; and of two liquids, if the specific gravity, and consequent pressure upon the syphon, were the same, that time would indicate exactly the relative viscidity of the two liquids. Thus oil of turpentine and sperm oil have each very nearly the same density; the former being, as sold in the shops, = 0.876, and the latter from 0.876 to 0.880, when pure and genuine. Now I found that 2000 grain-measures of oil of turpentine ran off through the small syphon in 95 seconds, while that quantity of sperm oil took 2700 seconds, being in the ratio of 1 to 28½; so that the fluency of oil of turpentine is 28½ times greater than that of sperm oil. Pyroxilic spirit, commonly called naphtha, and alcohol, each of specific gravity 0.825, were found to run off respectively in 80 and 120 seconds; showing that the former was 50 per cent. more fluent than the latter. Sperm oil, when heated to 265° Fahr., runs off in 300 seconds, or one-ninth of the time it took when at the temperature of 64°. Southern whale oil, having a somewhat greater density than the sperm oil, would therefore flow off faster, were it not somewhat more viscid. Its specific gravity is 0.926, and it takes just the same time to flow off as sperm oil, either in its cold state or heated to 265°.

2000 grain-measures of water at 60° run off through the said syphon in 75 seconds, but when heated to 180° they run off in 61.



In the adjoining figure, A, A, B, B, is a section of the cylinder, which constitutes the cistern; the oil being contained between the inner and outer cylinders, and receiving heat from the flame of the lamp, which passes up through the inner cylinder, B, B, and is reverberated more or less against its sides by the top of the iron chimney C, be ng notched and bent back. D is a stop cock which is opened to allow the oil to descend to the wick, and is shut when the cistern is to be separated from the pipe of supply, E, for the purpose of re-charging it with oil. The flame is modified, not by raising or lowering the wick, as in common lamps, but by raising or lowering the bell-mouthed glass chimney, which rests at its bottom on three points, and is moved by means of the rack-work mechanism F. The concentric cylindric space, A, A, & B, B, contains a pint imperial, and should be made entirely full before lighting the lamp; so as to leave no air in the cistern, which by its expansion with the heat, would inevitably cause an overflow of the oil.

Concentrated sulphuric acid, though possessing the great density of 1.840, yet flows off very slowly at 64°, on account of its viscidity; whence its name of oil of vitriol. 2000 grain-measures of it took 660 seconds to discharge.

Mr. Samuel Parker, long advantageously known to the public for his sinumbral, and pneumatic fountain lamps, as well as other inventions subservient to domestic comfort, having recently obtained a patent for a new lamp, in which the oil is heated, by a very simple contrivance, in the cistern, to any desired degree, before arriving at the wick, I instituted an extensive series of experiments to determine its value in the production of light, and consumption of oil, compared to the value of other lamps, as well as candles in these respects.

The following arrangement was adopted in these experiments for determining the relative illumination of the different lights. Having trimmed, with every precaution, my French mechanical lamp, and charged it with pure sperm oil, I placed it upon an oblong table, at a distance of 10 feet from a wall on which a sheet of white paper was stuck. One of Mr. Parker's hot-oil lamps, charged with a quantity of the same oil, was placed upon the same table; and each being made to burn with its maximum brilliancy, short of smoking, the relative illumination of the two lamps was determined by the well-known method of the comparison of shadows; a wire a few inches long, and of the thickness of a crow-quill, being found suitable for enabling the eye to estimate very nicely the shade of the intercepted light. It was observed in numerous trials, both by my own eyes and those of others, that when one of the lamps was shifted half an inch, nearer to or further from the paper screen, it caused a perceptible difference in the tint of the shadow—Professor Wheatstone kindly enabled me to verify the precision of the above method of shadows, by employing, in some of the experiments, a photometer of his own invention, in which the relative brightness of the two lights was determined by the relative brightness of the opposite sides of a revolving silvered ball, illuminated by them.

1. The mechanical lamp was furnished with a glass chimney 1.5 inches in diameter at the base, and 1.2 at top; the wide bottom part was 1.8 inches long, and the narrow upper part 8 inches. When placed at a distance of 10 feet from the wall its light there may be estimated as the square of this number, or 100. In the first series of experiments, when burning with its maximum flame, with occasional flickerings of smoke, it emitted a light equal to that of 11 wax candles, and consumed 912 grains of oil per hour. The sperm oil was quite pure, having a specific gravity of 0.874 compared to water at 1000. In a subsequent series of experiments, when its light was less flickering, and equal only to that of 10 wax candles, it consumed only 815 grains, or 0.1164 of a lib. per hour. If we multiply this number into the price of the oil (8*s.* per gallon) per lib. 11*d.*, the product 1.2804*d.* will represent the relative cost of this illumination, estimated at 100.

2. The hot-oil lamp burns with a much steadier flame than the mechanical, which must be ascribed in no small degree to the rounded slope of the bell-mouthed glass chimney, whereby the air is brought progressively closer and closer into contact with the outer surface of the flame, without being furiously dashed against it, as it is by the rectangular shoulder of the common contracted chimney. When charged with sperm oil, and made to burn with its maximum flame, this lamp required to be placed one foot further from the screen than the mechanical lamp, in order that its shadow should have the same depth of tint. Hence, its relative illumination was, in that case, as the square of 11 to the square of 10; or as 121 to 100. Yet its consumption of oil was only 696 grains, or somewhat less than 0.1 of a lib. per hour. Had its light been reduced to 100, it would have consumed only 576 grains per hour, or 0.82 of a lib. If we multiply this number by 11*d.* the product 0.902*d.* will represent the relative cost of 100 of this illumination.

3. The hot-oil lamp being charged with the southern whale oil, of specific gravity 0.926, at 2*s.* 6*d.* per gallon, or 3¾*d.* per lib., when burning with its maximum flame, required to be placed 9 feet and 1 inch from the screen to drop the same tint of shadow upon it as the flames of the other two lamps did at 10 and 11 feet with the sperm oil. The square of 9 feet 1 inch=82 is the relative illumination of the hot-oil lamp with the southern whale oil. It consumed 780 grains, or 0.111 of a pound per hour; but had it given 100 of light it would have consumed 911 grains, or 0.130 of a pound, which number being multiplied by its price 3¾*d.*, the product 0.4875*d.* will represent the relative cost of 100 of this light.

4. A hot-oil lamp charged with olive-oil of specific gravity 0.914, at 5*s.* 6*d.* per gallon, or 7¼*d.* per lib., when burning with its maximum flame, required to be placed at 9 feet 6 inches to obtain the standard tint of shadow upon the screen. It consumed 760 grains per hour. The square of 9½ feet is 90¼, which is the relative intensity of the light of this lamp. Had it emitted a light = 100, it would have con-

2 B 2

sumed 840 grains, or 0.12 of a pound per hour—which number multiplied by the price per pound, gives the product 0.9*d*. as the relative cost of 100 of this light.

5. A hot-oil lamp charged with Price and Co.'s cocoa-nut oil (oleine), of specific gravity 0.925, at 4*s*. 6*d*. per gallon, or 5¾*d*. per lib., had to be placed 9 feet from the screen, and consumed 103 grains per hour. Had its light been 100 instead of 81 (9^2), the consumption would have been 1277 grains, or 0.182 of a pound per hour; which number multiplied by its price per pound, the product 1.031*d*. will represent the cost of 100 of this illumination.

6. In comparing the common French annular lamp in general use, with the mechanical lamp, it was found to give about one-half the light, and to consume two-thirds of the oil of the mechanical lamp.

7. Wax candles from some of the most eminent wax-chandlers of of the metropolis were next subjected to experiment; and it is very remarkable that, whether they were threes, fours, or sixes in the pound, each afforded very nearly the same quantity of light, for each required to be placed at a distance of 3 feet from the screen to afford a shadow of the same tint as that dropped from the mechanical lamp, estimated at 100. The consumption of a genuine wax candle, in still air, is, upon an average of many experiments, 125 grains per hour, but as it affords only 1-11th of the light of the mechanical lamp, 11 times 125=1375 grains, or 0.1064 of a pound is the quantity that would need to be consumed to produce a light equal to that of the said lamp. If we multiply that number by the price of the candles per lib.=30*d*. the product=5.892*d*. is the cost of 100 of illumination by wax. A wax candle, three in the pound (short), is 1 inch in diameter, 12 inches in length, and contains 27 or 28 threads, each about 1-90th of an inch in diameter. But the quality of the wick depends upon the capillarity of the cotton fibrils, which is said to be greatest in the Turkey cotton, and hence the wicks for the best wax candles are always made with cotton yarn imported from the Levant. A wax candle, three in the pound (long), is ⅞ of an inch in diameter, 15 inches long, and has 26 threads in its wick. A wax candle, six to the pound, is 9 inches long, 4-5ths of an inch in diameter, and has 22 threads in its wick. The light of this candle may be reckoned to be at most, about 1-11th less than that of the threes in the pound. A well-made short three burns with surprising regularity in still air, being at the rate of an inch in an hour and a half, so that the whole candle will last 18 hours. A long three will last as long, and a six about 9½ hours. Specific gravity of wax=0.960.

8. Spermaceti candle, three in the pound, is 9-10ths of an inch in diameter, 15 inches long, and has a plaited wick, instead of the parallel threads of a wax candle. The same candles, four in the pound, are 8-10th of an inch in diameter, and 13½ inches long. Each gives very nearly the same quantity of light as the corresponding wax candles: viz., 1-11th of the light of the above-mentioned mechanical lamp, and consumes 142 grains per hour. Multiplying this number by 11, the product, 1562 grains = 0.223 of a pound, would be the consumption of spermaceti requisite to give 100 of illumination. Multiplying the last number by 24*d*., the price of the candles per pound, the product 5.352*d*. is the relative cost of 100 of this illumination.

9. *Stearic Acid* candles, commonly called German wax, consume 168.5 grains, or 0.024 of a pound, per hour, when emitting the same light as the standard wax candle. Multiplying the latter number by 11, and by 16*d*. (the price of the candles per lib.), the product 4.224*d*. will represent the relative cost of 100 of this illumination.

10. Tallow candles; moulds, short threes, 1 inch in diameter, and 12½ in length; ditto, long threes, 9-10ths of an inch in diameter, and 15 in length; ditto, long fours, 8-10ths of an inch in diameter, and 13¾ in length. Each of these candles burns with a most uncertain light, which varies from 1-12th to 1-16th of the light of the mechanical lamp—the average may be taken at 1-14th. The threes consume each 144 grains, or 0.2 of a pound, per hour; which number, multiplied by 14, and by 9*d*. (the price per pound,) gives the product 2.52*d*. for the relative cost of 100 of this illumination.

11. *Palmer's* spreading wick candles. Distance from the screen 3 feet 4 inches, with a shadow equal to the standard. Consumption of tallow per hour 232.5 grains, or 0.0332 of a pound. The square of 3 feet 4 inches = 11.9 is the relative illumination of this candle—11.9 : 0.3332 : : 100 : 0.28; and 0.28 × 10*d*. = 2.8 the relative cost of this illumination.

12. Cocoa-nut stearine candles consumed each 168 grains per hour, and emitted a light equal to 1-16th of the standard flame. Multiplying 168 by 16, the product 3088 grains, or 0.441 of a lib., is the quantity which would be consumed per hour to afford a light equal to 100. And 0.441 multiplied by 10*d*., the price per lib., gives the product 4.41*d*. as the cost of 100 of this illumination per hour.

13. A Gas Argand London Lamp, of 12 holes in a circle of ⅜ of an inch in diameter, with a flame 3 inches long, afforded a light = 78½ compared to the mechanical lamp; and estimating the light of the said mechanical lamp as before, at 100, that of the bot-oil lamp is 120, and that of the above gas flame 78.57, or in round numbers 80, *and the common French lamp in general use* 50.

Collecting the preceding results, we shall have the following tabular view of the cost per hour of an illumination equal to that of the mechanical lamp, reckoned 100, or that of 11 wax candles, three to the pound.

TABLE OF COST PER HOUR OF ONE HUNDRED OF ILLUMINATION.

		Pence.
1.	Parker's Hot-Oil Lamp, with southern whale oil	0.4875
2.	Mechanical or Carcel Lamp, with sperm oil	1.2804
3.	Parker's Hot-Oil Lamp, with sperm oil	0.902
4.	Ditto ditto common olive oil	0.900
5.	Ditto ditto cocoa-nut oleine or oil ..	1.031
6.	French Lamp in general use, with sperm oil	1.7072
7.	Wax Candles	5.892
8.	Spermaceti Candles	5.352
9.	German Wax (Stearic Acid) ditto	4.224
10.	Palmer's Spreading Wick Candles	2.800
11.	Tallow (Mould) Candles	2.520
12.	Cocoa-nut Stearine, of Price & Co.	4.41

Since the hot-oil lamp affords sufficient light for reading, writing, sewing, &c., with one-fifth of its maximum flame, it will burn at that rate for 10 *hours at the cost of about One Penny, and is, hence, well entitled to its inventor's designation, "The Economic."*

Sir D. Brewster, in his examination lately before the Committee of the House of Commons on lighting the House, stated, that the French light-house lamp of Fresnel emitted a light equal to that of 40 Argand flames: whereas, according to other accounts, it gave much less light. With the view of settling this point, before being examined by the said Committee, I repaired to the Trinity-house, and tried one of the two original Fresnel lamps, which had been deposited there by that eminent French engineer himself. This lamp consists of four concentric circular wicks, placed in one horizontal plane; the innermost wick being ¾ of an inch in diameter, and the outermost 3¼ inches. Being carefully trimmed, supplied with the best sperm oil, surmounted with its great glass chimney, burning with its maximum flame, and placed at a distance of 13 feet 3 inches from the screen, it let fall a shadow of the same tint as that let fall by the flame of my mechanical lamp, placed at a distance of 4 feet 6 inches from the screen. The squares of these two numbers are very nearly as 8¾ to 1 (175.5625 to 20.25); showing that the Fresnel lamp gives less than 9 times the light of my mechanical lamp, and about 9.6 times the light of one of the Trinity-house Argand lamps. The Fresnel lamp is exceedingly troublesome to manage, from the great intensity of its heat, and the frequent fractures of its chimneys—two having been broken in the course of my experiments at the Trinity-house.

Mr. Goldsworthy Gurney, the ingenious inventor of the new light-house lamp, in which a stream of oxygen gas is sent up through a small tube within the burning circular wick of a small Argand lamp, having politely sent two of his lamps to my house, along with a bag of oxygen gas, I made the following experiments, to ascertain their illuminating powers, compared to those of the mechanical lamp and wax candles.

His larger lamp has a wick ⅝ of an inch in diameter, but emits an oxygen flame of only ⅜ of an inch. The flame is so much whiter than that of the best lamp or candle, that it becomes difficult to determine, with ultimate precision, the comparative depths of the shadows let fall by them. The mean of several trials showed that the above *Bude*-light (as Mr. Gurney calls it, from the name of his residence in Cornwall,) has an illuminating power of from 28 to 30 wax candles. His smaller lamp has a flame ¼ of an inch in diameter, and a wick ⅛ of an inch. Its light is equal to that of from 18 to 20 wax candles. He propose to mount 60 such lights, distributed into 8 compartments, in the ceiling, for lighting the House of Commons, the light being reflected downwards by concave mirrors.

The Committee of the House of Commons, on lighting it, having asked me what was the relative vitiation of air by the breathing of men, and the burning of candles, I gave the following answer:—

Wax contains 81.75 parts of carbon in 100, which generate by combustion 300 parts of carbonic acid gas. Now, since 125 grains of wax constitute the average consumption of a candle per hour, these will generate 375 grains of carbonic acid; equivalent in volume to 800 cubic inches of gas. According to the most exact experiments on respiration, a man of ordinary size discharges from his lungs 1632 cubic inches of carbonic acid gas per hour, which is very nearly the double of the quantity produced from the wax candle. Hence the combustion of two such candles vitiates the air much the same as the breathing of one man. A tallow candle, 3 or 4 in the pound, generates nearly the quantity of carbonic acid as the wax candle; for though tallow contains only 79 per cent. of carbon, instead of 81.75, yet it consumes so much faster, as thereby to compensate fully for this difference.

13, *Charlotte Street, Bedford Square.*

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Report (addressed to the Commissioners of Her Majesty's Woods, Forests, Land Revenues, Works, and Buildings), as the Result of an Inquiry, undertaken under the authority of the Lords Commissioners of Her Majesty's Treasury, by CHARLES BARRY, Esq., H. T. DE LA BECHE, Esq., F.R.S. *and* F.G.S., WILLIAM SMITH, Esq., D.C.L. *and* F.G.S., *and* MR. CHARLES H. SMITH, *with reference to the Selection of Stone for Building the New Houses of Parliament.*

MY LORD AND GENTLEMEN.—In conformity with your instructions we have the honour to report, that in the months of August, September, and October last we made a tour of inspection to various stone quarries in the kingdom, and visited numerous public buildings, with a view to the selection of a proper stone to be employed in the erection of the new Houses of Parliament. We have also, in further compliance with your instructions, procured a fair average specimen of the workable stone from each of the quarries which we have visited, and have deposited cubes, prepared from such specimens, as well as from others which have been forwarded to us, in the Museum of Economic Geology.

From the number of quarries which we have visited, we consider that we have been enabled to obtain a competent knowledge of the varied character of each of the several classes of building stone in the Kingdom which are likely to be suited to the object in view, although we are well aware that there are many other freestone quarries in various parts of the country which we have not examined, where stone of different varieties, in some cases, perhaps, not inferior to those which have been brought under our immediate inspection, may be obtained. From many of such last-mentioned quarries we have received specimen blocks, and the requisite information concerning them, since the completion of our tour. We have not considered it necessary to extend our inquiry to granites, porphyries, and other stone of similar character, on account of the enormous expense of converting it to building purposes in decorative edifices, and from a conviction that an equally durable and more eligible material could be obtained for the object in view from among the limestones or sandstones of the Kingdom. We have, nevertheless, to acknowledge the receipt of several specimens of granite, among which are some from the estates of the Marquis of Breadalbane, near Oban, in the west of Scotland, accompanied by a munificent offer on the part of his Lordship that, should the granite from that locality be considered fit and available for the proposed new Houses of Parliament, he would be willing to make a free gift to the nation of his interest in any quantity that might be required for the purpose.

In order to render more complete the inquiry upon which we have been engaged, we have availed ourselves of the valuable assistance of Professors Daniell and Wheatstone, of King's College, London, in determining the physical properties of a large proportion of the specimens which we have obtained.

The details of the information collected in the course of our inquiry will be found at the end of this report, arranged in a series of tables, (A), (B), (C), and (D), for the purpose of more easy reference and comparison.

Table (A) exhibits an alphabetical enumeration of all the quarries which have been brought under our consideration; the names and residences of the parties interested in them; the mineral character and component parts of the stone, its colour, structure, and ordinary weight; a description of the workable and other beds; the price of stone at the quarry; the cost of its carriage to the pool of London; the cost of labour upon it, with reference to that upon Portland stone, in London; an enumeration of the public works wherein the stone is either known, or reported to have been employed; and such general remarks as are applicable to the peculiar circumstances of each quarry.

With respect to the cost prices enumerated in this table, it should be stated that they have been furnished by the several parties interested, without reference to a large supply, which if required would no doubt occasion new and more economical arrangements to be made, so that the stone would probably be supplied upon more reasonable terms.

Table (B) exhibits a list of the public buildings that we have visited, detailing the time of their erection, the stone of which they are constructed, and their present condition; arranged alphabetically, according to the class of stones employed in them.

Tables (C) and (D) contain the results of the analyses and experiments of Professors Daniel and Wheatstone, a description of the mode in which they have been conducted, and their observations upon the subject.

In proof of the necessity and importance of the inquiry upon which we have been engaged, the lamentable effects of decomposition observable in the greater part of the limestone employed at Oxford, in the magnesian limestone of the minster, churches, and other public buildings at York, and in the sandstones of which the churches and other public buildings in Derby and Newcastle are constructed, afford, among numerous other examples, incontestible and striking evidence. The unequal state of preservation of many buildings, often produced by the varied quality of the stone from the same quarry employed in their construction, shows the propriety of a minute examination of the quarries themselves, in order to acquire a proper knowledge of the particular beds from whence the different varieties have been obtained. An inspection of quarries is also desirable for the purpose of ascertaining their power of supply, the probable extent of any given bed, and many other matters of practical importance.

It frequently happens that the best stone in quarries is often neglected, or only in part worked, from the cost of bareing and removing those beds with which it may be associated; and, in consequence, the inferior material is in such cases supplied, especially when a great order is required to be fulfilled in a short space of time, and at an insufficient price, which is often the case with respect to works undertaken by contract.

As the supply of stone in particular localities would often appear to be due to accidental circumstances, such as the cost of quarrying, the degree of facility in transport, and the prejudice that generally exists in favour of a material which has been long in use; and as the means of transport have of late years been greatly increased, it becomes essential to ascertain whether better materials than those which have been employed in any given place may not be obtained from other although more distant localities, upon equally advantageous terms. The decomposition of stones employed for building purposes appears to be effected by chemical and mechanical causes, according to the conditions under which such stones were placed. With reference to sandstones, such as are usually employed for building purposes, and which are generally composed of either quartz or siliceous grains cemented by siliceous, argillaceous, calcareous, or other matter, their decomposition is effected according to the nature of the cemented substance, the grains being comparatively indestructible. With respect to limestones composed of carbonate of lime, or the carbonates of lime and magnesia, either nearly pure or mixed with variable proportions of foreign matter, their decomposition depends, other things being equal, upon the mode in which their component parts are aggregated, those which are most crystalline being found to be the most durable, while those which partake least of that character suffer most from exposure to atmospheric influences.

The varieties of limestones termed oolites, being composed of oviform bodies cemented by calcareous matter of a varied character, will, of necessity, suffer unequal decomposition, unless such oviform bodies and the cement be equally coherent. Those limestones which are usually termed "shelly," from being chiefly formed of either broken or perfect fossil shells cemented by calcareous matter, suffer decomposition in an unequal manner in consequence of the shells, which, being for the most part crystalline, offer the greatest amount of resistance to the decomposing effects of the atmosphere.

Sandstones, from the mode of their formation, are very frequently laminated, more especially when micaceous, the plates of mica being generally deposited in planes parallel to their beds. Hence, if such stone be placed in buildings at a right angle to its natural bed, it will decompose in flakes according to the thickness of the laminæ; whereas, if it be placed upon its natural bed, the amount of decomposition will be comparatively immaterial.

Limestones, from the general mode of their formation, are not liable to the kind of lamination observable in sandstones; nevertheless, varieties exist, especially those usually termed shelly, which have a coarse laminated structure, generally parallel to the planes of their beds, and therefore the same precaution in placing such stone in buildings upon its natural bed, is as necessary as with the sandstones above noticed.

The effects of the chemical and mechanical causes of the decomposition of stone in buildings, are greatly modified according as such buildings may be situated in town or country. The state of the atmosphere in populous smoky towns produces a greater amount of decomposition in buildings so situated, all other conditions being equal, than in those placed in an open country, where many of the aeriform products which arise from such towns, and are injurious to buildings, are not to be found.

The chemical action of the atmosphere produces a change in the entire matter of the limestones, and in the cementing substance of the sandstones, according to the amount of surface exposed to it. The mechanical action due to atmospheric causes, occasions either a removal or a disruption of the exposed particles; the former by means of powerful winds and driving rains, and the latter by the congelation of water forced into or absorbed by the external portions of the stone. These effects are reciprocal, chemical action rendering the stone liable to be more easily affected by mechanical action, which latter, by constantly presenting new surfaces, accelerates the disintegrating effects of the former.

Buildings in this climate are generally found to suffer the greatest amount of decomposition on their southern, south-western, and western fronts, arising, doubtless, from the prevalence of winds and rains from those quarters; hence it is desirable that stones of great durability should at least be employed in fronts with such aspects.

Buildings situated in the country appear to possess a great advantage over those in populous and smoky towns, owing to lichens, with which they almost invariably become covered in such situations, and which, when firmly established over their entire surface, seem to exercise a protective influence against the ordinary causes of the decomposition of the stone upon which they grow.

As an instance of the difference in degree of durability in the same material, subject to the effects of the atmosphere in town or country, we may notice the several frustra of columns and other blocks of stone which were quarried at the time of the erection of St. Paul's Cathedral in London, and are now lying in the Island of Portland, near the quarries from whence they were obtained. These blocks are invariably found to be covered with lichens, and although they have been exposed to all the vicissitudes of a marine atmosphere for more than 150 years, they still exhibit, beneath the lichens, their original form, even to the marks of the chisel employed upon them, whilst the stone which was taken from the same quarries (selected no doubt with equal if not greater care than the blocks alluded to), and placed in the Cathedral itself, is, in those parts which are exposed to the south and south-west winds, found in many instances to be fast mouldering away.

Colour is of more importance in the selection of a stone for a building to be situated in a populous and smoky town than for one to be placed in an open country, where all edifices usually become covered, as above stated, with lichens; for although in such towns those fronts which are not exposed to the prevailing winds and rains will soon become blackened, the remainder of the building will constantly exhibit a tint depending upon the natural colour of the material employed.

Before we proceed to adduce a few examples of the present condition of the various buildings that we have examined, we would wish to observe, that those which are highly decorated, such as the churches of the Norman and pointed styles of architecture, afford a more severe test of the durability of any given stone, all other circumstances being equal, than the more simple and less decorated buildings, such as the castles of the fourteenth and fifteenth centuries, inasmuch as the material employed in the former class of buildings is worked into more disadvantageous forms than in the latter, as regards exposure to the effects of the weather; and we would further observe, that buildings in a state of ruin, from being deprived of their ordinary protection of roofing, glazing of windows, &c., constitute an equally severe test of the durability of the stone employed in them.

As examples of the degree of durability of various building stones in particular localities, the following may be enumerated. Of the sandstone buildings which we examined we may notice the remains of Ecclestone Abbey, of the thirteenth century, near Barnard Castle, constructed of a stone closely resembling that of the Stenton Quarry, in the vicinity, as exhibiting the mouldings and other decorations, even to the dog's tooth ornament, in excellent condition. The circular keep of Barnard Castle, apparently also built of the same material, is in fine preservation. Tintern Abbey may also be noticed as a sandstone edifice that has to a considerable extent resisted decomposition; for, although it is decayed in some parts, it is nearly perfect in others. Some portions of Whitby Abbey are likewise in a perfect state, whilst others are fast yielding to the effects of the atmosphere. The older portions of Ripon Cathedral, constructed of sandstone, are in a fair state of preservation. Rivaulx Abbey is another good example of an ancient sandstone building in a fair condition. The Norman keep of Richmond Castle, in Yorkshire, affords an instance of a moderately hard sandstone, which has well resisted decomposition.

As examples of sandstone buildings of more recent date, in a good state of preservation, we may mention Hardwicke Hall, Haddon Hall, and all the buildings of Cragleith stone in Edinburgh and its vicinity. Of sandstone edifices in an advanced state of decomposition we may enumerate Durham Cathedral, the churches at Newcastle-upon-Tyne, Carlisle Cathedral, Kirstall Abbey, and Fountains Abbey. The sandstone churches of Derby are also extremely decomposed; and the church of St. Peter's at Shaftesbury is in such a state of decay, that some portions of the building are only prevented from falling by means of iron ties.

As an example of an edifice constructed of a calciferous variety of sandstone, we may notice Tisbury Church, which is in unequal condition, the mouldings and other enrichments being in a perfect state, whilst the ashler, apparently selected with less care, is fast mouldering away.

The choir of Southwell Church, of the twelfth century, may be mentioned as affording an instance of a magnesio-calciferous sandstone, resembling that of Mansfield, generally in good condition, after long exposure to the influences of the atmosphere.

Of buildings constructed of magnesian limestone we may mention the Norman portions of Southwell Church, built of stone similar to that of Bolsover, and which are throughout in a perfect state, the mouldings and carved enrichments being as sharp as when first executed. The Keep of Koningsburgh Castle, built of a magnesian limestone from the vicinity, is also in a perfect state, though the joints of the masonry are open in consequence of the decomposition and disappearance of the mortar formerly within them. The Church at Hemmingborough, of the fifteenth century, constructed of a material resembling the stone from Huddlestone, does not exhibit any appearance of decay. Tickhill Church, of the fifteenth century, built of a similar material, is in a fair state of preservation. Huddlestone Hall, of the sixteenth century, constructed of the stone of the immediate vicinity, is also in good condition. Roche Abbey, of the thirteenth century, in which stone from the immediate neighbourhood has been employed, exhibits generally a fair state of preservation, although some portions have yielded to the effects of the atmosphere.

As examples of magnesian limestone buildings in a more advanced state of decay, we may notice the churches at York, and a large portion of the Minster; Howden Church, Doncaster old Church, and others in that part of the country, many of which are so much decomposed that the mouldings, carvings, and other architectural decorations, are often entirely effaced.

We may here remark that, as far as our observations extend, in proportion as the stone employed in magnesian limestone buildings is crystalline, so does it appear to have resisted the decomposing effects of the atmosphere; a conclusion in accordance with the opinion of Professor Daniell, who has stated to us that from the results of experiments he is of opinion that "the nearer the magnesian limestones approach to equivalent proportions of carbonate of lime and carbonate of magnesia, the more crystalline and better they are in every respect."

Of buildings constructed of oolitic and other limestones we may notice the Church of Byland Abbey, of the twelfth century, especially the west front, built of stone from the immediate vicinity, as being in an almost perfect state of preservation. Sandysfoot Castle, near Weymouth, constructed of Portland oolite in the time of Henry the Eighth, is an example of that material in excellent condition; a few decomposed stones used in the interior, and which are exceptions to this fact, being from another oolite in the immediate vicinity of the castle. Bow and Arrow Castle, and the neighbouring ruins of a church of the fourteenth century, in the island of Portland, also afford instances of the Portland oolite in perfect condition. The new Church in the island, built in 1766 of a variety of the Portland stone termed roach, is in an excellent state throughout, even to the preservation of the marks of the chisel.

Many buildings constructed of a material similar to the oolite of Ancaster, such as Newark and Grantham Churches, and other edifices in various parts of Lincolnshire, have scarcely yielded to the effects of atmospheric influences. Windrush Church, built of an oolite from the neighbouring quarry, is in excellent condition; whilst the Abbey Church of Bath, constructed of the oolite in the vicinity of that city, has suffered much from decomposition; as is also the case with the Cathedral, St. Nicholas and St. Michael's Churches, in Gloucester, erected of a stone from the oolitic rocks of the neighbourhood.

The churches of Stamford, Ketton, Colley Weston, Kettering, and other places in that part of the country, attest the durability of the shelly oolite termed Barnack Rag, with the exception of those portions of some of them for which the stone has been ill selected. The excellent condition of those parts which remain of Glastonbury Abbey show the value of a shelly limestone similar to that of Doulting; whilst the stone employed in Wells Cathedral, apparently of the same kind, and not selected with equal care, is in parts decomposed. The Mansion, the Church, and the remains of the Abbey at Montacute, all the many other buildings in that vicinity, constructed of the limestone of Ham Hill, are in excellent condition. In Salisbury Cathedral, built of stone from Chilmark, we have evidence of the general durability of siliciferous limestone; for, although the west front has somewhat yielded to the effects of the atmosphere, the excellent condition of the building generally is most striking.

In the public buildings of Oxford we have a marked instance both of decomposition and durability in the materials employed; for whilst a shelly oolite similar to that of Taynton, which is employed in the more ancient parts of the Cathedral, in Merton College, Chapel, &c., and commonly for the plinths, string courses, and exposed portions of the other edifices in that city, is generally in a good state of preservation, a calcareous stone from Heddington, employed in nearly the whole of the colleges, churches, and other public buildings, is in such a deplorable state of decay, that in many instances all traces of architectural decoration have disappeared, and the ashler itself is in many places deeply disintegrated.

In Spofforth Castle we have a striking example of the unequal decomposition of two materials, a magnesian limestone and a sandstone; the former employed in the decorative parts, and the latter for the ashler or plain facing of the walls. Although the magnesian limestone has been equally exposed with the sandstone to the decomposing effects of the atmosphere, it has remained as perfect in form as when first employed, while the sandstone has suffered considerably from the effects of decomposition.

In Chepstow Castle may be observed a magnesian limestone in fine preservation, and a red sandstone in an advanced state of decomposition, both having been exposed to the same conditions as parts of the same archways; and in Bristol Cathedral we have a curious instance of the effects arising from the intermixture of very different materials, a yellow limestone and a red sandstone, which have been indiscriminately employed both for the plain and decorative parts of the building. Not only is the appearance in this case unsightly, but the architectural effect of the edifice is also much impaired by the unequal decomposition of the two materials, the limestone having suffered much less from decay than the sandstones.

Judging, therefore, from the evidence afforded by buildings of various dates, there are many varieties of sandstone and limestone employed for building purposes which successfully resist the destructive effects of atmospheric influences; among these, the sandstones of Stenton, Whitby, Tintern, Rivaulx, and Craigleith, the magnesio-calciferous sandstones of Mansfield, the calciferous sandstone of Tisbury, the crystalline magnesian limestones, or Dolomites, of Bolsover, Huddlestone, and Roche Abbey, the oolites of Byland, Portland, and Ancaster, the shelly oolites and limestone of Barnack and Ham Hill, and siliciferous limestone of Chilmark, appear to be amongst the most durable. To these, which may be all considered as desirable building materials, we are inclined to add, though they may not always have the evidence of ancient buildings in their favour, the sandstones of Darley Dale, Humbie, Longannet, and Crowbank, the magnesian limestones of Robin Hood's Well, and the oolite of Ketton.

If, however, we were called upon to select a class of stone for the more immediate object of our inquiry, we should give the preference to the limestones, on account of their more general uniformity of tint, their comparatively homogeneous structure, and the facility and economy of their conversion to building purposes; and of this class we should prefer those which are most crystalline.

In conclusion, having weighed to the best of our judgment the evidence in favour of the various building stones which have been brought under our consideration, and freely admitting that many sandstones as well as limestones possess very great advantages as building materials, we feel bound to state that for durability, as instanced in Southwell Church, &c., and the results of experiments, as detailed in the accompanying tables; for crystalline character, combined with a close approach to the equivalent proportions of carbonate of lime and carbonate of magnesia; for uniformity in structure; facility and economy in conversion; and for advantage of colour, the magnesian limestone, or dolomite, of Bolsover Moor and its neighbourhood, is in our opinion the most fit and proper material to be employed in the proposed new Houses of Parliament.

We have the honour to be, my Lord and Gentlemen,
Your very humble and obedient servants,
(Signed) Charles Barry.
H. T. De La Beche.
William Smith.
Charles H. Smith.

London, March 16, 1839.

We shall give the tables referred to in the report in our next Journal.—Editor.

ON THE OBSTRUCTION OF STREAMS BY DAMS.

(From the American Railroad Journal.)

An Essay on the Obstruction of Streams by Dams; with Formulæ for ascertaining the rise of water caused by their construction. By S. A. Roebling, *Civil Engineer.*

When a stream is to be obstructed by a dam, for the purpose of creating a water-power, making a slack-water navigation, or feeding a canal, it is a matter of importance to know how high the water will rise above its former level in time of freshets.

Owing to the want of proper investigation, notions contradictory to common sense, have been entertained by professional men on this subject, and the consequence has been, that their works have not realized their expectations. With a view of throwing some light upon this very important subject, the following illustrations and deductions, based upon the theory of *Du Buat* and *Eytelwein*, are offered to the public.

To compute formulæ for the rise of water by dams, it is necessary to know the amount of water discharged by a freshet, the average width of the stream, its average depth and area of cross section.

But the gauging of a large stream in high water is a difficult matter, and at the period when the construction of a dam is to be commenced, there is generally no time to wait for a freshet, for the purpose of making the desired measurements. I would therefore propose, for ascertaining the greatest discharge of water, to guage the river when at its medium height. For this purpose, let a cross section of the stream be taken, and the velocities of the surface measured at each sounding. It has been ascertained by experiments, that the velocity of water, in streams, *decreases* towards the bottom for every foot depth:

$$0.008\ v$$

where v signifies the velocity at the surface. If we now put the depth, for which the average velocity is to be ascertained, equal to h, and denote the required average velocity by v', then we have the velocity at the bottom equal to

$$v - 0.008\ v\ h$$

From the surface velocity and bottom velocity we find the average velocity:

$$v' = \frac{v + v - 0{\cdot}008\ v.\ h}{2} = v - 0{\cdot}004\ v.\ h$$

$$\text{or,}\quad v' = v\ (1 - 0{\cdot}004\ h)$$

When the average velocity, for each sounding, has been thus calculated, we can find the discharge per second, in cubic feet.

For ascertaining the discharge of a river, in time of a high freshet, let its width equal to l. By dividing l into the area of the cross section which has been measured, we get the average depth of the water, which may be represented by h. The area of the profile, divided into the discharge, gives us the average velocity of the whole section, which may be represented by v. The average velocity of a stream in different stages of the water, are, according to Buat and Eytelwein, as the square root of the different average depths.

Now, let us represent the average velocity of a cross section of a high flood by v' and the average depth of that section by h';

$$\text{Then is}\quad v : v' :: \sqrt{h} : \sqrt{h'} :$$

$$\text{therefore,}\quad v' = v\frac{\sqrt{h'}}{\sqrt{h}} = v\sqrt{\frac{h'}{h}}$$

The average velocity of a high freshet, thus found, multiplied into the area of its cross section, gives us the required discharge.

The above method should be applied, if the necessary measurements can be taken, when the stream is at or near its medium height. Without those data, however, an approximate result can be obtained by the formula:

$$v = 90.9\sqrt{\left(\frac{a}{p} \times \frac{h}{l}\right)}$$

where v is the average velocity in feet per second, a the area of the profile in superficial feet, h the fall of the river for a certain length l in feet; p signifies the perimeter of the profile, not including the line of surface.

The product of the area into the velocity, thus found, will give the required discharge. This formula, however, cannot be relied on when the stream is irregular; it applies with accuracy only to smooth and regular channels and to canals.

The velocities with which water is discharged through a horizontal opening in the side of a vessel, are according to the laws of gravity, in proportion to the square roots of the respective heights of the columns of water above the orifices. The pressure, which the particles of water support at a certain depth, is proportionate to the velocity with which they tend to escape. This velocity is hypothetically equal to that acquired by bodies falling through the same space. The velocity of a body, acquired at the end of the first second of its fall is $= 2 \times 16.1 = 32{\cdot}2$ feet, and if we denote the different velocities by v and V, and the respective heights by h and H, then according to the laws of gravity

$$\text{is} \quad v : V :: \sqrt{h} : \sqrt{H}$$

$$\text{and} \quad V = \sqrt{\frac{v^2\,H}{h}}$$

If we take $v = 32{\cdot}2$, and $h = 16{\cdot}1$, we have

$$\text{I.} \quad V = \sqrt{\frac{32{\cdot}2^2\,H}{16{\cdot}1}} = 8{\cdot}024\sqrt{H} \quad \text{and}$$

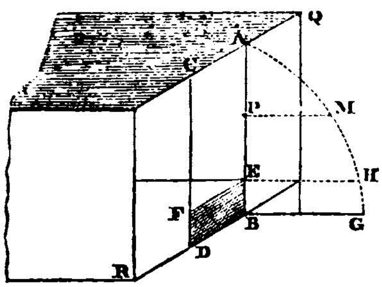
$$\text{II.} \quad H = \frac{v^2}{8{\cdot}024^2} = 0{\cdot}0155\,V^2$$

The quantity 8.024 is called the hypothetical co-efficient for falling bodies, and this co-efficient will be here generally denoted by the letter α. In applying the above rule to the motion of water, the case is somewhat different under different circumstances. Du Buat and Eytelwein have made a number of satisfactory experiments to fix co-efficients for the velocity of water in different circumstances.

According to these experiments, for instance, the value of the co-efficient for the discharge of water over a waste-weir, of common construction, is found to be - - - - - - - - = 5.7

For largè and well constructed dams, where all circumstances are favourable to the discharge, - - = 7.5

Before we can proceed to demonstrate the discharge of water over dams, we have to examine the laws under which water generally will be discharged, when under a certain head.



The annexed diagram represents a vessel, Q R, filled with water up to A. Suppose that sufficient water is flowing in to keep the surface at the same level, and that there are several small openings, P, E, B, above each other in the vertical line A B, in one side of the vessel.

The jets of water streaming through the opening P, E, B, are represented by the horizontal dotted lines, P M, E H, B G.

Let us put A P $= x$; the velocity with which the water rushes through the opening P, be $= y$; and the co-efficient of this velocity be $= \alpha$.

So is, by formula I.

$$y = \alpha\sqrt{x}.$$

The same is applicable to every other opening B, with a head of pressure = A B; and if we denote A B by h, and the corresponding velocity by v, we have

$$v = \alpha\sqrt{h}$$

$$\begin{array}{ll} \text{Now let} & PM = \alpha\sqrt{x} = y \\ \text{and} & BG = \alpha\sqrt{h} = v \\ \text{Then is} & AP : AB :: x : h \\ \text{and} & PM : BG :: \sqrt{x} : \sqrt{h} \\ \text{or} & PM^2 : BG^2 :: x : h \\ \text{Therefore} & AP : AB :: PM^2 : BG^2 \end{array}$$

The same is true for every other absciss and ordinate, as A P, and P M, and from this it follows, that the curved line A M H G, which is formed by the extreme points M, G, &c. of the dotted lines, representing the velocities of the water-jets, forms a *parabola*. If we now imagine the vertical line A B consists of a great number of such small openings, than the amount of water, or the sum of all the water-jets, may be represented by the area of the parabola. The superficial content of the parabola A B G is

$$= \tfrac{2}{3}\,AB.\,BG = \tfrac{2}{3}\,v\,h$$

If we denote the width of the perpendicular narrow opening or slit A B, by l', the amount of water discharged through this slit will be

$$= \tfrac{2}{3}\,l'.\,v.\,h$$

Now, suppose the great rectangular opening, A B C D, consists of a large number of such vertical openings, and let be

$$AC = BD = l$$

and the discharge through that rectangle = Q, then we have

$$Q = \tfrac{2}{3}\,l\,v\,h$$

and by substituting for v, its value $= \alpha\sqrt{h}$, we have the discharge per second, or

$$\text{III.} \quad Q = \tfrac{2}{3}\,\alpha\,l\,h\sqrt{h}$$

$$\text{and} \quad h\sqrt{h} = \frac{Q}{\tfrac{2}{3}\alpha\,l} \text{ or } h^3 = \left(\frac{Q}{\tfrac{2}{3}\alpha\,l}\right)^2 \quad \text{or}$$

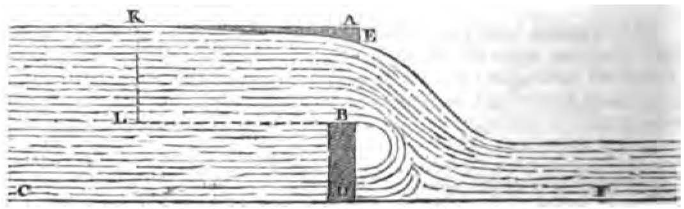
$$\text{IV} \quad h = \left(\frac{3\,Q}{2\,\alpha\,l}\right)^{\frac{2}{3}}$$

In investigating the state of water, when obstructed by dams, three different cases present themselves.

1.

When a dam serves only on a waste-weir, and the pool above it forms an extensive sheet of water, the surface of which is kept at the same level, without any perceptible current.

In the annexed diagram, B D represents the dam or weir; the line K A, the level of the upper pool; and C F, the bed of the river or reservoir, corresponding to the average depth of the water.



The body of water, discharging over a dam, will sink considerably below the level of the surface of the pool, before it reaches the breast of the dam, forming a curve tangential to the surface of the pool.

The formulæ III and IV apply to this case exactly. The height h, or the head of the fall, is in the diagram represented by the lines K L = A B, the elevation of the surface above the top of the dam.

If we, therefore, know the quantity of discharge per second, we find by the formula IV the height corresponding to it; and if the height is known, we find the discharge by formula III.

The height of the water above the edge of the dam, or B E, and the contraction of it below, is here not taken in consideration, as it is of no practical use.

2.

When, as in the first case, the comb, or top of the dam is above the surface of the lower pool, and the water in the upper pool arrives at the head of the fall with a certain velocity.

With reference to the above diagram, let us term the point K in the surface of the upper pool, where the water is horizontal, or nearly so, or has yet about the same inclination as the pool farther up, the *head of the fall*.

The elevation of this point B above the top of the dam, or A B, may be denoted by the letter - - - - - h
The height of the dam, or B D, by - - - - - - K
The average width of the pool, by - - - - - - B
The length of the dam, by - - - - - - - l
The quantity of discharge over the dam per second, in cubic feet, by - - - - - - - - - - - Q

The line C F represents the bed of the river, (corresponding to the average depth) as well as the base of the dam, and all the heights are calculated from it.

If we now suppose the upper pool forms a still water without any current, then we have the former case, and if we represent the fall, or A B, by the letter h', we find according to formula IV

$$h' = \left\{\frac{3\,Q}{2\,\alpha\,l}\right\}^{\frac{2}{3}}$$

But in the present case the water arrives at the head of the pool, with a certain velocity due to the current in the river above the pool, and this velocity comes to the aid of the velocity of discharge, caused by the height of the fall.

The velocity of the discharge is therefore equal to the velocity, due to the height of the fall, plus the velocity, due to the current of the pool. But the quantity of discharge remaining the same, and the velocity being increased, the height of a discharging body of water will be reduced in a proportion corresponding to the increased velocity. The water in the pool, is in consequence of the current in motion through its whole depth, though the velocity near the bottom is but very small.

We find the area of the cross section equal to

$$(h+K)\ B$$

and if v represents the average velocity of the current in the pool, we have

$$v=\frac{Q}{(h+k)\ B}$$

Now, let us represent the height which corresponds to this velocity by the letter H, then we have, according to formula I,

$$H = 0.0155\ v^2$$

and by substituting for v its value, we get

$$H = 0.0155\ \left\{\frac{Q}{(h+k)\ B}\right\}^2$$

For finding the true height of the surface of the pool above the top of the dam, or the height A B $= h$, we have therefore to deduct the value of H from the value of h', and we arrive at the formula

$$\text{V}' \quad A\ B = h' = \left\{\frac{3\ Q}{2\ \alpha\ l}\right\}^{\frac{2}{3}} - 0.0155\left\{\frac{Q}{(h+k)\ B}\right\}^2$$

And if we put the co-efficient $\alpha = 7.5$ and $B = l$, we have

$$\text{V} \qquad h = \left\{\frac{3\ Q}{15\ l}\right\}^{\frac{2}{3}} - 0.0155\left\{\frac{Q}{(h+k)\ l}\right\}^2$$

This formula contains in the substractive member the value of h itself. As this term of the equation, however, is comparatively small, it will be sufficiently correct in practice, to find the value of h by approximation, without making the formula more intricate by further reduction.

Example I.

Suppose a dam of 500 feet long and 11 feet high, has been constructed across a river of the same width, the average depth of which in time of a high freshet is ten feet, and its discharge at the same time 25,000 cubic feet, per second. How much will the water rise above the top of the dam, if all circumstances are favourable to the discharge, and the co-efficient α is put $= 7.5$?

The above formula for h, is here

$$h = \left\{\frac{3\times 25000}{15\times 500}\right\}^{\frac{2}{3}} - 0.0155\left\{\frac{25000}{(h+11)\times 500}\right\}$$

Now, let us assume $h = 4.5$

$$\text{then is } h = \sqrt[3]{100} - 0.0155\left\{\frac{25000}{15.5\times 500}\right\}^2$$

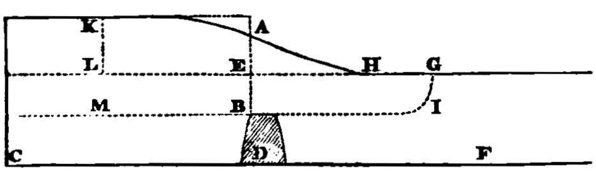
$$\text{or,} \qquad h = 4.641 - 0.161$$

$$\text{therefore,} \qquad h = 4.48 \text{ feet.}$$

This result is near enough to the assumed value, and therefore sufficiently correct.

3.

When the top of the dam is lower than the surface of the lower pool, and the water in the upper pool arrives at the head of the fall with a certain velocity.



The annexed diagram may represent the case in question, and we will represent the depth of the river below the dam, or E D, by the letter - - - - - - - - h

The height of the fall from the upper level to the lower level, or A E, by - - - - - - - - - - H

The height of the dam, or B D, by - - - - - - K

The length of the dam, or width of the river, by - - l

The quantity of water discharged per second, by - - Q

The line C F may represent the bed of the river corresponding to the average height h of the water.

To simplify the demonstration of this case, let us suppose the water in the upper pool form a perfect level without current, and not consider the effect which the whirl below the dam, caused by the fall of the water, has upon the discharge.

The quantity of water discharged through the height A E, will then be found by formula III.

$$= \tfrac{2}{3}\ \alpha\ l H \sqrt{H}$$

The body of this water above the level L E presses upon the body of water below, included between the dotted lines L E and M B, which, therefore, will be forced to pass off through the height E B.

Let us now imagine a pipe E H G I B, of the width of the river, and the height E B resting on top of the dam, with one vertical opening E B at the dam, and another horizontal opening H G at the surface of the lower level, below the fall. The body of water included between the lines L E and M B, would then pass through this pipe, and be discharged at the surface of the lower level with a velocity corresponding to the pressure of the water above, or due to the height A E. The velocity of the water flowing through the height E B is therefore found, according to formula I

$$= \alpha \sqrt{H}$$

and the discharge

$$= E B.\ l.\ \alpha \sqrt{H} = \alpha\ l\ (h-k) \sqrt{H}$$

The discharge through the height A B is equal to the sum of discharges through A E and E B, and therefore

$$Q = \tfrac{2}{3}\ \alpha\ l H \sqrt{H} + \alpha\ l\ (h-k) \sqrt{H} \qquad \text{or}$$

$$\text{VI} \qquad Q = \alpha\ l\ (\tfrac{2}{3}\ H + h - k) \sqrt{H}$$

and from this we find

$$\text{VII} \qquad H = \frac{Q}{\alpha^2\ l^2\ (\tfrac{2}{3}\ H + h - K)^2}$$

The value of H must be found here by approximation, as in formula V.

With respect to the velocity of the current in the upper pool, Mr. Eytelwein offers a formula for the value of H, the application of which is very difficult on account of its perplexity. The following demonstration, however, will bring us near enough to truth, and furnish a formula which will be found sufficient to all practical purposes.

When H has been found by formula VII, we have then an approximate value for the average depth of the upper pool, or

$$A\ D = H + h$$

The area of the profile of the upper pool is therefore

$$= l\ (H + h)$$

From this we find the average velocity of the current in the pool

$$= \frac{Q}{l\ (H + h)}$$

which velocity is owing to the current of the river above, independent of the fall of the water over the dam.

According to formula II, we find the height, corresponding to this velocity

$$= 0.0155 \left\{\frac{Q}{l\ (H + h)}\right\}$$

which ought to be deducted from the value H in formula VII, as we have done in case No. 2, in order to arrive at the true height of the fall.

We therefore arrive at the formula.

$$\text{VIII} \qquad H = A\ E = \frac{Q^2}{\alpha^2 l^2\ (\tfrac{2}{3}\ H + h - K)^2} - 0.0155 \left\{\frac{Q}{l\ (H+h)}\right\}^2$$

The objection can be made against this formula, that the current of the upper pool may be reduced by the resistance of the water below, and that then the value of H is found too small.

To examine this question, we must distinguish several cases. The first case is, when a dam forms a breast-dam, with no lower slope. The falling water will here produce a whirl, the effect of which will not extend far below the dam, and will have little influence on the current of the tail-water. The second case, when the dam has a long slope forming an inclined plane, or better, an inverted parabola, on which the water glides down. The lower body of water, after having moved down the slope, shoots off in a more horizontal direction, not affecting the bed of the river immediately below the dam, but pushing ahead the tail-water, the current of which consequently will be increased. Without reference to the form of dams, other considerations present themselves with respect to the depth of the water. When the river is not deep, and the lower level but little above the top of the dam, the escape of the tail-water will be increased by the mechanical momentum, produced by the *height of the fall* of the water, rolling down the slope, and the resistance offered to the current of the upper level, will be therefore decreased. On the other hand, when the dam is very low and the water very high, the momentum of the falling water will be increased proportionably by the *general increase of the velocity* of the river, and will therefore also increase the velocity of the tail-water below the fall, so as not to resist the current above.

It appears, therefore, that we may apply the above formula, without any deduction, in all cases *favourable* to the escape of the tail-water. When the construction of the dam, and the features of the river, however, are *unfavourable* to the discharge of the tail-water, then we must reduce the value of the substractive member of the formula.

The value of the co-efficient α should be fixed with reference to the construction of the dam, and to the nature of the pool above the dam.

When a dam serves as a waste-weir, and the pool above the dam, forms proportionally an extensive sheet of water with no current, then the value of α is found, according to Du Buat and Eytelwein, to be - - - - - - - - - - $= 5.70$

For a dam in a small stream, with no wing-walls and embankments confining the current, we may put α - $= 7.00$

For a dam in a large river, with wing-walls and high embankments, leading the current fairly to the fall, we may put α - - - - - - - - - - - $= 7.50$

EXAMPLE 2.

A river is 500 feet wide, its average depth in time of a freshet is ten feet, and its discharge at the same time 25000 cubic feet per second. A dam of 500 feet long, and 7 feet high, has been constructed across the river. How much will the water be raised above its former level, or how much is the height of the fall from the upper level to the lower level?

The co-efficient α be here $= 7.5$.

By applying the formula VIII, and substituting the above data, we have

$$H = \frac{25000^2}{7.5^2 \times 500^2 (\frac{2}{3} H + 10 - 7)^2} - 0.0155 \left\{ \frac{25000}{(H + 10) \times 500} \right\}^2$$

Let us assume $H = 2.00$; then we get

$$H = \frac{44.44}{(\frac{2}{3} \times 2 + 3)^2} - 0.0155 \left\{ \frac{25000}{12 \times 500} \right\}^2$$

or $$H = \frac{18.775}{44.44} - 0.0155 \times 17.361$$

or $$H = 2.367 - 0.269 = 2.098 \text{ feet.}$$

which result is near enough to the assumed value of H, and therefore sufficiently correct.

EXAMPLE 3

A dam of 800 feet long, and 6 feet high, is to be constructed across a river of about the same width, and which in time of a high freshet discharges 60,000 cubic feet per second, and has an average depth of 16 feet. What will be the height of the fall, or the value of H, if we put $\alpha = 7.5$?

Let us assume the value of $H = 0.8$, then we have

$$\alpha = \frac{6000^2}{7.5^2 \times 800^2 (\frac{2}{3} \times 0.8 + 16 - 6)^2} - 0.0155 \left\{ \frac{60000}{16.8 \times 800} \right\}^2$$

or $$H = \frac{100}{(0.533 + 10)^2} - 0.0155 \left\{ \frac{60000}{13400} \right\}^2$$

or $$= \frac{100}{110.944} - 0.0155 \times 19.927$$

or $$H = 0.901 - 0.3088 = 0.593 \text{ feet.}$$

This result does not agree with the value assumed for H, and is too small. From the nature of the formula it follows, that we must assume a smaller quantity for H. Let us therefore put H = 0.6, and we have

$$H = \frac{60000^2}{7.5^2 \times 800^2 (\frac{2}{3} \times 0.6 + 10)^2} - 0.0155 \left\{ \frac{60000}{6 \quad 800} \right\}^2$$

or $$H = \frac{100}{(\frac{2}{3} \times 0.6 + 10)^2} - 0.0155 \left\{ \frac{60000}{13280} \right\}^2$$

or $$H = \frac{100}{108.16} - 0.0155 \times 4.158^2$$

or $$H = 0.924 - 0.316 = 0.608 \text{ feet.}$$

This result agrees well with the assumed value of H, and is therefore sufficiently correct.

ON GEOLOGY, APPLIED TO ARCHITECTURE.

Being part of a Course of Six Lectures, by G. F. RICHARDSON, Esq., of the British Museum. *Delivered at the Royal Institute of British Architects. Lecture the Fifth.*

IN my last discourse I alluded to the fact that as stones are selected for proximity rather than for value, because they are nearest rather than because they are the best, it followed that those countries would naturally exhibit the best specimens of architecture whose geological formations were best adapted for this object, whose limestones were finest and most abundant, whose marbles were purest and most frequently to be found. I reminded you that the lovely land of Greece was most favoured in this particular, and that her mountains of limestone and of marble offered the most picturesque sites for the dis[illegible] of the builder's art, while they contained within their caves [illegible] quarries materials of the most valuable and most enduring quality, while the dryness and serenity of the climate of those regions allowed such materials to be placed in situations which our less genial atmosphere forbids us to expose in the same manner. Yet the geological features of our island are so striking and important, that the geologists of the continent are always anxious to investigate our strata, and their singular organic remains, our Wealden and lias with their colossal dragon forms, our coal and our primary rocks in the north of England and in Wales; while I have the authority of our friend Mr. Donaldson for the fact that foreign architects who visit this country are alike impressed with the variety and value of the stones which our strata present. The fact is, that our island contains in a limited space, an epitome of, with one or two comparatively unimportant exceptions (the Muschel Kalk is one, the Calcaire Grossiere a second, and the Miocene deposits of the Tertiary series a third), with these relatively insignificant deficiencies our island contains a miniature resemblance of the whole earth. Professor Whewell, the late president of the Geological Society, in his farewell address on quitting the chair, employed in allusion to this fact, and more particularly with reference to the labours and discoveries of my distinguished friend Mr. Murchison, an image which is so rare, so ingenious, and so natural, that I can discover no illustration more fitted to convey a correct idea of this interesting fact. Alluding to the number and variety of the rocks contained in the limited area of our own island, and refering in particular to those which had been investigated by the labours of Mr. Murchison, he observed that nature in this respect seems to have condescended to imitate our own process, and as in the construction of our geological maps we place in the corner minute delineations to serve as types of the strata, so she had placed in our island, our corner of the globe, types of strata whose representatives were to be found elsewhere, diffused only over vast areas, in short, over the map of our planet. Our island exhibits in fact, with the few exceptions I have named, a complete ascending or descending scale of the chronology of the earth, and the geological map before you, extending in a direction from south-west to north-east exhibits the regular succession of the strata, either commencing with the primary and oldest formations in the north and west of our island, and proceeding down to the tertiary or most modern in the south, or on the contrary, ascending from the modern tertiary in the south, to the older or primary in the north and west. The three grand divisions under which the strata of our island may be classed are, first, the primary and mountainous or mining districts, whose inhabitants of course are miners and mountaineers; secondly, the midland regions exhibiting a succession of fertile hills and valleys overspread with towns and cities, and crowded with a dense population, whose industry is supplied by the coal with which the strata of these districts are abundantly interspersed. The third class is formed by the chalk and oolitic limestones which extend from the western to the northern coasts of our island. To pursue these routes along the map, the traveller who would wish to investigate the first of those geological series which we have described, would be required to start from the extremity of England, the Land's End, to traverse the whole of Cornwall and the north of Devon, and thence passing through Cumberland by the Isle of Man, to the south-western shores of Scotland, should proceed either through the hilly districts of the border counties, or along the Grampians to the German Ocean. Such a traveller would meet in all his journey little else than mountains and mines, and would consider the country he had traversed barren, and cold, and thinly peopled, its scanty population being composed of miners and mountaineers. To take the second route a traveller would start nearer, from the coast of Devon, and crossing the Midland Counties from the mouth of the Exe to that of the Tyne, would find a succession of fertile and highly cultivated scenes, interspersed with numerous towns and cities, and in many parts crowded with a manufacturing population, who derive the chief supply and incentive to their industry from the vast mines of coal with which these districts are abundantly supplied, they being located in the new red sandstone. The largest, most considerable, and most influential towns in England are placed in this peculiar stratum the new red sandstone, as the following list will evince: Exeter, Bristol, Worcester, Warwick, Birmingham, Lichfield, Coventry, Leicester, Nottingham, Derby, Stafford, Shrewsbury, Chester, Liverpool, Warrington, Manchester, Preston, York and Carlisle.

The third route would extend nearer from the coast of Dorset to that of Yorkshire, from Weymouth to Scarbro', and the traveller through such a district would pass only over elevated plains of oolite limestone and chalk, without a single mountain, or mine, or coalpit, or a manufactory of any importance, and would meet with a population almost exclusively agricultural. These different appearances being deducible from stratification.

The first of our travellers will have seen only these north-western portions of our country which are composed of rocks belonging to the prima y and transition series; the second will have traversed those fossil portions of the new red sandstone formation, which are made up of the detritus of more ancient rocks, and have beneath and near them, inestimable treasures of mineral coal, while the third will have confined his route to wolds of limestone and downs of chalk, which are best adapted for sheep walks and the growth of corn.

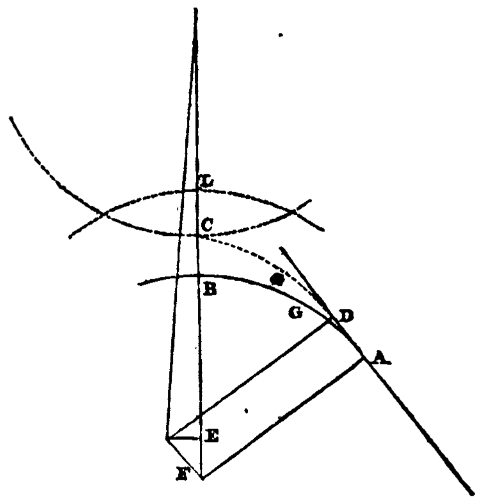
We will now, with your permission, take the various counties beginning with the southern coasts, and proceeding in a northerly direction, will describe the chief formations which present themselves. Beginning with the Land's End, we have in the county of Cornwall the primary formations, the granite and the sienite, with schistose rocks, and similarly ancient formations; in the adjoining county of Devonshire we find rocks of the greywacke and transition series; and passing into Wales, and thence to the border counties of Scotland, will meet with rocks of similarly ancient origin; in Dorsetshire we have the lias and the oclite, in Hampshire and the Isle of Wight we have the tertiary formations, which also extend into Sussex; at Brighton we meet the chalk which extends to Beachy Head, beyond which the Wealden strata terminates at the coast; the chalk again appearing on the coast of Kent. At the Isle of Sheppey we meet with the tertiary beds, which form a part of the London basin. In the county of Sussex we have the remarkable and peculiar Wealden deposits, which have been ascertained by my distinguished friend Dr. Mantell, to be the bed of an ancient and mighty river, which overflowed through the vallies of Kent and Sussex, constituting the drainage of an extensive tract of country.

The road from Bath to Oxford, and thence by Stamford to Lincoln, affords an instance of similarity in the character and cultivation of the soil and the occupations of the people, which attends the line in which the oolite traverses England from Weymouth to Scarborough. The road from Dorchester, through Salisbury to Basingstoke, or from Dunstable to Royston, Cambridge and Newmarket, and thence into Norfolk, affords a like uniformity which characterise the line of chalk from near Bridport in Dorsetshire, to Flamborough Head on the coast of Yorkshire. In the same line of direction or line of bearing of the strata across England, a journey might be made from Lyme Regis to Whitby, almost entirely upon the lias formation; and from Weymouth to the Humber without once leaving the Oxford clay of the oolite formation. Indeed almost any route taking a north-east and south-west direction across England, will for the most part pass continuously along the same formation, while a line from north-east to south-west at right angles to the former line, will nowhere continue on the same stratum beyond a few miles. Such a line which displays the greatest variety in the strata, will give the best information of the order of superposition, and various condition of the very numerous strata that traverse our islandin a succession of narrow belts, the main direction of which is nearly north-east and south-west. This line has afforded to Mr. Coneybeare the instructive section from Newhaven and Brighton to Whitehaven, published in his Geology of England and Wales, along which nearly seventy changes of strata take place.

We have described the south-eastern portion of our island. The tract extending from London to the sea in a south and south-easterly direction, is occupied by the various deposits of the tertiary, the chalk, and the Wealden. Of these the tertiary beds, deposits analogous in date and character to those of London occur in the craig formation, so called of Norfolk and Suffolk; the chalk appears again in Wiltshire, Oxfordshire, Bedfordshire, Cambridgeshire, Norfolk and Yorkshire; the Wealden formation is confined to Kent and Sussex, with some few indications in Wiltshire, and with regard to the last of the secondary strata, they are disposed in the manner I have described in narrow belts, traversing the island from south-west to north-east, but developed of course in a manner so varied as to render them extremely irregular in their relative situation and character, one particular formation being contracted in its course through one county, expanded in another, lost in a third, and reappearing in a fourth. The best general idea, I repeat, which we can best convey to a popular audience, being that the older rocks are developed on the west, and in proportion as we proceed north till we reach the great coal fields of Northumberland and Durham, and the transition beds of Cumberland, and the primary rocks of the borders and of Scotland, and the whole of the strata of our island, as I have before described, forming a descending scale, which commencing with the tertiary series, the upper or latest deposits in the south proceeds onward to the deeper rocks in the northern districts of our island, and comprising, as before stated, a variety of geological deposits to be found elsewhere, only diffused over areas of far wider extent. This variety of deposits of course while it provides generally the requisite supplies for the chief wants and necessities of mankind, yields abundant supplies for the purposes of the architect, and when to the materials already known and employed, shall be added those which have been discovered and brought into notice by the labours of the commission to which I have before had occasion to allude, you will perceive gentlemen, that the geological deposits of our native land, are such as will supply ample materials for the exercise of your taste and skill. That in this as in every other respect your beautiful and highly valuable art may be cultivated to the honour of our native land, and the embellishment of its splendid capital, is the sincere wish of the humble individual who now presumes to address you.

A brief but luminous and interesting description of the chalk formation which the lecturer described as the bed of an ancient sea abounding in the usual marine exuviæ, weeds, corals, shells, and fish, formed the conclusion of the discourse of this evening.

RAILWAY CURVES.



Sir—I would have trespassed on your columns before this, to answer the remarks in your April number signed J. Ely, but that, having been on leave of absence for some time, it, as well as your May number, lay most innocently by, neither cut nor read, until my return on the twenty-first of the latter month, when it was too late to send anything even for your June number.

Mr. Ely asserts the incorrectness of a statement of mine, and founds his assertion on the supposition that the object of "A Sub." was, "to begin curving *sooner*, and make the radii of portions of his curve greater." On referring, however, to "A Sub." 's letter, I can see nothing about *beginning sooner*, and surely there can be no reason why a constant curvature might not be commenced *just as soon* as "A Sub." 's or Mr. Ely's plan of a gradually increasing curvature; and if the two kinds were to commence together, (which is the real case to be considered,) my observation "that if the curvature is not equable, some part of it must be sharper than if the same radius were used all through," is perfectly correct. A figure would make it quite clear, but I don't like to encumber you with one.

Mr. E. also dissents from another assertion of mine, viz. "that when an engine is entering upon a curve, it will not be affected by the nature of the path it was *previously* describing;" and brings forward a fact to disprove it; still, however, I must maintain my assertion, but I only supposed the case of an engine travelling *alone*. I don't nor never did mean to say, that the action of *a train* upon the engine dragging it, does not depend upon the relative positions of the paths they are both describing; it certainly does; and in the case he mentions, it will easily be seen, that the drag of the train upon the engine, *it* being on the commencement of a curve, is *more oblique* when the former is on a straight line, than when it is on a curve of opposite curvature (forming an S). In fact, in an S curve, the commencing rail of the one is in direction with the concluding rail of the other. This obliquity of strain at once accounts for the difference of wear and tear he mentions, it being only at the *commencement* of a curve.

In the latter part of his communication, in endeavouring to carry out the similarity which "A Sub." took for granted that there existed between an engine upon a railway and a projectile, Mr. Ely seems to have mistaken *friction* for *gravity*, for he states that "gravity acts upon a locomotive with the same effect as upon a projectile, viz. to bring it to a state of rest. Now gravity, on the contrary, tends to keep every body in a state of motion, until that motion is put a stop to, either suddenly, by the inertia of some greater body it meets, or gradually, by the retarding force of friction; which latter force is what really tends to bring all bodies to a state of rest.

As to his *primâ facie* case, that "the vertical pressure upon the rails increases as the squares of the velocities decrease," or in other words, that the vertical pressure (*or weight*) varies inversely as the square of the velocity. I shall not at present enter upon it, further than asking him for *a proof*, as it would indeed be a discovery; for we know that the friction of a train varies as the weight or *vertical pressure*. If, therefore, the vertical pressure can be diminished by increasing the velocity, the *friction* can also!

As I don't think "An Assistant Engineer" 's query has been yet answered, I take the liberty of advising him not to connect the two curves by another of a less radius, but to commence one of them a little farther up on the tangent, (from which I take it for granted it springs,) as in the figure I subjoin. And to enable him to do so, I think he will find the following approximation to the distance he should go upon the tangent, a useful one.

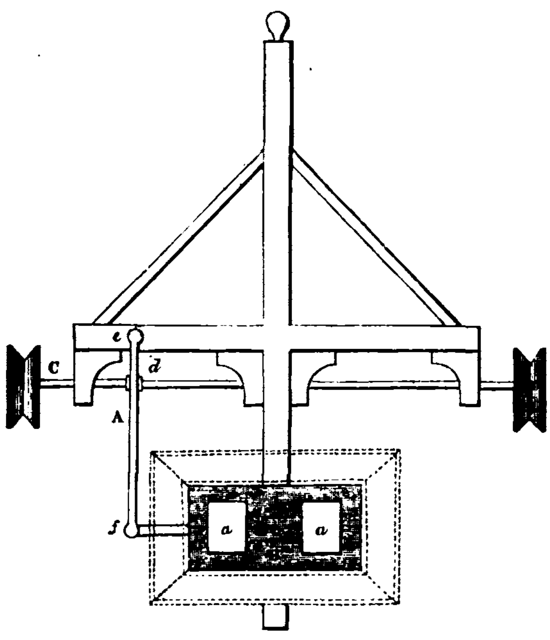
Let $AD=d$ be the distance which it is necessary to go upon the tangent, $CB=c$ the least distance between the curves, (which I suppose to be already described upon the ground,) then $c =$ (nearly) to $EF : d :: \sin. \angle AFB : \text{rad.}$ and $\therefore d = \frac{r}{\sin. \angle AFB}$. This of course is but an approximation, but it will be found sufficiently correct for all practical purposes, where the distance to be gone on the tangent, or that between the curves, is not very great. The $\angle AFB$ may be got from its tangent, which is known, as I suppose the curve AGB to be laid out by offsets perpendicular to it. The same formula will answer when the curves cut, only then, c should be taken equal to the distance CL; and of course the distance gone upon the tangent should be taken in an opposite direction. It will also apply when it is desired merely to pass through a given point e.

I am, Sir,
Your most obedient servant,
June 18, 1839. R. W. T.

[This communication not being received until the 8th August, is the reason that it did not appear earlier.]—EDITOR.

IMPROVED RUNNING GAUGE,

FOR ASCERTAINING IF THE WIDTH BETWEEN THE RAILS OF A RAILWAY BE IN GUAGE.



SIR—Observing the notice in your Journal for this month that Messrs. Bramah and Fox are manufacturing the railway gauges invented by Mr. Cowper, I take the liberty of suggesting, through the same medium, what I consider will be an improvement, viz. instead of having a man to watch the index, and throw oyster-shells, &c. upon the road where it is out of gauge, I would make the machine self-acting in this respect by the addition of a lever (A in the annexed sketch) having its fulcrum at e; the sliding axle C should run through the lever at d, and have collars fitting exactly to the sides of the lever, so that while the axle could turn freely on its axis, the least motion in the direction of the axis should be communicated to the lever. To the end f of the lever should be attached a moveable slide B, having two slits a a in it, and moving close under the bottom of a box or hopper indicated by the dotted lines; this box should be filled with Calais sand or powdered chalk, and have an opening in the bottom exactly corresponding with the solid part (b) of the slide B. When the machine is running upon rails of true gauge, the solid part (b) of the slide will be under the opening in the bottom of the box, and prevent the escape of the material within; but on coming to a different width of rails, one or other of the openings in the slide will be brought under the opening in the bottom of the box, and allow a greater or less quantity of the material in the box to escape, as the width of the rails is greater or less than the true gauge.

I am, Sir,
Your obedient servant,
Barnsley, *2nd Aug.* 1839. W. J. HINDLE, *Civil Engineer.*

ON PEAT FUEL.

SIR—Having long known that peat is underrated as a fuel for steam boilers by Tredgold and others, and believing that in various parts of the country, especially in Scotland and Ireland, there is immense store of excellent fuel, which by simple and inexpensive machinery might be so improved as to be of great use not only to those living near it but likewise to distant parts. It was with much interest that I read the article in your last number, on Lord Willoughby De Eresby's patent pressing machinery, as constructed by Mr. James White, but however ingenious and effective this plan may be, I fear the first cost and the difficulty of getting repairs done, in the out of the way situation in which the machinery must necessarily be worked, will prevent it from coming into any thing like general use. Another consideration, which I regret to see, is the observation, that the black peat free from fibre is the only kind of any service. Thinking these views have a strong tendency to limit the use of peat, which I believe is directly contrary to his Lordship's wishes, I beg to trouble you with a few observations which are the result of a little experience, and regret that circumstances at the time put an end to the operation I was engaged in rather prematurely, and at a time when perseverance only was requisite to produce results useful to the individuals and to the country. Four years ago three gentlemen erected, about 14 miles from Edinburgh, a steam engine of 4 horse power, with edge rollers and hydraulic presses, with the intention of manufacturing an improved fuel from peat, this they did to small extent, but gave up before it was well tried, for reasons that had nothing to do with the business either as to the improvement of the peat as a fuel, or to loss or gain as a commercial transaction; soon after this was abandoned, the late Michael Linning, Esq., of Edinburgh, one of the parties, erected near Glasgow, alongside of the Gainkirk railway, a manufactory with horse power, which was likewise prematurely stopped by his sudden death, but not before he had shown in some respects the value of his labours, whether this is now carried on or not I do not know, but it was at these works that any knowledge I have was obtained. Like Lord Willoughby, we found that the finer parts of the peat made its escape with the water through the linen cloths with which the boxes were lined, and that the pressing was tedious and slow, and thinking that I saw enough to prove that pressing is both troublesome and needless; I will state as shortly and clearly as I can, how I should proceed to improve peat, and render it so compact that it would bear a considerable carriage, and for certain purposes, such as locomotive machinery, be very valuable.

As is well known, all common peat when merely weather dried is of a spongy texture, and occupies much room; this I have seen is entirely owing to the fibres—break them down, as is easy to do, either with edge stones or in a clay mill, and then the peat *shrinks upon itself* like clay, instead of shrinking within and consequently hollow. I have seen a piece of peat, merely molded with the hand till it was well mixed, after a few days drying, so compact and hard that when struck against coal it broke it, and the piece of peat would bear cutting, and take a polish as fine as Cannel coal. All, therefore, which I think requisite to make peat an excellent, and for many purposes a better fuel than coal, is to pass it under edge stones or a clay mill, when well broken down, lay it to drain for a short time on a rough boarded or stone floor, with a small slope, and after it has drained, mould it and dry it under low sheds like bricks or tiles, this would be only children or women's work.

As to its use as a fuel to raise steam, prepared peat might be burnt in the same fire-place as coal, but common peat will answer well on the spot for that purpose, only a larger fire-place would be required, with the bars rather closer and less draft. I have carefully weighed peat, and found a steam engine, with an 8 inch cylinder, 16 inches stroke, and making 70 strokes per minute, the steam at 30 lbs. pressure, kept in full work for an hour and a half with one cwt. of peat, the evaporation of water during that period was from 50 to 60 gallons, and this with what was called bad peat and otherwise unsaleable.

Mr. Liming made two or three experiments with the locomotive engine on the Gainkirk railway, which carried very heavy loads of coal. I have seen certificates of the engineer and others, that the steam was well kept up, but that, as might be suspected, more peat was burnt than coal; this most likely was partly owing to the steam draft being too strong for the peat, it being the same as when coal was burnt.

If the common road steam carriages which we hear are about starting, would procure a supply of peat, I believe one of their greatest difficulties would be surmounted, at least there would be no clinkers to annoy them.

Considering the immense stores of peat in Scotland and Ireland, as well as in some parts of England, often far from coal, and the general want of capital and skill in these districts, which are mostly inhabited by poor people. I trust these rough observations, which are simply to recommend methods of improving peat, which are within their reach, will be considered worthy of insertion.

I am, Sir, your obedient servant,

TIMOTHY BURSTALL.

Saint Phillips, Bristol, August 12, 1839.

ARTICLES FROM THE FRENCH JOURNALS.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

The Artesian Wells at the Abattoirs of Grenelle, Paris.

This well has now a depth of 418 metres, (= 1371 feet.) The sound, or borer, weighs 20 thousand; its height is treble that of the dome of the Invalides, and it requires two machines of immense power to put it in motion. The instrument is still in the chalk bed, the hardness of which is comparable to flint. M. Mulot, the director, states that the sound advances a foot per day.—*Rec. Soc. Polyt., July*, 1838.

Analysis of Several Bituminous Minerals. By M. P. BERTHIER.

As bituminous substances have of late years claimed an increased share of public attention, this celebrated analytical chemist has examined the constitution of a number of those which have gained the most notice on account of their practical applications.

Bitumen of Seyssel.—There are at Seyssel, (in the department of L'Ain) three kinds of minerals. 1. The sandy mineral. 2. The very fusible calcareous mineral. 3. The calcareous mineral of difficult fusion.

The first of these melts in boiling water, and becomes detached from the stony matters to which it was adherent. It rises to the surface, or sticks to the sides of the vessel in brown lumps, or forms a transparent coating of a brownish red colour. A rich specimen of it gave

Bituminous oil	·086	bitumen ·106
Carbon	·020	
Quartzy grains	·690	
Calcareous grains	·204	
	1.000	

In the mass it is much less rich. When purified by hot water, this bitumen is called *la graisse*, grease.

The second variety is called at Seyssel asphaltum. It may be pulverized and sifted, but the powder spontaneously forms into balls. The specimen analysed contained ·11 of bitumen, 5·89 of carbonate of lime, without clay, and quite pure.

The mastic of Seyssel is prepared by mixing nine parts of asphaltum with one of the pure grease extracted from the sand.

The third variety is a compact limestone, in extremely thin, parallel beds. It consists of

Bituminous matter	·100
Argil	·020
Sulphate of Lime	·012
Carbonate of lime	·868
	1·000

The bituminous mineral of Belley is very similar to the preceding. It is found in several communes in very considerable quantities, near the surface of the ground. It is of variable quality. A variable specimen yielded

Carbonate of lime	·824
Carbonate of magnesia	·020
Sulphate of lime	·013
Argil	·023
Bitumen	·120
	1·000

Bitumen of Bastenne.—This bitumen flows out from several openings or springs, mixed with water. Analysis of the solid gave

Oily matter	·200	bitumen
Carbon	·037	
Fine quartzy sand, mixed with argil	·763	
	1·000	

Bitumen of Cuba.—This is transported to Europe under the name of Mexican asphalt, or chapopote. It is a solid bitumen, which exists in abundance near Havana. It may be used with great advantage in paving. It consists, like the greater number of natural bitumens, of at least two different substances, the one soluble and the other insoluble in ether and spirits of turpentine. It is the relative proportion of these two substances which imparts to each bitumen its peculiar properties.

Bitumen of Monastier. (Haute-Loire.)—This does not soften in the least in boiling water, and hence cannot be extracted by simple means in the large way. It contains

Bituminous oil	·070	·105
Carbon	·035	
Water	·045	
Gas and vapours	·040	
Quartz and mica	·600	
Ferruginous argil	·210	
	1·000	

This bitumen of the Haute-Loire differs essentially from those of Seyssel and Bastennes by its infusibility in boiling water, and its fusibility in alcohol. —*Annales des Mines, tom* 13, *liv. iii.*

New Mode of Preparing Carburetted Hydrogen Gas for the purpose of Illumination. By M. SELLIGUE, Engineer.

This new invention has gained for M. Selligue the premium of 2000 francs proposed by the *Société d'Encouragement.* It consists in obtaining pure hydrogen by decomposing water by means of incandescent charcoal, and then carburizing it by mixture during the simultaneous decomposition of another liquid substance rich in carbon and hydrogen. Among all known substances, that which appears to answer best is the oil of schist (l'huile de schiste).

The furnace is composed, first, of three vertical retorts, communicating with each other, so as to form, in a manner, only one. In a double furnace there will be six retorts. These are all open at both ends, but closed below by sliding stoppers (*couvercles rodés*), so that simple contact and the least pressure is sufficient to shut them firmly. The top of each retort is closed by a head fixed by keyed gudgeons and iron cement. Each head bears itself a stopper, or cover, like those below.

The first retort, into which steam is introduced through a tube, communicates below, by a tube twice bent, with the second, which connects at top with the third by a similar tube, and this third retort has, below, a vertical tube with branches, by which the gas is conducted to a refrigerator, and thence to the gasometer. This tube dips into a trough of water, to serve as a hydraulic closure. The third retort bears at top a funnel syphon, through which the carburizing substances are introduced. 2nd. Two horizontal tubes, placed in the sides of the vault, serve as boilers to vapourize the water; each communicates at one end with the first retort by an arched tube, and to the other end is attached a funnel syphon, by which the boiler is supplied with water. 3rd. Two furnaces. 4th. A chimney in four parts, uniting at first into two, and then into one, in order to regulate the fire with greater ease.

Operation.—Having filled with charcoal the first two retorts in each of the (double) furnaces, and suspended chains in the two last, in order to increase the surface, the fire is lighted, and when the retorts have attained a cherry red heat, a gentle flow of water and oil is made through the syphons. The water falling into the boilers is instantly evaporated, passes into the first retort, then into the second, where it is deprived of its oxygen, and reaching the third, the hydrogen alone mingles with and carries along the carbonated hydrogen simultaneously formed from the oil in the last retorts. The united gases then issue from the lower end of the third retort, and press off through the branches, while the more volatile matters are deposited in the reservoir of water.—*Annales des Mines, Oct.* 1838.

Fonvielle's Filtering Apparatus.

A trial has been had in the courts at Paris, relative to the validity of the claims of the "French Filtering Company," who are now the possessors of Fonvielle's patent, to an exclusive right, founded on the merits of this invention. It was urged by the opposing party, that this right, being dependent on the application of high pressure, is invalidated by the fact of a prior use of the same principle to the process of filtration, as was shown by *brevets* (patents) of an anterior date. This plea was answered on behalf of the Company, by the proof that Fonvielle's mode of applying high pressure was entirely different from those of his predecessors. These were to force the water through *tissues of felt, wool, or flax, or through skins*, while Fonvielle's consists in filtering through *sand, pounded stones, gravel, and other inert animal substances*, which is so different, that previous to this date it had been found impracticable to apply high pressure to such filters, the effect being inevitably to overturn the filtering bed and confound the materials with the liquid to be filtered;—that this being the difficulty, in this consisted the merits of the invention. M. Fonvielle had discovered the means of so retaining and compressing the materials, as to be able to apply high pressure, the sole agent which can operate on great masses of water. In a word, filtration on a great scale is the principal object of Fonvielle's patent. It was shown that the greatest effect of preceding methods was to filter *five hectolitres* (=132 gallons) per day, whereas it was proved that filters of the "French Company," of the same capacity, would give in the same time *fifteen hundred and two thousand gallons*, or even more. Hence the evidence of a new idea—a great and real invention.

But the patent of the Company proves its value by two other new and happy applications; the first is the facility of cleaning the filter, without unpacking it, by a simple play of opening stop cocks, continued for 5 or 6 minutes only. This alone is enough to condemn every other filter which cannot, like those of the Company, *clean themselves*. The second is the happy use of the laws of hydraulic level, in raising the filtered water to a height nearly equal to that of the fountain head, a principle of the highest utility in the domestic and other arts, while all other filters leave the water simply at their feet.

The honourable testimony of the Academy of Sciences, evidenced by the report of Arago, was brought into view, and the advocate for the Company, at the conclusion, read another communication, addressed to the President from the same academician, containing some new developments of the scientific question, and treating this delicate and interesting subject in the enlightened manner, and with the energetic precision, which distinguish his pen. We cannot withhold the following extract from it:—

"I will add a few words on the merits of the question. This will only be pursuing the task I have long imposed on myself, of defending the rights of inventors, dead or living, against imitators, copyists, and plagiaries—a task in which, to the great displeasure of the English, I have been allowed to restore to our countryman, Papin, the honour of the discovery of the steam engine, and of steam boats.

"When the law declares *in general terms* (en thése générale) that a patent shall never be granted for a simple idea, it goes perhaps beyond its own object; but it thereby shows the complete separation which society ought to make between a theoretical and a practical machine. To transform an apparatus which works with difficulty, or scarcely works at all, into a powerful, common, economical machine, which, occasionally, changes completely the manufacturing aspect of a whole nation—nothing more is sometimes requisite than an apparently insignificant alteration, which, in the shops, might be designated by the simple term, 'a turn of the hand.'

"The machine which we owe to the genius of Watt, includes no principle which is not seen in the much older machine of Neucomen, only the steam was no longer condensed in the body of the pump, but in a separate cylinder. What did Bramah add to the principles of Stevin and Pascal in the hydraulic press? Nothing, absolutely nothing! He only modified the shape of the large piston, so as to render it completely tight and staunch. Watt and Bramah are none the less regarded as the principal and most skilful promoters of British industry. M. Fonvielle may have added to the results of his predecessors only his demonstration of the possibility of filtering under strong pressure through filters *par excellence*. composed of sand and pounded sandstone; he may have only proved that the two materials in question can be so disposed as to maintain their situation under the action of rapid currents, and not to mingle with and be carried away with the fluid mass,—he is still an inventor: but he has dono more; he has found the means of cleaning the filter without dismounting it, without handling it. The two inventions united form a process whose efficiency is not contested, and which provide the means of filtering vast masses of water with very small machines. Nothing like this existed before. Never, for example, had the city of Paris suspected the possibility of filtering, on the spot, the water of the public fountains. Now, our citizens are certain of soon seeing this valuable improvement realized. The only water not subjected to filtration will be that for washing the streets. Well! this might have been possible without any one having recently invented any thing! The able engineers of Paris, the hydraulic engineers of London, where the subject of filtering was not long since an object of parliamentary investigation, might have had in their eye all the elements of a simple, elegant, economical solution of the problem, and yet no one has seized hold of it! Vain supposition! Such pretensions cannot be supported, without opposing the most useful thing in the world—common sense itself.

"The name of the engineer Thom of Greenock, has been cited in the memoir of our adversaries. This name, which was parenthetically introduced into my report, did not prevent the celebrated Mylne, engineer of the New River, the chief hydraulic establishment in London, from considering Fonvielle's apparatus as a good and useful invention. When lately Mr. Mylne came to Paris with Mr. Curtis, President of the Bank of England, for the purpose of inquiring relative to a project for the distribution of water at each house, and on which occasion the Municipal Council charged me with the preparation of the account of charges, Mr. Mylne declared to m[e he in]tended to apply to the 'French Company,' and purchase from th[em the right] to their process of filtering.—*Rec. Soc. Polytech., Juillet*, 1838.

CHELSEA WATER-WORKS.

Water may with truth be called the blood of cities; the first introduction of it into London was by leaden pipes in 1236, in the reign of Henry III.; it was brought from Tybourne. In 1285 was erected, in Westcheap, a great stone castellated cistern of lead called the Great Conduit. The Tun upon Cornhill was constructed in 1401. Perilous-pool, Muswell-hill, Hackney, St. Marylebone, and Hampstead-heath, were the sources from whence the supplies were derived; and new conduits were in the year 1546 erected in Lothbury and Coleman-street. "The brook of Tybourne (according to Pennant) furnished nine conduits for supplying the city with water. Here the Lord Mayor had a banqueting-house, to which he and the Aldermen were accustomed to repair on horseback, attended by their ladies in wagons, and after viewing the conduit (query, if they tasted the water), returned to the city, where they were magnificently entertained." Thames water was first supplied to the houses of the citizens in 1582, by engines at London Bridge, made by Peter Maurice; the water was carried over the steeple of St. Magnus, and thence into the houses in Thames-street, New Fish-street, and Gracechurch-street, up to Cornhill, by the north corner of Leadenhall, then the highest ground in the city. Here the water from the principal pipe rose into a standard, rushed out through four spouts, one running each way at every side. The chief conduits were at Leadenhall, Cripplegate, Paul's-gate, Old Fish-street, Cripplegate, Oldbourne, Fleet-bridge, and Aldgate. Stowe describes that at Fleet-bridge as having the image of St. Christopher at the top, and lower down surrounded with angels, with sweet-sounding bells before them, whereupon, by means of an engine within the tower, they "dyvers hours of the day and night, chymed suche a hymne as was appointed." In West Smithfield was a pool, which, according to Burton, was called Horse-pool, and another in St. Giles's, and divers fair wells and springs, by which the city was served with sweet water. These conduits continued till they were destroyed by the fire of 1666.

The vast improvement, by means of pipes conveying water to every house, is but of comparatively modern date: to the ancients it was not in use, at least only in the more splendid habitations of the rich. The larger kind of iron pipes called mains they had not discovered the means to fabricate. Water was conveyed to their cities by means of those gigantic aqueducts, whose ruins are the admiration of posterity. That at Rome called Nuo Anio, according to Frontibus and Strabo, was six miles and a-half in length, was formed of 1,000 arches. That called Aqua Martia was taken from the Tiber, and was 38 miles in length, and brought the water in a wandering course 43 miles, part of it having a subterranean channel. The nine earlier aqueducts distributed into Rome 14,018 quinaria, which is equal to 28,000,000 cubic feet, and when all the aqueducts were in operation the supply must have exceeded 50,000,000, which, putting the population at 4,000,000, 13 cubic feet would give above a hogshead and a-half of water to each inhabitant.

The first foundation of the Chelsea waterworks was by act of Parliament passed in the year 1724. Two years afterwards the basin in the Green-park was constructed to supply Whitehall and part of Westminster. They also formed the reservoir in Hyde-park. At that time they possessed the means of supplying 10,000 houses, at a cheaper rate than the New River Company. In the year 1742 the extraordinary severity of the winter destroyed the works, and a new act was passed to increase their capital. In 1767 the daily supply raised by their works amounted to 1,740 tuns; it was shortly after increased to 3,500; in 1809 it exceeded 6,500! and it now may amount to 20,000 tuns.

The more easily attainable any article of general necessity and consumption, the more fastidious in his choice becomes the consumer. The supply of water to the metropolis in the past century was not only more scanty, but of a quality very much inferior even to what it was some years since; the inhabitants of third and fourth rate houses were then content to receive a moderate supply. The great convenience of which, and the small item it made in the yearly expenditure, the saving of labour and of time it afforded, were found so beneficial, that its quality was hardly considered, or if it was, to find a remedy was supposed almost hopeless. In larger houses, quantity was the object considered, that for draught being otherwise procured, and in the smaller tenements the convenience was unknown; but as enterprise and competition became extended, it was necessary that not only the quantity, but the quality should be considered. To effect this object, many different plans have, therefore, been tried; many have failed, after enormous sums expended. The means by which the Chelsea company have endeavoured to succeed has been by applying the principle of the filter on a scale of greater magnitude than has hitherto been attempted.

It had always been the opinion of foreign chemists, that although water, in certain and moderate quantities, might by this means be brought to a great degree of purity, yet it would be found, if attempted to any great extent, that the earthy, limeous, and vegetable particles would be only held in solution, and the water would still continue to deposit whatever impurities it possessed, acquired from the source from whence derived; also, that even if it gained a greater degree of purity from the process, yet that a surface of water exposed in a quiescent state in a tank, shallow in comparison to its extent, would imbibe from the depositions of the atmosphere, earthy particles sufficient to counterbalance whatever good the filter might have effected. It had also been thought that the nature of the Thames water is such, from the variety of the deposits it receives in its course through the metropolis and its precincts, that no process would prove sufficiently effective to give it that degree of purity spring water possesses; and that although the water of the Thames has the property of purifying itself, and will afterwards remain in that state longer than almost any other, and for that reason is always preferred by sea-going ships, also for many other purposes, among which may be mentioned that none other is found to be of equal value in porter breweries; yet, that as the process which goes on by the chemistry of nature in the closed tank, or in the cask in the hold of the ship, requires time for its operations, and the constant and speedy supply necessary for daily use not allowing this, so peculiar a property could not be brought into action. It was the constant complaint that the water received into the reservoir of houses was both nauseous to the taste, unwholesome to the constitution, and hardly fit for domestic purposes; the fact was, that being in a state of chemical action during its state of transition, it could not, by possibility, be otherwise. It may be thought that, submit river water to whatever process you may, you can never render it as pure as that procured immediately from the spring. This to a certain extent may be true; yet, as all springs must partake of the nature of the soils through which they pass, they will all more or less be found to possess different quantities, and they will all, without exception, acquire that property called "hardness." In such a state the element loses some of its most wholesome and nutritive properties, and plants and flowers watered immediately from a spring, especially if that spring is covered, are seldom found to thrive, and are frequently destroyed; you will often find gardeners filling a reservoir for future use, thus giving themselves double labour, the beneficial effects of which they find in the improved state of their plants, although not always aware of the cause. Nothing but exposure to the light and air will effectually deprive water of that pernicious quality. The Thames, flowing through a tract of country destitute of minerals, can only receive into its composition those bodies which form the nature of the soil through which it passes; and although there are other rivers, such as the Neva and the Volga, which are more translucent, and are found to make less deposit, they are not more wholesome nor do they possess its peculiar properties. When it enters the bounds of the metropolis, the adulteration which it receives unfits it for domestic use, but as that adulteration is immediate, the deleterious particles it receives have not sufficient time afforded effectually to amalgamate themselves with its other component parts, and by immediately submitting it to the process of a mechanical filter, its purity becomes restored without its parting from those beneficial properties which as a running stream it has acquired. The attempt, therefore, of obtaining water for the capital of greater purity than the Thames, by seeking the source of supply from any spring or rivulet a few miles distant, is a work of supererogation, and will not, and has not, been found to answer; the before-mentioned causes will continue to operate. That water will be found the best whose exposure to the air has been longest, and whose state of motion has been greatest. We do not mean to say that there are not limits to this; but it always has been found, without there are natural and local causes to prevent it, that such is the case, provided always the impurities it contracts in the immediate vicinity of its consumption are removed. We proceed to show how that object has been attempted to be attained, and we think effected. There is also another cause, which, to a much greater extent than is commonly supposed, must render harmless whatever bad effects the immense drains and sewers which open into the Thames from the metropolis would otherwise create—that is, the action of the tide; the river in its fall to the sea, from its declination carries down with it all the impurities it has collected in its course; it leaves none behind—that it does not is clear; its depth for ages has neither increased nor decreased, and did not artificial and local causes operate, it would be as pure near its mouth as at its source; for in the same proportion as its stream would become turbid from all it had received in its way, so the width it acquires as it approaches its embouchere counteracts and nullifies the effect. Now the tide, acting against the current, carries back but a small portion of the deposit it has brought into the sea, the saline particles of which, mixing with the waters of the river, in a great measure neutralizes the effect of whatever impurities it may have received.

In the beginning of the year 1810 the Chelsea Waterworks were removed from the original site, at the east end of the cut made from the river, which now forms the Belgrave-basin, to the bank of the Thames, nearly opposite the Red-house, Battersea. The ground which they occupy is about six acres and a-half. The supply of water from the river was, till the late improvements, received into the mains from a building called a Dolphin, which stood about 50 feet from the bank. This was fabricated of brick, till within about eight feet of the surface of the stream at low-water mark; above it was a structure of iron, pierced in holes in every direction, through which the element flowed, and which, by preventing any large or foreign body from passing, to a certain extent supplied the purpose of a filter. A little higher, near the Ranelagh-basin, was the mouth of a large sewer; and thus this contrivance could not by any possibility have been of much use in purifying the supply. This building has been removed, and the main pipes are now laid across the bottom of the bed of the river to the Surrey side, from whence they receive their supply, and which, from having nothing but a few land-drains opening into it for some miles, is in a great degree free from those objections which the densely populated state of the northern side was the occasion. The water then being received from the mains into the first reservoir, which is 100 feet in length by 70 in breadth, and ten feet deep, then enters a basin lined with stone and brick, from which it is forced up into the southern reservoir, 300 feet in length, by 160 in breadth, and the northern one, 540 by 140 feet. Both these reservoirs are lined throughout with what is called brick-on-edge paving, and being located at a considerable elevation above the filtering beds, the water flows from them into the filters, of which there are two—the southern one 240 feet by 180, and the northern 351 in length by 180 in breadth, the latter being placed at a greater elevation than the other. Having passed through both of these, it is slowly received into an open culvert immediately from them, of about 15 feet in depth, and from thence being taken into the mains, some of which pass under, and are affixed to the bridge over the Belgrave canal, then supplies the district. The formation of these filtering beds, and the great scale on which they are constructed, is curious. The sides are elevated about 12 feet above the level of the ground, strongly embanked, and covered with turf; the bottom is formed of clay, which is 18 inches in depth. Upon this are placed, upon the northern 9, and in the southern 11, brick tunnels, which extend from one end of the bed to the other, each three feet in diameter, and two bricks in thickness, and so constructed that every other brick is left out, and the water has a free passage through them. They are then surrounded on all sides, and covered to the height of 24 inches with gravel stones; above this is a layer of six inches of a shelly concrete, and upon that a bed of coarse sand, upon which is another of fine sand. These two beds may be about five feet in depth. Between the tunnels placed on the sand are wooden troughs, three feet in length by six inches in width, and three deep, at about ten feet distance from each other. The use of these—and it is most ingenious—is to prevent the water from washing the sand into holes when it is admitted into the filter. The deposit which the water makes on the surface of the sand is easily removed, and requires the sand, with which it becomes mixed to the depth of two or three inches, to be raked off once in three weeks or a month, which is done in a few hours, the intervals of removal depending, to a certain extent, on the action of the wind and tide. A steam-engine of 120 horse power raises the water, to the amount of 3,500 gallons a minute, or upwards of 5,000,000 gallons in the course of the day. The expense, we understand, has exceeded the sum of 60,000*l.*—*Times*

Draining of Land by Steam Power.—The drainage of land by steam power has been extensively adopted in the fens of Lincolnshire, Cambridgeshire, and Bedfordshire, and with immense advantage. A steam-engine of 10 horse power has been found sufficient to drain a district comprising 1,000 acres of land, and the water can always be kept down to any given distance below the plants. If rain fall in excess, the water is thrown off by the engine; if the weather is dry, the sluices can be opened, and water let in from the river. The engines are required to work four months out of the twelve, at intervals varying with the season, where the districts are large; the expense of drainage by steam power is about 2*s.* 6*d.* per acre. The first cost of the work varies with the different nature of the substrata, but generally it amounts to 20*s.* per acre for the machinery and buildings. An engine of 40 horse power, and scool-wheel for draining, and requisite buildings, costs about 4,000*l.* and is capable of draining 4,000 acres of land. In many places in the fens, land has been purchased at from 10*l.* to 20*l.* per acre, which has been so much improved by drainage as to be worth 60*l.* to 70*l.* per acre. The following list shews the number of steam-engines employed for this purpose in England:—Deeping Fen, near Spalding, Lincolnshire, containing 25,000 acres, is drained by two engines of 80 and 60 horse power. March West Fen, in Cambridgeshire, containing 3,600 acres, by one engine of 40 horse power. Misserton Moss, with Everton and Graingley Carrs, containing about 6,000 acres, effectually drained by one engine of 40 horse power. Littleport Fen, near Ely, about 28,000 acres, drained by two steam-engines of 30 or 40 horse power each. Before steam was used there were 75 wind engines in this district, a few of which are still retained. Middle Fen, near Soham, Cambridgeshire, about 7,000 acres, drained by an engine of 60 horse power. Waterbeach Level, between Ely and Cambridgeshire, containing 5,000 acres, by a steam-engine of 60 horse power. Magdalen Fen, near Lynn, in Norfolk, contains upwards of 4,000 acres, and is completely drained by a steam-engine of 40 horse-power. March Fen district, Cambridge, of 2,700 acres, is kept in the finest possible state of drainage by a 30 horse-power engine. Feltwell Fen, near Brandon, 2,400 acres, by an engine of 20 horse power. Soham Mere, Cambridgeshire, formerly (as its name implies) a lake of 1,600 acres, drained by a 40 horse-power engine, the lift at this place being very great.—*Lincoln paper.*

In the first volume of our Journal, p. 98, will be found a very interesting paper on the above subject, accompanied by drawings of the water-wheel.—Ed. C. E. & A. Journal.

THE IRON TRADE.

The following paper, "*On the state and prospects of the iron trade in Scotland and South Wales, in May,* 1839," *was read before the Liverpool Polytechnic Society, on the* 13*th June, by* Joseph Johnson, Esq., *Iron merchant, Liverpool.*

The vast and increasing importance of the iron trade to this country must be so apparent to the most indifferent observer, that I feel fully persuaded I need offer no apology to you for intruding upon your notice the consideration of a subject that appears, at first sight, so completely without the legitimate sphere of the objects for the promotion of which this society was established. The daily increasing magnitude of this branch of British industry is surprisingly great; but to enable you to obtain a clear view of its rapid extension, I have extracted from Dr. Ure's valuable "Dictionary of Arts, Manufactures, and Mines," the following sketch of its progression from 1740 to 1826. The Doctor observes, p. 687, that, "Till 1740, the smelting of iron ore in England was executed entirely with wood charcoal, and ores employed were principally brown and red hematites. Earthy iron ores were also smelted; but it does not appear that the clay ironstones of the coal basins were then used, though they constitute almost the sole smelting material of the present day. At that era there were fifty-nine blast furnaces, whose annual product was 17,350 tons of cast-iron—that is for each furnace, 294 tons per annum, and 5½ tons per week. By the year 1788 several attempts had been made to reduce iron ore with coked coal; and there remained only twenty-four charcoal blast furnaces, which produced altogether 13,000 tons of cast-iron in the year, being at the rate of 546 tons for each per annum, or nearly 11 tons per week. This remarkable increase of 11 tons for 5½ was due chiefly to the substitution of cylinder blowing machines, worked with pistons, for the common wooden bellows.

"Already fifty-three blast-furnaces, fired with coke, were in activity, which furnished *in toto* 48,800 tons of iron in a year, and which raises the annual product of each furnace to 907 tons, and the weekly product to about 17½ tons. The quantity of cast-iron produced that year (1788) by means of coal was 48,800 tons, and that by wood charcoal was 13,100, constituting a total quantity of 61,900.

"In 1796, the wood charcoal process was almost entirely given up, when the returns of the iron-trade, made by desire of Mr. Pitt, for establishing taxes on the manufacture, afforded the following results:—121 blast-furnaces, furnishing in the whole per annum 124,879 tons, giving an average amount of each furnace of 1032 tons.

"In 1802 Great Britain possessed 168 blast-furnaces, yielding a product of about 170,000 tons, and this product amounted, in 1806, to 250,000 tons, derived from 227 coke furnaces, of which only 159 were in activity at once.

"In 1820 the make of iron had risen to 400,000 tons, and in 1826 to about 600,000 tons.

"From 1823 to 1839 the iron-trade saw many fluctuations. The price of forge pig-iron varying from 2*l.* 10*s.* to 10*l.* per ton at the works. But the make of this country was still increasing, and, in 1838, I believe it reached to upwards of 1,000,000 tons."

For many interesting particulars connected with the iron-trade of the United Kingdom, and particularly for a detailed account of the introduction of the heated air-blast, by Mr. Neilson, of Glasgow, I must refer you to the excellent work from which I have made the foregoing extracts.

The introduction of the hot-blast formed quite a new era in the iron trade, and the consequent increase of produce of iron, particularly in Scotland, where this inventiou was first applied, has been incredibly great, and is still progressing. I have been very kindly furnished by a friend, who is intimately connected with the Scotch iron trade, with a list of all the furnaces now in operation in Scotland, the number out of blast, the number erecting, and about to be erected; I have every confidence in the accuracy of my friend's information, and have no doubt but that the correctness of the list may be relied upon. This list shows that there are in Scotland fifty furnaces in blast, five out, seven building, and twenty-six contemplated. With the permission of the meeting, I will read over the names of the works, and their respective owners.

Names of Works.	Owners.	In Blast.	Out of Blast.	Building.	Contemplated.
Clyde	James Dunlop	4	1	—	4
Calder	W. Dixon and Co.	6	—	—	—
Carron	Carron Company	4	1	—	—
Muirkirk	Muirkirk Iron Co.	2	—	—	—
Devon	Devon Iron Co.	2	1	—	—
Shotts	Shott's Iron Co.	2	—	1	—
Monkland	Monkland Iron Co.	5	—	—	—
Gartsherrie	W. Baird and Co.	7	—	1	6
Dundyvan	Dunlop and Co.	5	—	1	4
Summerlee	Wilsons and Co	4	—	—	2
Castle-hill	Shott's Iron Co.	2	—	—	—
Bona	Bona Iron Co.	1	—	—	—
Govan	W. Dixon, Esq.	2	—	—	4
Wilsontown	W. Dixon, Esq.	1	—	—	—
Coltness	Mr. Holdsworth	2	—	—	—
Omoa	W. Young	1	—	—	—
Carnbroe	Alison and Co.	—	—	2	4
Galston	M'Callam and Co.	—	1	—	—
Blair	Mr. J. M'Donald	—	—	2	—
Houale	Mr. Galloway	—	1	—	2
		50	5	7	26

Supposing the whole of these furnaces to be in full activity by the end of the year 1842, and giving the average produce of eighty tons per week to each furnace, we shall have Scotland alone producing upwards of 360,000 tons of cast-iron per year, nearly equalling the make of the United Kingdom twenty years ago. Sixty-five out of eighty-seven furnaces I have enumerated, are situated in or about the Monklands, to the south and south-east of Glasgow, and distant from that city seven to ten miles. The works in that district have the command of the blackband ironstone, the possession of which my informant states to be so great an advantage, that without it, the trade would not bo worth following. The furnaces in the Monklands, by using this combustible blankband ironstone, may average 100 tons in seven days each, but those which have not this material, do not yield nearly so large a quantity. Therefore, bearing in mind that the Presbyterians stop their furnaces one shift, or nearly twelve hours on each Sunday, we may safely put down the average yield of the furnaces in Scotland at eighty tons per week each.

Three of the largest makers of iron in Scotland are directing their attention to the manufacture of bar-iron, and with every prospect of most complete success. The Monkland Iron Company are erecting mills and forges capable of making 230 tons malleable iron per week. Dunlop, Wilson, and Co., of Dundyvan, are making preparations to enable them, when in full operation, to make 300 tons of bars, &c., weekly, and they will be partially at work in two months. William Dixon, Esq., of Govan Iron Works, has now ready for immediate working, capabilities for producing 200 tons of malleable iron per week. His mills and forges are on the outskirts of Glasgow, and are known as the Glasgow Iron Works, at the Town Head.

The Muirkirk Iron Company have five puddling furnaces, rolling mill, &c., but they are not making more than about twenty tons of bars weekly.

This statement comprises the present, and so far as is known, the prospective operations in the malleable iron trade in Scotland, with the exception of two small forges, the Lancefield and the Gartness, where they puddle a little from white iron.

It was for a long time considered doubtful whether the Scotch cast-iron, made as it is with raw bituminous coal and heated air, would answer for malleable iron, and several experiments have latety been made with a view to ascertain more nearly than had hitherto been done its applicability for this purpose. So far as I have been able to learn, these experiments have been attended with most satisfacto.y results. I was informed a few days ago by Edmund Buckley, Esq., of Manchester, who has for a long time past taken a very lively interest in these matters, that in some trials recently made by Messrs. Beecroft, Bntler, and Co., at their works, at Kirkstall, near Leeds, they found 4 cwt. 2 qrs. of Scotch pig-iron to yield, by the process of boiling instead of puddling, blooms of 4 cwt. 1 qr. 8 lbs. each, showing only the comparatively trifling waste of 20 lbs. in a charge of 4 cwt. 2 qrs., and the quality of the iron was found to be at least equal to any made with cold air. Indeed, many thousand tons of Scotch cast-iron have been purchased from time to time by the iron masters of South Wales to mix with their own country metal in their puddling furnaces, thus affording unquestionable proof of its fitness for conversion into malleable iron. I have no doubt that we may speedily receive extensive supplies of bar-iron from Scotland, such as we have hitherto received principally from South Wales and Staffordshire.

I must now ask your indulgent attention for a little while longer, and request the favour of your company on a very interesting tour through the mineral districts of the counties of Gloucester, Monmouth, and Glamorgan. I class the iron works of the Forest of Dean with those of South Wales, as well from their proximity to the latter, as from the circumstances of their being worked by those eminent South Wales iron masters, Messrs. Guest, Lewis, and Co., and W. Crawshay and Sons. At the "Cinderford" works there are four furnaces, three in blast, and one out, producing on an average from 100 to 120 tons each of excellent forge pig-iron weekly. At the "Sewdley" works there are two furnaces, one in and one out of blast, producing abont ninety tons of iron per week; and at the Park-end works there are two furnaces, one in blast, and the other out, making about eighty tons per week.

The differences in the produce of furnaces may be accounted for in a variety of ways; some are larger than others, some have superior blowing engines, and others may be under better management. The furnaces I have named are all that are on the Forest of Dean; but large quantities of iron ore are raised here, and are sent, as well as the iron, to different works in South Wales and Staffordshire. The shipments are made at a wharf a little below Newnham.

Leaving the forest, we will proceed to Newport. Here you will find a most excellent river navigation—the Usk, and at all seasons of the year may be seen large numbers of vessels, of various tonnage, waiting to receive the mineral produce of Monmouthshire, in the shapes of coal and iron. Having viewed the port, and noted all its facilities for shipment, and especially the magnificent dock now constructing for affording to the shipping increased conveniences, we will, if you please, proceed to the interior of the county, and notice the various works in the order in which we reach them.

The first works we arrive at are those of Capel Hanbury Leigh, Esq., near Pontypool, and are called the Pontypool Iron Works. Here you will find three furnaces in blast, and one out; two blown with cold air, and one with hot. There are not any furnaces erecting, or about to be erected here. The make of these three furnaces is about 300 tons per week. The hot-air pigs are sold chiefly for foundry purposes, and the cold-air iron is used by Mr. Leigh, for tin-plates, of which he has been for a long time past a very eminent maker. The yield of the ironstone at these works is about 30 per cent.; but Mr. Leigh imports large quantities of the richer ores from Lancashire and Cornwall, for the improvement of the quality of his iron.

A little further up the valley we reach the works of the Pentwyn and Golynos Iron Company, where you will find five furnaces all in blast, and one about to be erected; three are blown with hot-air, and two with cold. The produce of the five furnaces is about 450 tons per week. They have just completed first-rate forges and rolling mills, calculated to make 350 tons of bar and other malleable iron per week. About a mile above these works, you find those of the British Iron Company, at Abersychan. Here are four furnaces in blast, all blown with cold air, and two out of blast. The four make about 380 tons of pig-iron per week, from which they make about 270 tons of malleable iron, and the remainder is made into castings, &c.

We next arrive at the Varteg Iron Company's works, where you will find five furnaces all in blast, four blown with hot, and one with cold air. They produce about 350 tons of pig-iron per week, from which they make about 160 tons of bars and rails, about twenty tons of castings for engine uses, &c., and the remainder is sold for foundry purposes.

Pursuing our course for two miles further up this valley, we arrive at the works of the Blaenavon Iron Company, where we find five furnaces all in blast, blown with cold air, and six others erecting. This mineral property, I am told, is one of the best and most valuable in the county of Monmouth, and these works have been long distinguished for the superior strength, and general excellence of their iron. These five furnaces produce about 400 tons of cast-iron per week, about one-half of which is refined, and part of it made into cable iron, and the remainder is sold for tin-plates and foundry work. This company are erecting extensive forges and rolling mills, and will, in a few years, contribute largely to the supply of bar-iron and rails.

We have now arrived at at the extremity of the first valley, and, crossing the mountain, we will descend to Abergavenny. The rolling-mills on the left-hand side are those of the Garndyrris Iron Company, and have been worked for many years by the late firm of Messrs. Hills and Wheely. They are now united to the Blaenavon Iron Works, and are carried on by the same company.

By the time we have reached Abergavenny, I strongly suspect that you will feel disposed to enjoy the comforts of a good dinner, an evening walk in that most delightful country, and a refreshing sleep, for all of which gratifications you will here find the most ample provision.

Next morning, after the usual and very necessary preliminaries, we resume our tour, and in about five miles we reach the works of the Clydach Iron Company, at Llanelly. Here are four furnaces at work, and all blown with cold air. They produce about 320 tons of pig-iron per week, from which they make about 230 tons of bars, &c., and the remainder is run into castings and ballast iron.

The Nant-y-glo Works are the next we arrive at, situated, as their name imports, in the Valley of Coal. Here, some years ago, was expended upwards of 50,000*l.* in attempts to establish a profitable iron work, but without success; and not until the property was purchased by the present talented and enterprising proprietors, Messrs. Joseph and Crawshay Bailey, was any remuneration realised. These works now rank amongst the very first class. Messrs. Bailey have, within the last few years, purchased the Beaufort Iron Works. At the two establishments they have fourteen furnaces in blast, ten blown with cold and four with hot-air, and I am informed that they intend erecting four others very soon. Their make of pig-iron is from 1200 to 1300 tons per week, from which they make about 750 tons bars, rails, and rods, and the remainder is sold for foundry purposes.

Near the Nant-y-glo works, and situated in the same valley, are the Coalbrook Vale Company's works, consisting of three furnaces, all blown with cold air, and another is about to be erected. The make of the three furnaces is 160 to 180 tons of cast-iron per week, all of which they make into castings, or dispose of for that purpose.

A mile lower down this valley you reach the Blaina and Cwm Celyn Iron Company's iron works. These two properties have recently been purchased by a joint-stock company, and promise well for their proprietors. Messrs. Russell and Browns, the former proprietors, are the managing directors. At Blaina they have two furnaces in blast, and one about to be erected, all blown with cold air. They yield about 120 tons of pig-iron per week, which is nearly all made into castings on the spot. At Cwm Celyn they are building four furnaces, the entire produce of which is to be made into malleable iron.

We have now finished our inspection of the works in the second valley, and will proceed to the third, which is called Ebbw Vale, from the river Ebbw flowing through it.

The first works we reach are the Beaufort, which I have already informed you, belong to Messrs. Bailey, and their produce I have included in the return for Nant-y-glo.

Proceeding onwards, we arrive at the Ebbw Vale works, the property of Messrs. Harfords, Davies, and Co., who are also the owners of the Sirhowey iron works, situated in the next valley. At Ebbw Vale they have three furnaces in operation, and are building a fourth. They blow one furnace with hot, and two with cold air. These furnaces are very productive, yielding 100 tons per week each. At Sirhowey, they have four furnaces in blast, and one undergoing repairs; two are blown with hot, and two with cold-air. These furnaces also make about 100 tons per week each, so that at the two works they make about 700 tons of cast-iron weekly; the whole of which is converted into bars, rails and rods. Their make of malleable iron is from 600 to 630 tons per week.

One mile lower down the Ebbw Vale, you will find the Victoria Iron Works, recently established under the able superintendence of Roger Hopkins, Esq. These works belong to the Monmouthshire Iron and Coal Company. Only one furnace is yet at work, but another is ready to be blown in, and they are erecting two others. They have just commenced the manufacture of bar-iron. I have been informed that they intend building ten additional furnaces lower down the valley, near to Abercarne. When in full operation, they calculate on making 1000 tons of wrought or malleable iron per week; but this expectation will probably require a few years for its accomplishment.

Having seen all the works in the third valley, we proceed to the fourth, and we here find, first, the Sirhowey works, to which I have already alluded, and next to these, the works of the Tredegar Iron Company. At Tredegar, they have five furnaces in operation, all blown with cold air; they are building two others, and contemplate the erection of two more, making nine altogether. They now produce 400 to 450 tons cast-iron weekly, which is nearly all made into bars, rails, and rods; of these they make about 330 tons per week.

We must now travel on to the fifth valley, in which we find only the Rhymney and Bute Iron Works, belonging to the joint-stock company of that name. This is a very extensive and most valuable mineral property, and these works bid fair very soon to rival the largest establishment in South Wales. They have now six furnaces in blast, two blown with hot, and four with cold-air; and they are building four others. They make about 550 tons pig-iron per week, from which they produce 450 to 480 tons malleable iron in the same period of time.

The whole of the works we have visited since we left Newport, send their iron to that port for shipment, and it is conveyed chiefly down tramroads by locomotive-engines, and by canals.

We must now take a stretch or five or six miles to the westward, and this will bring us to the hitherto unrivalled establishment of Sir John Guest, Lewis, and Co., at Dowlais. Here you will find fifteen furnaces in full activity, and four others building. I find that I have omitted to note how many were blown with hot, and how many with cold air, but if my memory serves me correctly, I think five with the former, and ten with the latter. These fifteen furnaces make on an average 1350 tons of pig-iron per week, nearly the whole of which is converted into malleable iron, say about 1000 tons bars, rails, and rods per week. At this establishment they employ upwards of 4000 hands.

The next works we reach are those of the Pen-y-darran Iron Company. They have six furnaces in blast, and one out, making about 400 to 500 tons cast-iron per week, and they convert nearly the whole of it into malleable iron, of which they produce about 400 tons per week. I believe the whole of these furnaces are blown with cold air.

We have now, gentlemen, performed a very good day's work, and I am sure you will heartily join me in a proposal to take up our quarters for the night at the Castle Hotel, at Merthyr Tydvil, where I give you my word that you may make yourselves comfortable, if you choose. You must take care to muster for breakfast at eight o'clock to-morrow morning, and at nine we will go to see Mr. Crawshay, who is a very early man of business.

The preparations of the morning over, and our arrival having been announced at the Cyfarthfa office, we will now on our way to Cyfarhtfa see the Iron Works, belonging to Messrs. Crawshay and Sons, and shall no doubt be willingly accompanied by Mr. Williams, their talented engineer. These works are in my opinion the neatest and best arranged in all South Wales, and Mr. Williams I am sure will have pleasure in showing you the whole of the machinery. Amongst other interesting objects for your attention, you may here see the largest pump I ever heard of. The diameter of the working barrel is six feet, and the length of the lift in the barrel is four feet. It pumps up the whole of the river Taff, and the water, after turning all the wheels about the works, is discharged into the bed of the river. This may appear, at first view, an expensive way of obtaining power; but experience shows that it is cheaper than erecting a number of small engines, or transmitting power through complicated machinery. Besides the Cyfarthfa, Messrs. Crawshay have the Hirwain works, which are situated about some six miles from Merthyr. At the two establishments there are in the whole fourteen blast furnaces, twelve at work, all blown with cold air, and two inoperative. They make about 900 tons of cast-iron per week, and the greatest part of it is made into malleable iron, of which they produce 600 to 650 tons per week.

We next visit the Plymouth Iron Works, belonging to Messrs. Richard and Anthony Hill. Here are seven furnaces, all in blast, and all blown with cold air, making 700 tons of cast-iron per week on an average, and from which they make about 600 tons into bars, &c. weekly.

About six miles from Merthyr, over a mountain, are situated the works of the Aberdare Iron Company. They have six furnaces in blast, two blown with hot, and four with cold air, producing 350 to 400 tons cast-iron per week. They make about 220 tons bar-iron per week, and the remainder of their produce is disposed of for foundry purposes.

At the Pentyrch Iron Works, near Cardiff, there are two furnaces in blast, blown with cold air, and making about 150 tons cast-iron weekly.

The whole of the iron made at the seven last-named works is shipped at Cardiff, where a very commodious dock has recently been constructed by the Marquis of Bute, under the superintendence of William Cubitt, Esq., F.R.S., C.E., for the better accommodation of vessels entering that port.

The statistical information I promised to obtain, I found I should have great difficulty in procuring * * * I am compelled to offer you on these subjects the opinion of an excellent friend of mine, who has ample means of forming a tolerably correct estimate. His remarks are very general, and as such I offer them. He says, "To make 1000 tons of bar-iron weekly, requires about 4000 persons of every description, but I cannot give you the proportionate numbers to each process. The rates of wages for men range from 12*s.* to 60*s.*, for women 6*s.* to 10*s.*, and for boys 7*s.* to 11*s.* per week." * *

There is another branch of statistics of the iron trade on which I felt desirous of affording you some information, and in obtaining this I have been somewhat more successful, though it was not procured without very great difficulty—I mean the proportions of the materials used in each process, and the waste of the iron. I am glad to say that I can inform you on these most important points with the utmost exactness. Fifteen furnaces, averaging ninety tons each per week, will produce 1350 tons of cast-iron with a consumption of 50 cwt. of coal per ton of iron, inclusive of calcining—say 3375 tons of coal to furnaces and calcining, and to the blowing engines 10 cwt. of coal per ton of iron, or 675 tons. If the furnaces make 1350 tons of cast-iron, 100 tons may be deducted for ballast iron. Then refining 1250 tons, at 22cwt. 1 qr. of pig to the ton of refined iron, will produce 1110 tons refined metal with a consumption of 9 cwt. per ton, or about 500 tons of coal weekly for the refineries. 1110 tons refined metal will yield of puddled iron, at 21 cwt. per ton of the metal, and 18 cwt. of coal per ton of iron, 1045 tons with 940 tons of coal; and then the rolling-mills, at 22½ cwt. of puddled iron and 20 cwt. of coal per ton, will produce 915 tons of merchant bars, or what is called No. 2 iron, with a consumption of 915 tons of coal. * *

Within the last three years, Mr. George Crane, of the Yniscedwyn iron works, has discovered, that by using heated air, he can melt iron ores with the anthracite coal. When I was last in South Wales, I visited Mr. Crane, at his works, near Swansea, in order that I might see and judge for myself of the merits of this discovery. To enable you to form some idea of its value and national importance, I need only inform you that it has added to the available resources of this kingdom, for the purposes of its iron trade, a district sixty to seventy miles long, by six to eight miles broad, abounding with the anthracite or carbon coal, lime, and ironstone; and, further, that it has already trebled the value of this extensive mineral property. * * *

Mr. Crane has yet only one small cupola furnace, in which he uses anthracite exclusively; for firing the other two, he uses, as I have before remarked, three-fourths bituminous, and one-fourth anthracite coal; and by using anthracite in this comparatively small proportion, he effects a saving of 12s. to 13s. per ton in the cost of making iron, and very materially improves its quality. His furnaces also yield a better produce, in proportions of 35 to 50 per cent. His small cupola furnace No. 2, from which, when using cold air and coke, he could obtain only twenty to twenty-two tons of cast-iron per week, by being fired with anthracite coal alone, and blown with hot air, has produced, on an average of many months, thirty-five tons per week, and the larger furnaces, in which he uses the proportions I have before stated, have increased, the No. 1, from thirty-four to thirty-five tons up to forty-five to forty-nine tons; and the No. 3, from fifty to fifty-five up to sixty-five to eighty tons per week. All his furnaces are very small, and his blowing machinery not so good as it ought to be, hence his very limited produce.

The quality of this iron is very highly spoken—Mr. Crane has received assurances from several parties who had used it for various purposes, that, "for bars it had given great satisfaction;" "for foundry work it was admirable;" that, "in re-melting, it was found very fluid, and at the same time very strong"—a union of qualities most desirable, but rarely to be met with.

With respect to the economy of this new process, Mr. Crane has, on the average of several months, produced the ton of cast-iron with the before-unheard-of small quantity of 27 cwt. of coal, and he entertains the greatest confidence that he will be able to reduce the quantity still further, say to 22 cwt. His main bed of anthracite coal is eighteen feet thick. I produce a sample of it as obtained from the mine.

The maturing of this most important plan has cost Mr. Crane much time, and money, and anxiety, and it is to hoped that he will be most amply repaid for his valuable services.

This new feature in the iron trade soon attracted the attention of capitalists, both here and in London; and the counties of Pembroke, Carmarthen, and the western part of Glamorgan, give fair promise soon, at least to rival Monmouthshire and the eastern part of Glamorgan, in the manufacture of iron. I will first enumerate the works already in operation in the Swansea and Neath districts, and then inform you of the extent to which new establishments are being erected and others contemplated.

The Maesteg iron works are worked by Messrs. Robert Smith and Co., with bituminous coal and hot air; they have two furnaces at work, producing from 180 to 200 tons per week of cast-iron. A part of this they make into malleable iron, but I am not aware of the exact quantity—perhaps, about sixty to seventy tons per week.

The make of Mr. Crane, at the Yniscedwyn iron works, I have already acquainted you with.

The Neath Abbey Iron Company have two furnaces in blast, blown with heated air, and fired with three-fourths bituminous, and one-fourth anthracite coal. They make about 160 tons of cast-iron per week, the chief part of which is made into castings on the spot, for their very extensive engineering establishment.

The Millbrook Iron Company have two furnaces in blast, producing about forty tons per week, blown with cold air.

The works erecting in the anthracite district are the Venallt, in the vale of Neath, and belonging to our enterprising townsmen, Messrs. Jevons and the Messrs. Arthur, of Neath. They are carried on under the firm of Jevons, Arthur, Wood, and Co. They are building two furnaces, and hope to be in blast by the end of the year. They have a very abundant supply of both kinds of coal and ironstone.

The Ystal-y-fera works, near Swansea, are also being erected by a Liverpool company, at the head of which stands our spirited and excellent fellow-townsman, Sir Thomas Brancker. This company is building four furnaces, and I am told that they intend building four more. Their fuel is all of the anthracite kind.

The Cambrian Iron Company are erecting four furnaces near Pile, on bituminous coal, and I have been informed, intend building four furnaces in the anthracite district.

Messrs. Mellins and Co. have one furnace near Pile.

The Gwendrath is a new work about to be established by a London company near Swansea, but I could not ascertain the extent to which they intend going. Mr. Crane informed me that he knew of twelve to fourteen new iron works, of from two to eight furnaces each, erecting, and about to be erected, in the anthracite district, the existence of which will be solely attributable to his invaluable discovery.

The aggregate number of furnaces in blast in South Wales we have found to be 122; out of blast, 7; building, 31; and contemplated, 91; and, allowing for the twelve works that Mr. Crane alludes to, as being likely to be erected soon, only five furnaces each, or sixty in all, we thus find that probably within the next five years the number of furnaces in South Wales will be doubled, and number 244. Allowing an average produce of eighty tons per week for each furnace, we have the astounding quantity of 1,015,040, or, in round numbers, 1,000,000 tons of cast-iron produced in this district alone—a quantity equal to that produced last year in the whole of Great Britain.

MOTTO FOR A LOCOMOTIVE ENGINE.

Mr. Editor.—Allow me to subscribe *a motto for a Locomotive*, the effusion of an ingenious friend, if you have a corner of your Journal to fill up, perhaps, for the novelty and "naiveté," of the idea you will insert it in your next:—

"Upon the four elements I feed,
Which life and power supply,
To run my race of boundless speed,
By loss of one I die."

J. H.

IMPORTANT INVENTION IN THE MAUFACTURE OF PAPER HANGINGS.—We were favoured a few days since with an opportunity of visiting the extensive paper works of Messrs. J. Evans and Co., at the Alder Mills, near Tamworth, where we had the pleasure of witnessing the application of an ingenious and very beautiful piece of mechanism, the invention of the Messrs. Evans, to the printing of paper hangings, which cannot fail to produce a complete change in this department of our manufactures, from its superiority over the ordinary method of block printing. The Messrs. Evans would have brought their invention into practical operation many years ago, had it not been for the heavy duties imposed on the manufacture of stained papers, which, by limiting the consumption, rendered their invention comparatively useless, a fact which supplies another argument against the imposition of heavy duties upon the manufacturing skill and industry of the country. In connection with the present invention, we may here state that the Messrs. Evans took out a patent in February last, for an important improvement in the manufacture of paper, by the application of a pneumatic pump in the compression of the moisture from the pulp, by which means the substance is almost instantaneously converted into paper. By this invention they are, we understand, enabled to manufacture a continuous sheet of paper six feet in width, and nearly 2,000 yards in length every hour. This paper, as it is taken off the reel, is in every respect fit for immediate use, and is conveyed on rollers to another part of the mill, in which the printing machinery is erected, through which it is passed with great rapidity, and receives the impression of the pattern intended to be produced, with all the precision and beauty of finish which machinery can alone effect. In order to connect the operations of the paper making and printing machines, the Messrs. Evans are at present engaged enlarging their premises, and when this alteration is completed they will be enabled to print, glaze, and emboss, the most complicated and delicate patterns in paper hangings, in every variety of shade or colour, as rapidly as the paper can be manufactured. Some idea may be formed of the power of the machinery, and the importance of the invention, when we state that during our visit to the mill, the machinery was working at a rate which would produce 1,680 yards of paper per hour, consisting of two very beautiful patterns, the only hand labour employed being that of one man, who superintended the machinery, and four girls, employed in rolling up the paper in pieces of the required length. The whole process of manufacturing the paper from the pulp and impressing it with the most complicated patterns, is carried on within a comparatively small space, and with a precision and rapidity which affords another instance of the progress and triumph of science and mechanical skill, in supplying the necessaries and comforts of civilised life. We understand it is the intention of Messrs. Evans to exhibit some specimens of their beautiful manufacture at the forthcoming meeting of the British Association, and we feel confident that amongst the many objects of interest which the mechanical skill and industry of Birmingham afford, the present will excite not the least interest or gratification. We may, perhaps, here observe, that the Messrs. Evans have also executed a very ingenious design of an envelope, which seems admirably adapted for meeting the views of government in the contemplated change about to be made by the adoption of Mr. Rowland Hill's plan of a uniform penny postage. Specimens of this design have been forwarded to the Chancellor of the Exchequer for examination, and from the security which it affords against any successful attempt at forgery there appears great probability that it will be in part, if not wholly adopted.—*Midland Counties Herald.*

Cerography.—An account has appeared in the American papers of a new method of engraving, the nature of which appears to be unknown, though specimens have been published. The editor of the *Boston Daily Advertiser* says he has endeavoured, but without success, to form some conjecture as to the manner in which the work is executed,—"Being printed," he observes, "on a large sheet in common with the letter-press of a large newspaper, the plate must be of the character of a wood engraving, yet it possesses almost the delicacy of a copper-plate engraving, and abounds in lines which are evidently impracticable in wood engraving. The uniformity of the lettering, although varied by the diversity of characters afforded by the use of different fonts of type, shows that this part of the work is of the nature of stereotype casting, but in what manner the shading, roads, and other arbitrary lines are inserted, it is difficult, from an inspection of the impression, to imagine, unless it be by some process of etching. From what is stated by the inventor of the rapidity and cheapness of the execution, the size to which the plate may be extended, its adaptation to the rapid and cheap mode of printing, by which the ordinary book and newspaper printing is executed, we cannot but regard it as a very important and useful invention, particularly applicable to the printing of maps and drawings, in connexion with letter-press, for the illustration of works of almost every description." The *New York Observer* further states—"The advantages of Cerography are, 1. The engraving of many subjects can be executed with a rapidity approaching very near to that of drawing upon stone; and the whole expense of a plate prepared for the press will ordinarily be less than that of a plate in copper or wood. 2. The plate is durable under the press. A million good copies may be struck from it; and as it can be stereotyped, the number of plates may be multiplied indefinitely at a trifling expense, and each plate will give a million copies. 3. Lines of all engravings, except, perhaps, the very finest class, can be made with nearly or quite the same perfection as in copper or steal, and with less labour. 4. We know of no limit to the size of cerographic plates. We suppose they may be made as large as the bed of the largest Napier press. 5. The printing is executed with the common printing press, and of course as rapidly as wood-cut or letter-press printing. With this statement, our readers can judge, as well as ourselves, of the effects which Cerography, in the hands of accomplished artists will probably produce on the other arts of engraving. We suppose that, with an improvement of which it is evidently susceptible, it will also have an important effect on the art of printing, especially on printing in the characters of the Chinese, Hindoo, and other Oriental languages. Even in its present state, it will, no doubt, be used as a substitute for type-setting in some cases; but of this we will say more hereafter.

Artificial Ivory.—Certain parties in Sheffield have just obtained a patent for the making of a substance so nearly resembling ivory, and so applicable to all the purposes of that valuable material, that it is almost impossible to detect the difference. We understand, also, that an imitation of tortoiseshell is prepared and in use, which for some purposes is little inferior to some varieties of the real article.

Mowing Machine.—An ingenious carpenter at Ingatestone, named Groom, is engaged in the construction of a machine for mowing meadows, &c. to which he has long directed his attention: and our informant, who has seen the model, states that hopes may be entertained of a successful application of the principle. It is to be driven by hand, in the same way as Budding's machine for mowing lawns, but will work as well through valleys as on level ground; and he calculates that it will cut as wide a breadth in a day as seven or eight ordinary labourers. The work is performed by two or three sets of revolving scythes or knives, put in motion, our correspondent adds, by a somewhat complicated machinery.—*Essex Herald*

Consumption of Engine Smoke.—We have been requested, by a correspondent at Bradford, to notice a plan, which he has successfully adopted, for the consumption of engine smoke, and which we have great pleasure in submitting to our readers, convinced that few subjects of greater importance can attract public attention in this manufacturing district. Messrs. Wood and Walker, of Bradford, have applied this apparatus to four large boilers, supplying steam to two 80 horse engines, and to two small boilers, supplying a 30 horse engine; and, this week, Mr. Thompson has completed a like apparatus to two boilers, supplying a 30 horse engine. As this is a patent matter, we have not the power to enter into particulars. It is the property of a Mr. Cheetham. The saving in fuel is such as to fully remunerate the adoption of this plan; and how much the public health and comfort must be benefitted, we need not say. We are authorised by Mr. Thompson to state, that he will be happy to allow an inspection of his works to any gentleman desirous of adopting this plan.—*Leeds Intelligencer.*

REVIEWS.

Description of the Warming and Ventilating Apparatus at the Residence of Charles Babbage, Esq., Dorset Street, Manchester Square. By Charles James Richardson, F.R.I.B.A.

This pamphlet is a succinct description of one of Mr. Perkins' apparatus fitted for warming Mr. Babbage's residence, and forms an addendum to a work by Mr. Richardson on Warming and Ventilating, noticed by us some time back.

In this pamphlet, the author has given drawings, of Mr. Babbage's house, shewing what way the pipes are distributed throughout the rooms and staircase. He has also given some additional drawings upon an enlarged scale, explaining the apparatus.

Upon examining the drawings, it appears to us, that it would be far better, if instead of the pipes branching off from a multiple cock at right angles, they were made to start with a curve, and the mouth formed with a large orifice, gradually diminishing off like a trumpet, to the size of the pipe. From the want of some such arrangement, probably it is, that the dining room and bed room circulations of Mr. Babbage's residence are not effective; we imagine, that according to the construction of the multiple cock, the hot water rushes up to the end or top of the cock, and distributes itself rapidly through the two upper branches, and passes by the two lower ones, where the water circulating through the pipes creates an eddy, and prevents a free egress into the lower pipes; thereby obstructing the free circulation to the bed rooms and dining room: we should very much like to see this suggestion tried, which might very easily be done, without much disturbance of the pipes. We feel convinced that warming apparatuses are often condemned for the want of a little attention in ascertaining the causes of their failure or defect, as it is often found that in some situations, an apparatus is effective, while in others, a similar apparatus proves a total failure.

The quantity of fuel stated to be sufficient for warming Mr. Babbage's residence is very small, and if it does its duty effectively, must prove the apparatus to be very economic.

The Theory of the Steam-Engine. By Comte de Pambour. London: J. Weale. 1839.

The author has in this work entered upon a hitherto almost unexplored field of research; for the authors who had previously written on the steam-engine had scarcely touched upon the general theory. He has endeavoured to analyze the phenomena which take place in steam-engines, to point out the laws which govern their effects, and to reduce them to a perfect system. This was an arduous enterprise, and has not been altogether without success: the author has established two fundamental laws, which he considers as forming the basis of the whole theory, but he has neglected others which cannot with propriety be omitted. However, when we consider the magnitude and novelty of the undertaking, we cannot be surprised at finding some defects and omissions, which it would require a long and laborious investigation to remove; we ought, therefore, to give M. de Pambour credit for the service which he *has* rendered to science, hoping that his work, which every one who takes an interest in the subject ought to possess, will, by opening a new channel for discussion, stimulate others to join their endeavours in a work of so much general utility and interest. We wish it then to be distinctly understood that, in the observations we are about to make, we are far from having any intention of depreciating the labours of the talented author, whose chief fault seems to have been a deficiency of practical experience: our sole aim is to elicit truth, and aid, as far as lies in our power, in the advancement of mechanical science.

The work is divided into twelve chapters. Chap. I. is intended to prove the inaccuracy of the ordinary methods of calculation, and the accuracy of the proposed theory.

Chap. II. treats of the laws which regulate the mechanical action of steam.

In Chap. III. the general theory of the steam-engine is developed, and in each of the following chapters it is applied to a particular system of engine.

In the first section of Chap. I., where the ordinary mode of calculation is explained, there is a little confusion respecting the term *theoretic effect*. The author tells us, page 5, that by this mode

The force applied to the piston was computed, in supposing the pressure of the steam in the cylinder equal to that of the steam in the boiler: that is to say, the area of the piston was multiplied by the pressure of the steam in the boiler, which gave the force exerted by the engine; this result was then multiplied by the velocity of the piston, and thus was obtained the *theoretic* effect of the engine. But the result of this calculation having been compared with that of some experiments made on engines of the same kind, the ratio between the two results had furnished a fractional coefficient, which was regarded as the constant ratio between the theoretical and practical effects of all engines of the same system; therefore, in multiplying the number expressing the theoretic effect by this fractional coefficient, a definitive product was obtained, which was the *practical* effect that could be expected from the engine.

Now, the *theoretic effect* cannot be obtained without first deducting from the pressure in the boiler that on the opposite side of the piston; and the co-efficient was applied, not to the effective pressure so found, but to the total pressure in the boiler, the pressure on the opposite side of the piston being regarded as part of the direct resistance overcome, and therefore added to the useful effect.

In the next paragraph to that just quoted, the same rule is expressed algebraically, a constant coefficient being used to pass from the *theoretic* to the *practical* effect; thus, the former is expressed by $a\pi$, and the latter by $ka\pi$, a representing the area of the piston, π the pressure in the boiler, and k the constant coefficient. M. de Pambour here gives a table of the coefficients indicated by Tredgold, and in the next following paragraph corrects the above rule, by deducting afterwards the pressure on the opposite side of the piston. He then says that the coefficient ought to be applied to the *effective*, and not to the *total* pressure of the steam, in which case the coefficient must necessarily be smaller; but he states that "the calculation comes to the same either way, provided a suitable coefficient be used." One example will prove, that the calculation cannot come to the same either way, when the same coefficient is used in two cases in which the *total* pressure is different, but the pressure on the opposite side of the piston the same.

Taking the author's example of a high pressure engine working at the *total* pressure of 65 lbs. per square inch, and applying the coefficient ·6, and deducting 15 from the product, we find 24 lbs. for the *practical* effort applied by the engine, the effective pressure or *theoretic* effort being 50 lbs., so that if we had to pass from the latter to the former, we ought to make use of the coefficient ·48. (M. de Pambour calls it ·5.) If now we take another case, in which the *total* pressure is only 45 lbs., we shall find the *practical* effort by Tredgold's rule to be 12 lbs., the *theoretic* effort being 30 lbs., so that the coefficient in this case would be only ·4 to make the calculation come to the same as by Tredgold's rule. Thus, no suitable coefficient can be found, which may be applied to the effective pressure, when the total pressure varies, without essentially changing the rule.

We think the author must be in error with regard to the following rule, which he states (page 9) to have been used to calculate the evaporation necessary to produce a given effect.

The rule consisted in calculating the volume described by the piston, and in supposing that volume to have been filled with steam at the same pressure as in the boiler, and then applying to it a constant coefficient. That determined in the preceding problem was usually employed, but it was applied as a divisor, with a view to augment the evaporation in proportion to the losses represented by that coefficient.

This rule is doubtless entirely destitute of foundation, nor have we found it laid down by any author who has written on the steam-engine. Tredgold very properly omitted the co-efficient in the divisor, which has in reality nothing at all to do with the question, and Farey has erred by using too high a constant divisor in the expression of the quantity of water evaporated, which thus differs, still more widely than Tredgold's, from that condemned by M. de Pambour.

SECT. II.—*Objections against that Mode of Calculation.*

These objections are in substance as follows:—The ordinary calculation supposes that the steam, generated in the boiler under any given pressure, loses a certain constant proportion of that pressure during its passage through the steam pipes and valves.

That the steam having arrived in the cylinder as a pressure rather less than that in the boiler, a certain fixed proportion of its power is expended in friction and other resistances in the engine itself; the remainder, besides producing the useful effect, being supposed to overcome the resistance on the opposite side of the piston; excepting, in the case of high pressure engines, the force, over and above the pressure of the atmosphere, required to expel the steam from the cylinder after having accomplished the stroke.

To this is objected:—

1st. That the friction and other losses, to which the diminution of effect is attributed, cannot absorb so great a portion of the force of the steam as is supposed. To prove this, the author shows, by applying his own co-efficient ·5 to the *theoretic* effect of a high pressure engine having an *useful* effect of 100 horses power, that Tredgold allows a power of 12 horses to move the machinery, and of 40 to draw the piston. But, if he had applied Tredgold's own rule, he would have found 16·79 and 54·17 instead of the above numbers, which shew the absurdity of the rule in a still stronger light.

It is however well known that there is not actually so great a loss of effect in engines as the above rule attempts to account for, so that it is unnecessary to make such exaggerated allowances for friction; otherwise another strong objection might be urged against the rule, namely, that it gives 25lbs. *total*, or 10lbs. *effective* pressure as a limit below which steam cannot be used in high pressure engines, even without doing any work; which is contrary to experience.

The second and third objections are, that the co-efficient used to pass from the *theoretical* to the *practical* effect of an engine, is sometimes too high and sometimes too low to make the calculated results harmonize with practice, the ratio of the effect produced to the theoretical effect falling in some cases as low as ·25, and rising in others to ·8. However, until more conclusive experiments have been made, we must continue to doubt the accuracy of the facts themselves. As the author here instances five experiments from Wood's Treatise on Railroads, it is necessary to say a few words respecting them. The power of the engines, which were stationary, was calculated by multiplying the area of the pistons, by the pressure of steam in the boiler, and by the velocity of the pistons; and the work done was estimated by adding together all the various resistances calculated by certain rules, previously determined by experiment, and multiplying the sum by the velocity of the load. The ratio of the work done to the power developed by the engines, calculated as above, was found in the several cases:

·256, ·288, ·309, ·27 and ·3.

The two first experiments were made with condensing, and the three latter with high pressure engines, all stationary. To account for the loss of effect in the former, we have the loss of pressure experienced by the steam during its passage from the boiler to the cylinder, the pressure in the condenser and the friction of the engines.

The first experiment was made with an engine constructed by Boulton and Watt, with two thirty inch cylinders, length of stroke 5 feet. The steam is stated to have been generated under a pressure of 45lbs. per square inch above the atmospheric pressure, for want of knowing which we must content ourselves with assuming it at 14·7lbs., and the pressure in the condenser, for the same reason, at 1lb. per square inch.

A train of seven loaded carriages, each weighing 9408lbs., was drawn up an inclined plane 2646 feet in length, and rising 154 feet 6 inches, in 620 seconds, the engine making 374 single strokes.

Mr. Wood calculates the resistance of the load to have been equal to 4991lbs., which would require a pressure of 7062·18lbs. on the piston, or 5·020lbs. per square inch. To this we have to add the friction and losses in the engine.

Calculating the friction of the engine by Pambour's rule, page 172 of the work under review, and adding 1lb. for the pressure in the condenser, we find.

Pressure corresponding to the useful effect		5·020lbs.
Pressure in the condenser	1·000	
Friction of the engine without load	1·000	
Friction owing to the load of 5·020lbs.	0·717	
Total friction and resistance in the engine		2·717
Total pressure per square inch of the piston necessary to overcome all the friction, and resistance of the engine and its load		7·737

But the pressure in the boiler was 19·2lbs., therefore it would in this case be necessary to admit that the steam had lost 11·363lbs. in its passage from the boiler to the cylinder, which we think inadmissible, when the velocity of the piston was no more than 181 feet per minute. We are of opinion, that the fraction ·463lb. would be sufficient allowance for loss in the steam pipes and passages, in which case there would still remain 11lbs. to be accounted for. This cannot all be attributed to friction and losses in the engine; but, if we add seven eighths of it to the load, and the remaining eighth to the friction of the engine, due to that additional load by Pambour's rule, we shall have

Pressure corresponding to the useful effect		14·645lbs.
Pressure in the condenser	1·000	
Friction of the engine without load	1·000	
Friction due to the load 14·645lbs.	2·092	
Total friction and resistance in the engine		4·092
Total pressure on each square inch of the pistons necessary to overcome all the resistance and friction of the engine and its load		18·737
Loss of pressure in the pipes and passages		0·463
Total pressure in the boiler		19·200

The quantity of water evaporated on the former supposition would have been no more than 0·632 cubic feet per minute, hardly half as much as would have been allowed by Watt, namely, 1·344 cubic feet. On the latter supposition the expenditure must have been 1·430 cubic feet., or very nearly the same as Watt's allowance. It is, therefore, much more likely that the pressure in the cylinder was 18·737lbs. per square inch, than 7·717lbs., and if so, the resistances are necessarily estimated too low, or the pressure in the boiler too high, or, what is more probable, both these errors have been committed at once. It is also more than possible that Pambour's rule gives too low a result for the friction of the engine in this case. However it may be, we cannot put any confidence in such experiments, nor admit them as arguments against the ordinary mode of calculation. We are much more ready to admit that the useful effects may sometimes amount to ·8 of the whole effort of the engine; for we believe, as we have already stated, that the allowance made for friction is generally much too high.

We quote the fourth objection, as it embraces an important part of the theory of the steam engine, and we have some observations to make upon it, which materially affect the views explained by the author. He expresses himself thus:

4th. The measure of the theoretic effect of the engine results from three elements, to wit: the surface of the piston, the pressure of the steam, and the velocity of the motion. The causes which are said to explain the reduction to which this theoretic effect is liable, are: first, the friction of the engine, then the contraction of the passages, their changes of direction, the friction of the steam, its waste and its condensation. Now of the last five causes, the condensation is the only one that can diminish the *pressure* of the steam during its passage, and that condensation is almost entirely obviated by the precautions used in practice: all the remaining causes of reduction act merely on the velocity. If then these causes produce definitively a reduction in the theoretic effect, it can only be by reason of their action on the velocity.

What is here objected to is, therefore, that the pressure of the steam in the cylinder is supposed to be diminished by the contraction of the passages, their changes of direction, the friction of the steam, and its waste, which M. de Pambour asserts to act merely on the velocity; but this objection, as regards the contraction of the passages, is cancelled in Section VII., where he states that the degree of opening of the regulator acts upon the pressure in the boiler, but can have no influence on the pressure in the cylinder. Now this is admitting that the area of the passages influences the ratio of the two pressures; so that, if we suppose either of them known, the other must be determined by the area of the passages. It is most natural to assume as known that pressure which may be immediately measured, namely, that in the boiler, and conclude from that on the pressure in cylinder, which is the method usually followed. If, with the same load, and consequently the same pressure in the cylinder, a contraction of the passages causes the pressure in the boiler to rise (which must necessarily be the effect, if the velocity remains the same,) it is very clear that, with the same pressure in the boiler, a contraction of the passages will necessitate a diminution of the load, which must be accompanied by a diminution of the pressure in the cylinder. Thus, the contraction of the passages, and every other cause which tends to retard the motion of the steam from the boiler to the cylinder, may be said to diminish the pressure in the cylinder, and they cannot be said to act upon the velocity, since that is known. This last objection, therefore, falls to the ground.

The formulæ objected to in Section III. are based on a law, (that of the velocity of falling bodies, which as there applied, have no reference whatever to the velocity of the piston of an engine, which they were intended to determine. We shall therefore merely remark that the velocity sought was that corresponding to the *maximum useful effect* of an engine, and not to a given load, as M. de Pambour seems to have supposed.

SECT. IV.—*View of the Theory proposed.*

This section contains only the basis of this theory, consisting of the two following laws:—1st. That there is necessarily equilibrium between the pressure of the steam *in the cylinder* and the resistance against the piston; and 2d. That there is also a necessary equality between the production of steam and its expenditure. These laws are undoubtedly true, and we believe the author of the work before us to have been the first to point them out; but, as it is of importance that no inaccuracy, however slight, should be found in the exposition of a principle, which is supposed of itself to explain the whole theory of the steam engine, we shall quote the paragraph from page 20, in order to point out an error, which, though perhaps too trifling to be of any consequence in practice, should nevertheless be avoided in the expression of a general law.

Now in every machine which has attained a uniform motion, the power is strictly in equilibrio with the resistance; for were it greater or less, there would be acceleration or retardation of motion, which is not the case. In a steam-engine, the force applied by the mover is no other than the pressure of the steam *against the piston* or *in the cylinder*. This pressure then, in the cylinder, is strictly equal to the resistance opposed by the load against the piston.

Consequently, the steam in passing from the boiler into the cylinder changes its pressure, assuming that which represents the resistance to the piston. This principle, of itself, explains all the theory of the steam-engine, and in a manner lays its play open.

The error alluded to is, that "the pressure in the cylinder is *strictly* equal to the resistance opposed by the load against the piston." Now the mean resistance opposed by the load can never exceed the pressure which the steam exerts against the piston, which, while the piston is in motion, can never be *strictly* equal to its whole pressure *in the cylinder*, though in most, or even in all cases which occur in practice, the difference *may be* inappreciable. It would, however, have been preferable under these circumstances, if the word *practically* had been used instead of *strictly*.

The method of calculating the effort applied on the pison, consists in ascertaining the quantity of water evaporated and transmitted in the form of steam to the cylinder in a given time, which, compared with the distance travelled by the piston in that time, gives the density of the steam in the cylinder, whence its elastic force may be deduced. By the ordinary method, the elastic force of the steam is assumed to be reduced in a constant proportion during its passage from the boiler to the cylinder, the loss of elasticity being supposed to be very trifling with steam pipes, &c. of suitable dimensions, and a moderate velocity of the piston; while M. de Pambour asserts that that loss may be very great, even as much as one half of the total pressure in the boiler. This is however in opposition to the law of the flowing of elastic fluids, which must obtain in a steam engine as well as under any other circumstances. Now it must be extremely difficult to ascertain with any degree of accuracy the quantity of water which passes in the form of steam through the cylinder, particularly in locomotive engines, from experiments on which M. de Pambour deduced his theory; for the rise of the safety valve can by no means be admitted as an accurate measure of the quantity of steam escaping through it, until all the phenomena connected with it have been more satisfactorily elucidated; and no experiment can be satisfactory, unless the engine be compelled to work for a considerable length of time under precisely the same circumstances.

SECT. V.—*New proofs of the accuracy of the theory proposed, and of the inaccuracy of the ordinary theory.*

The tendency of these proofs, is to establish "that the pressure of the steam in the cylinder is strictly regulated by the resistance on the piston, and by nothing else," and implicitly, that the ratio of the pressure in the cylinder to that in the boiler is *independent* of the area of the steam passages and the velocity of the piston. It is assumed throughout that the pressure in the boiler is, or may be, the same with all loads. All this is, however, distinctly contradicted in the last paragraph of the section. The following extracts will prove the truth of our assertions.

In fact, were it actually true that the steam be expended in the cylinder, either at the pressure of the boiler, or at any other pressure that were in any fixed ratio whatever to that of the boiler, then, since the quantity of steam raised per minute in the boiler would be expended by the cylinder at one and the same pressure in all cases, and would consequently fill the cylinder a fixed number of times in a minute, it would follow that the engine, so long as it should work with the same pressure in the boiler and the same apertures or steam passages, would assume the same velocity with all loads. Now, we see that the very contrary takes place; for, the lighter the load, the greater becomes the velocity of the engine.

The *Atlas* engine, for instance, evaporated 132 cubic feet of water in drawing 195·5 tons, and 95 cubic feet only in drawing 127·6 tons. Since the same number of cylinders-full of steam was expended in each case, the steam of the first must have been of a density different from that of the second; and here again it is manifest that, notwithstanding the equality of the pressure in the boiler, and of the opening of the regulator in the two cases, the density of the expended steam followed the intensity of the resistance, that is to say, the pressure of steam in the cylinder was regulated by the resistance.

6thly. It is clear, moreover, that if the pressure in the cylinder were, as it is thought, constant for a given pressure in the boiler, then after an engine has been found capable of drawing a certain load with a certain pressure, and of communicating to it a uniform motion, it would follow that the same engine could never draw a less load with the same pressure in the boiler, without communicating to it a velocity indefinitely accelerated; since the power having been found equal to the resistance in the first case, would be necessarily superior to the resistance in the second.

7thly and lastly. On looking over our experiments on locomotives, the same engine will be seen sometimes drawing a very light load with a high pressure in the boiler, and sometimes, on the contrary, a very heavy load with a low pressure. It is then impossible to admit, as the ordinary theory would have us, that there is any fixed ratio whatever between the two pressures. This effect, moreover, is most easy to explain; for it depends simply on this, that in both cases the pressure in the boiler was superior to the resistance against the piston, and no more was needful in order that the steam, generated at that pressure, or at any other fulfilling merely that condition, might, on passing into the cylinder, assume the pressure of the resistance.

Here the author evidently assumes that a decrease of the load of an engine would not be followed by a corresponding diminution of pressure in the boiler. But it is clear that this effect can only be prevented by partially closing the regulator.

All that precedes is, as we have already stated, contradicted in the following paragraph, which is the last of the section.

It is, however, essential to observe, that we wish to establish by these reasonings, that, since the pressure in the cylinder is fixed *a priori*, it cannot depend on the pressure of the boiler; but we believe, on the contrary, as will be seen, Sect. VII., that the pressure in the cylinder being once regulated by the resistance on the piston, that of the boiler afterwards depends on it, in proportion to the size of the passages, the volume of steam produced, and the weight of the safety-valves. It would only be for want of making this needful distinction, that we could be thought to admit an entire independence between the two pressures.

SECT. VI.—*Comparison of the two theories in their application to particular examples.*

The facts here stated require a corroboration before we can admit them as evidence of the correctness or incorrectness of any theory. The examples cited are two experiments which are given, pages 233 and 234 of *Pambour's Treatise on Locomotives.*

1. The locomotive engine *Leeds*, which has two cylinders of 11 inches diameter: stroke of the piston, 16 inches; wheels, 5 feet; weight, 7·07 tons; drew a load of 81·34 tons, ascending a plane inclined $\frac{1}{1300}$ at the velocity of 20·34 miles per hour; the effective pressure in the boiler being 54 lbs. per square inch, or the total pressure 68·71 lbs. per square inch.

2. The same day the same engine drew a load of 38·52 tons, descending a plane inclined $\frac{1}{1094}$, at the velocity of 29·09 miles per hour; the pressure in the boiler being precisely the same as in the preceding experiment, and the regulator opened to the same degree.

We do not believe it possible that, under such circumstances, the pressure in the boiler could be so high in the second case as in the first. But if the pressure were really 68·71 lbs. on the square inch in the first case, we are led to the conclusion that it could not have been more than 46·44 in the second, to satisfy all the conditions supposed. On this hypothesis we should find, using the coefficient 0·625, in both cases:

1st Case.	Useful effect, by the ordinary calculation, $(68{\cdot}71 \times 0{\cdot}625 - 14{\cdot}71) \times 190{\cdot}08$	5367 lbs.
	Useful effect produced, from M. de Pambour's calculation, page 35	5404
	Difference	37
2nd Case.	Useful effect by the ordinary calculation, $(46{\cdot}44 \times 0{\cdot}625 - 14{\cdot}71.) \times 190{\cdot}08$	2721
	Useful effect produced, from M. de Pambour's calculation	2708
	Difference	13
	Mean difference	12

Thus, supposing the amount of resistances, as calculated by M. de Pambour to be correct, as well as the pressure in the boiler in the first case, but reducing the pressure in the second case in conformity with the law of the flowing of elastic fluids, and making use of the coefficient ·625, we commit an error by the ordinary mode of calculation of 37 lbs. in the first case, and 13 lbs. in the second, one *plus* and the other *minus*, so that the mean error is 12 lbs. By M. de Pambour's method, the error is 404 lbs. in the first case, and 131 lbs. in the second, one *plus* and the other *minus*, making the mean error 136½ lbs. But we have no doubt one of the resistances has been estimated too high in the second case, namely, the resistance caused by the blast-pipe. In the first case, this was assumed to be equal to 3·4 lbs. on each square inch of the pistons, which we believe to be very near the truth; but in the second case, where the cylinder is filled with steam of less elastic force, the resistance it opposes to its expulsion is taken at 5·1 lbs. per square inch, we calculate it to be about 2·6 lbs. per square inch, which makes the sum of resistances in the second case (supposing all the rest correct) less by 475 lbs. than in the author's calculation. We should thus have in this case,

Effort exerted by the engine by M. de Pambour's calculation	7215 lbs.
Effect produced, including friction, &c	6871
Difference	344

This difference, being on the same side as that in the first case, makes the mean error 374 lbs.

However, ignorant as we are as to the actual pressure in the boiler, and the exact quantity of steam which passed through the engine in the two experiments, we can offer nothing but surmises and hypotheses on the subject, hoping that all doubt and uncertainty may shortly be cleared away by more circumstantial and conclusive experiments.

We would not be understood to approve altogether of the ordinary mode of calculating the power of a steam-engine: we believe the friction of the engine to be generally much exaggerated, and we do not look upon the system as perfectly accurate; yet we cannot admit the proofs brought forward by M. de Pambour as conclusive of the inaccuracy of this, or the accuracy of his own theory.

SECT. VII.—*Of the area of the steam passages.*

We have already mentioned that the author asserts in this section "that the degree of opening of the regulator can have no influence on the pressure in the cylinder, but that its reaction, on the contrary, is upon the pressure *in the boiler*." This he endeavours to demonstrate in the 48th and following pages, but we think we can shew from the following quotation that he has miscomprehended the meaning of the expression, *that the degree of opening of the regulator influences the pressure in the cylinder,* and that his arguments fully prove that this pressure is really influenced by that circumstance.

It should be borne in mind that, when it is stated that a contraction of the steam passages is accompanied by a diminution of pressure in the cylinder, the velocity of the piston is supposed to be constant; the author admits that that contraction may change the *quantity* of steam which passes through it, therefore, a smaller quantity having to fill the same space, its density, and with it its pressure must necessarily be diminished. But M. de Pambour objects to this, that the pressure in the cylinder is always strictly determined, *à priori*, by the resistance on the piston. This is true; but if the resistance on the piston is not known, neither is the elastic force of the steam, and it is evident that with a given pressure in the boiler, area of steam passages and load, the piston of an engine can only travel at a certain velocity; so that, if the pressure in the boiler remain the same, but the area of the passages be contracted, the same velocity can only be kept up by diminishing the load or resistance on the piston, in which case the pressure in the cylinder must also be diminished, according to M. de Pambour's own theory.

In concluding our remarks on the first chapter, we will observe that, in our opinion the theory proposed does not differ in any great degree from the ordinary theory, but in consequence of the opinion entertained by the author, that there can exist *any* difference whatever between the pressure in the boiler and that in the cylinder, the results furnished by the two theories appear to be totally at variance. M. de Pambour's chief objection to the ordinary theory is to the use of a constant co-efficient; but if the co-efficient were applied to the effective pressure, instead of the total pressure in the boiler, it would be little more a *method of co-efficients* than that proposed by the author: for it would become

$$r = k\,(R - p),$$

r being the pressure on each square inch of the piston due to the load or useful effect, R the total pressure in the cylinder (which we may assume to be known, since we suppose that pressure to differ but inconsiderably from that in the boiler, and, therefore, consider it a sufficiently near approximation to take off a constant proportion of the latter), p is the pressure on the opposite side of the piston, and k the constant co-efficient. By M. de Pambour's theory we find

$$r = \frac{1}{1+\delta}\left\{(R-p) - f\right\}$$

in which f is the friction of the engine without any load. M. de Pambour estimates the fraction $\frac{1}{1+\delta}$ at $\frac{7}{8}$, and $f = 1$lb.; and if we assume $R - p = 16$, for a condensing engine, we shall have, for that particular case, $f = \frac{1}{16}(R-p)$, and

$$r = \frac{7}{8}\left\{(R-p) - \frac{1}{16}(R-p)\right\}$$

$$\text{or } r = \frac{105}{128}\left\{R - p\right\} = \cdot 8203\,(R-p).$$

If now we assume $R - p = 14$lbs., we shall have

$$r = \frac{7}{8}\left\{(R-p) - \frac{1}{14}(R-p)\right\}$$

$$\text{or } r = \frac{13}{16}(R-p) = \cdot 8125\,(R-p).$$

Thus if we made use of the co-efficient ·8203 instead of ·8125, we should commit an error of ·0078 $(R-p) =$ ·1092lb. per square inch. In the same manner it may be shewn that if we applied the same co-efficient, ·8203, when the effective pressure $R-p$ was 18lbs., the error would be ·0061 $(R-p) =$ ·1098lbs. per square inch. It is thus demonstrated, for condensing engines, that, supposing M. de Pambour's constant co-efficients to be correct, no error worthy of notice would be committed by applying a constant co-efficient to the effective pressure in the cylinder.

For high pressure engines, the same values are attributed to f and δ as for low pressure condensing engines. Thus, taking $R = 60$lbs. and $p = 15$lbs. for simplicity, we find

$$r = \frac{7}{8}\left\{(R-p) - \frac{1}{45}(R-p)\right\},$$

$$\text{or } r = \cdot 8556\,(R-p).$$

Assuming now $r = 95$, whence $r - p = 80$, we have

$$r = \frac{7}{8}\left\{(R-p) - \frac{1}{\;}(R-p)\right\},$$

$$\text{or } r = \cdot 8641\,(R-p).$$

The error committed by making use of the co-efficient ·8556 instead of the latter would be ·0085 $(R-p) =$ ·68lbs. per square inch, = ·01 r nearly. In the same manner, by taking $R - p = 10$, it may be shewn that the co-efficient ought to be ·7875, in which case the error committed by using the first co-efficient would be ·0681 $(R-p) =$ ·681lbs. = ·087 r nearly. This error is too great, even for practical purposes; but it would be easy to determine another co-efficient for the lower pressures, which should be sufficiently accurate, and the *method of co-efficients* would be as correct, and much more easy of application than that proposed in this work.

An Essay on Arithmetical Perspective; in which the representation is obtained by computation from the known dimensions and position of the object. By C. E. Bernard, C. E. 1839, J. Williams, London.

Mr. Barnard in this essay has attempted, what we believe has not been before done, to make Perspective a Science, and a branch of Mathematics. Instead of drawing the lines to vanishing points, he proposes to ascertain the relative positions, heights and lengths by arithmetical calculation, although the artist may be averse to this mode of proceeding, calculation being foreign to his profession, it will be found by the engineer and the scientific, a most interesting and valuable acquisition. We cannot do better than by letting the author explain for himself, for which purpose we shall give some extracts from the introduction.

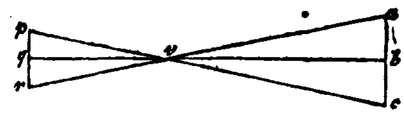
By the term Arithmetical Perspective, I mean the application of arithmetic to the purpose of obtaining the dimensions and position of the representation of an original object, which application of arithmetic amounts to this: when certain geometrical relations are found to exist between lines, we substitute the numerical values of those lines for the lines themselves. Now, as by far the greater part of the lines necessary to the consideration of perspective are imaginary ones, by making use of their values we are thus enabled to designate them, and to draw only such as are absolutely essential to a complete representation of the original. The object, however, of the present treatise is to show how we may indicate the original lines of an object, as well as the imaginary ones, by means of their numerical values; thus obviating the necessity of drawing a plan and elevation of the object to be represented perspectively.

In the description of objects whose forms are geometrical, such as buildings, by means of perspectve, it will often be the easier mode to ascertain the dimensions and position of the representation, by computation than by construction, according to the usual methods. If, for instance, a draughtsman were asked of what size should a tower, one hundred feet in height, and distant a mile, be shown upon his drawing, he would be obliged to perform several operations before the required answer could be given; the truth of which would depend altogether upon his accuracy in drawing.

Arithmetically, however, the result may be obtained with far greater correctness and dispatch, thus: if the picture be viewed at the distance of a foot, then $5280 : 100 :: 1 : x$, or $x = \frac{100}{5280} = 0.22$ in., the required height of the representation. But, before detailing the means by which we arrived at this answer, some preliminary considerations require our attention.

Proposition I.—The size of the image in the eye varies as the size of the object directly, but as the distance of the object inversely.

Let the distance vb be constant, then in the triangles avb and qvr, we have by the preceding, $ab : av = qr : vr$. Likewise in the triangles avc and pvr we have $: av : ac = vr : pr$; therefore $ab : ac = qr : pr$, and alternately $ab : qr = ac : pr$. That is to say, the size of the image is in proportion to the size of the object, when the distance remains the same.



Let the size of the object be constant; then in the triangles avc and pvr we have $ac : cv = pr : pv$, or $\frac{pr}{pv} = \frac{ac}{cv}$. But pv is constant, for it is the radial from v, the pupil, to p at the back of the eye; therefore pr, the image, varies as $\frac{ac}{cv}$: that is, as ac, the object directly, and as cv, its distance reciprocally.

We now perceive that objects vary in apparent size according to their distances, because the images of those objects in the eye actually become larger as the objects approach, or they decrease in size as the originals recede.

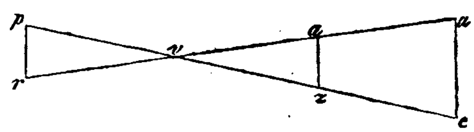
I have here considered the object to be of but one dimension, as a line. If, however, the object be of two dimensions, as a plane, then the plane of the image will evidently vary as the plane of the original object directly, and reciprocally as the square of the distance.

Mr. Barnard commences his instructions by giving some definitions of perspective, he then proceeds to lay down *preliminary propositions*, for the study of his system of perspective.

PRELIMINARY PROPOSITIONS.

Proposition 1.—The size of the image in the eye is proportional to the size of the picture, divided by the distance of the picture.

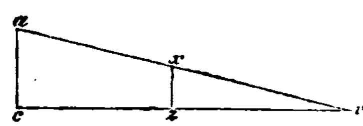
It has already been proved that the size of the image pr is proportional to the size of the object ac divided by the distance cv. Let xz, representing the plane of the picture, be drawn parallel to ac, then the triangles avc and xvz are similar, and therefore the sides about the equal angles proportional.



or . . . . $ac : cv = xz : zv$
and . . . . $pr : pv = ac : cv$
therefore . . . . $pr : pv = xz : zv$
or . . . . $\frac{pr}{pv} = \frac{xz}{zv}$

But pv is constant, therefore the image pr varies, as xz, the picture directly, but as xv, the distance of the picture inversely, which relation is the same as that already shown to exist between the image and the original object; therefore, if the representation be drawn, as here supposed, bearing the same proportion to its distance as the object does to its distance, we may then dismiss altogether the consideration of the image formed within the eye, and confine our attention exclusively to the object and its representation.

Proposition 2, *Case* 1.—The representation is equal to the product of the original object into the distance of the picture, divided by the distance of the object.

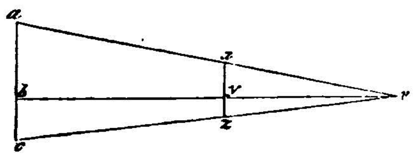


In the triangle avc let ac be perpendicular to vc, and draw zx from z parallel to ca. Then we have, by preceding propositions, $vc : ac = vz : xz$

$$\text{or } xz = \frac{ac \times vz}{vc}$$

Example:—Let ac, equal to 1000 feet, be a vertical line whose perspective representation is required; vc, equal to 5000 feet, the distance of the object from the point of sight v. Let also the plane xz, upon which the representation of ac is required to be drawn at the distance of 500 feet from v, be parallel to ac; then, to find the height xz of the representation, we have $xz = \frac{1000 \times 500}{5000} = 100$ feet., the required height.

CASE 2.



In the triangle *avc*, *ac* and *xz* are drawn parallel, being both perpendicular to *bv*. By the previous proposition we have $vb : ab = vy : yx$

and . $vb : bc = vy : yx$

adding these $2\,vb : ab + bc = 2\,vy : yx + yz$

but . $ab + bc$ is equal to ac

and . $yx + yz$ is equal to xz

therefore . $2\,vb : ac = 2\,vy : xz$

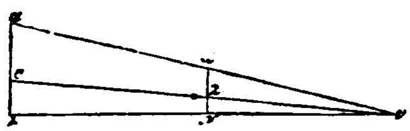
dividing each side of the equation by 2

we get . $vb : ac = vy : xz$

therefore . $xz = \frac{ac \times vy}{vb}$

Example:—Let *ac*, equal to 1100 feet, be a vertical line, whose representation is required; *vb*, equal to 5000 feet, the distance of the object, and *xz*, the plane of the picture parallel to *ac*, at the distance of 500 feet from *v*. The for the height of the representation we have $xz = \frac{1100 \times 500}{5000} = 110$ feet.

CASE 3.



In the triangle *avb* let *ab* and *wy* be both perpendicular to *vb*; then by the previous propositions

we have . $vb : ab = vy : xy$

also in the triangles *cvb* and *xvy*

we have . $vb : bc = vy : yz$

multiplying the first equation by 2, and then subtracting the second,

we get . $vb : ab - bc = vy : xy - yz$

but . $ab - bc$ is equal to ac

and . $xy - yz$ is equal to xz

therefore . $bv : ac = vy : xz$ or $xz = \frac{ac \times vy}{bv}$

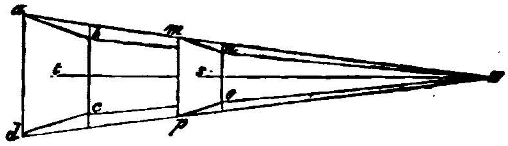
Example:—Let *ac*, equal to 900 feet, be a vertical line, whose representation is required; *vb* the horizontal distance, or distance of the object, equal to 5000 feet, and *xy*, the plane of the picture, parallel to *ab* at the distance of 500 feet from *v*. Then $xz = \frac{900 \times 500}{5000} = 90$ feet, the required height of the representation.

In each of the foregoing three cases, we observe that the same rule holds good; namely, the height of the representation is always equal to the height of the original, multiplied into the distance of the picture, and the product divided by the distance of the object, whether the base of the object be level with the point of sight, below it or above it. It is evident that the same rule applies to horizontal lines (lines drawn upon the horizontal plane), for the purpose of obtaining the widths, by merely substituting in the above proportion the word width instead of height, thus:—the width of the representation is always equal to the width of the original object, multiplied into the distance of the picture, and the product divided by the distance of the object. Observe, that this proportion for the widths holds good only when the plane of picture and the original plane are parallel.

If the distance of the picture be taken $= o$, we have $vc : ac = o : xz$, or $xz = \frac{ac \times o}{vc} = o$. If the distance of the picture be taken equal to the distance of the object, we have $vc : ac = vc : xz$, therefore $xz = \frac{ac \times vc}{vc} = ac$, the size of the original; hence the picture *xz* may have any value whatever between *o* and the original, according to the distance of the picture.

Proposition 3.—If we consider the surfaces of objects, we shall find that, the distance of the picture being constant, the representation varies as the object directly, but as the square of the distance inversely.

Let the original plane, *abcd*, and the plane of the picture, *mnop*, be parallel. We have, upon the vertical plane,— $vt : ad = vs : mp$ and upon the horizontal plane $vt : ab = vs : mn$ multiplying $(vt)^2 : ad \times ab = (vs)^2 : mp \times mn$



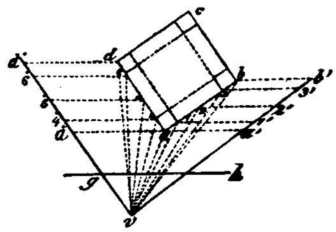
but $ad \times ab$ is equal to the surface of the plane *abcd*; also $mp \times mn$ is equal to the surface of the representation, or $(vt)^2 : abcd = (vs)^2 : mnop$ and $mnop = \frac{abcd \times (vs)^2}{(vt)^2}$

that is, the surface of the representation is equal to the original surface multiplied into the square of the distance of the picture, and the product divided by the square of the distance of the object. Now, if $(vs)^2$ be constant, then *mnop* varies as *abcd* directly, but as $(vt)^2$ inversely.

Having, I hope, already, by aid of the very few propositions just given, successfully demonstrated the leading principle, I shall now endeavour to apply the foregoing rules to some of the most obvious and general examples in perspective.

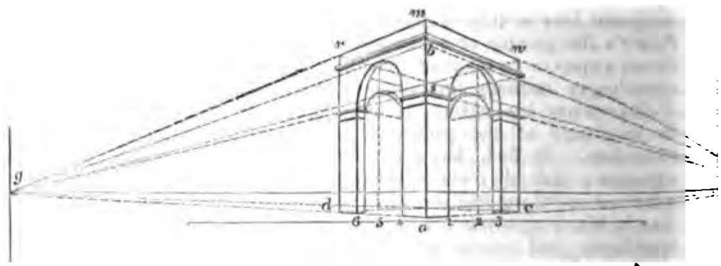
The author has given full instructions and rules for the application of the system to *Parallel perspective*, followed by similar directions for *Angular perspective*. From which we select the following practical example:—

"Required the perspective representation of a square building, of which the accompanying sketch is a plan.



"Let the length of a side be 30 feet, and the height 38 feet. Let the length of the radial *vg* be 40 in., and that of the radial *vh* 30 in.; then the distance between *gh* will be equal to 50 in.

"Upon the plane of the picture draw *gh*, and make it equal to 50 in. *(See engraving below.)*



"Let the radial distance of *g* be 120 feet; then the radial distance of *h* will be 90 feet.

"Suppose the distance *aa*, or the distance from *a* to the radial plane of *g*, to be 80 feet; then for the distance from *a* to the radial plane of *h* we have 70 feet.

"The height of the eye is 5 feet. To find its representation we have $90 : 5 = 30 : a$, or $a = \frac{15}{9}$ in. $= 1{\cdot}66$ in. below *gh*. For the distance of *a* from *h* we have $90 : 70 = 30 : a$, or $a = \frac{210}{9} = 23{\cdot}33$ in. from *h*. Set off this last distance from *h* upon *gh*, and at the distance so set off draw a perpendicular to *gh*, and make the part below it equal to 1·66 in. for the point *a*; next draw *ag* and *ah*.

"For the distance of *b* from *h* we have $120 : 70 = 30 : b$, or $b = \frac{210}{12} = 17{\cdot}5$ in. Set off that distance accordingly, to intersect *a h* in *b* and from *b* draw *bg*.

"To find the distance of *d* from *g* we have $150 : 80 = 40 : d$, or $= d\ \frac{320}{15} = 21{\cdot}33$ in. from *g*. This distance set off in like manner, from *g* to meet *ag* in *d*, and from *d* draw *dh*.

"For the height am we have $90 : 38 = 30 : am$, or $am = \frac{114}{9} =$ 12·66 in. Make am equal to 12·66 in., and from m draw mg and mh, to meet the perpendiculars from d and c in p and n. Now from p and n draw ph and ng.

"Let the thickness of each of the piers be 6 feet; then for the point 1 we have $96 : 70 = 30 : 1$, or $1 = \frac{2100}{96} = 21{\cdot}87$ in. from h. The point 2, in the centre, is $= \frac{2100}{105} = 20$ in. from h; the point 3 is $= \frac{2100}{114} = 18{\cdot}42$ in. from h.

"In a similar manner we find that the point 4 is $= \frac{80 \times 40}{126}$ in. from g; the point $5 = \frac{80 \times 40}{135}$ in., and $6 = \frac{80 \times 40}{114}$ in. from g.

"At those distances, when set off, draw perpendiculars to gh.

"Let the height of the springing s of the arches be 24 feet; then we have $90 : 24 = 30 : 8$, or $8 = \frac{72}{9} = 8$ in. above a. Make as equal to 8 in., and from s draw sg and sh.

"Let the arches be semi-circular; then the height t to the crown will be 33 feet. Hence we get $90 : 33 = 30 : t$, or $t = \frac{99}{9} = 11$ in. above a. Set it up, and draw tg and th. The intersection of tg, with the perpendicular from 5, gives the representation of the crown of the one arch; and the intersection of th, with the perpendicular from 2, gives the representation of the other arch."

The concluding sections contain practical examples, and shows the applicability of the system to *Landscape Painting*.

Although we have extracted very freely from the volume before us, we must refer the scientific reader to the essay itself, if he wishes to obtain a knowledge of the author's system, from which we are sure he will derive much pleasure, by contemplating its novelty and ingenuity

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The Ancient Half-Timbered Houses of England. *By*. M. HABERSHON Architect. Large 4to. 36 Plates. Weale. 1836.

WE know not how to account for the date upon the title-page otherwise than as an error of the press; the introductory essay bearing the date of March, 1839. It is possible, therefore, as it is so recently published, that that portion of the work may still draw forth some reply from Mr. Pugin, unless he should consider Mr. Habershon an antagonist less worthy of his notice than was the anonymous writer in *Fraser's Magazine*, or else deem it more prudent to be silent. Indeed silence appears to be almost his only course for safety, since it will be exceedingly difficult for him, we imagine, even to make a show of disproving his egregious unfairness with respect to estimating the archinture of the present day, and further his attack on Protestantism. In fact, Mr. Habershon has decidedly the best of the argument; and his remarks must convince every one, that in order to make out anything like a case in favour of his own views, and his own church, Mr. Pugin was obliged to have recourse to the most trumpery expedients and clumsy shifts, foisting upon us the house of the commandery of the Knight's Templars at Grantham, as a specimen of an ancient inn, because it is now converted into one; and dragging forward the wretched structure at Battle Bridge, as an instance of a modern *cross*, because it happens to bear the name of King's Cross. Had Mr. Pugin contented himself with showing that the Roman Catholic religion is greatly more favourable to the display of magnificence in sacred buildings than Protestantism either is or affects to be; and that with here and there an exception, our modern churches are greatly inferior in architectural character and style, he would have said no more than the truth, and no more than what the public, architects included, are ready to admit. But when he would make it appear that not only our buildings belonging to that particular class—and in which pomp and splendour are rather shunned than at all aimed at—are inferior to those of Catholic times, but that architecture itself has progressively declined among us since the Reformation, and continues to decline still more and more every day; he quite overshoots his mark, and lays himself open to the charge of either wilful blindnessa, or very great ignorance. No one can deny him zeal, even to furiousness, in support of the cause in which he has put himself forth as a volunteer advocate; yet it may be questioned whether even his own party will not consider him rather an officious bunglar. No one but a complete bunglar would have gone out of his way as he has done, in order to call attention most pointedly to one very important difference in the condition of Catholic and Protestant church; namely, that the clergy of the latter may marry, while those of the former are interdicted from doing so; which prohibition has been the source of the most enormous scandals to the see of Rome, not only among its monks and inferior clergy, but its dignitaries; nay, more, in the person of its supreme pontiffs, the popes themselves, many of whom have been men of the most notorious profligacy, surrounded by mistresses and bastards, and who, could they see Mr. Pugin's satirical etching, displaying the "Nursery windows" of the present Ely house, in Dover-street, would hold it to be a most bitter and stinging libel upon themselves.

Now, had Mr. Pugin been forced to bring forward, or even in any way to allude to this very unfortunate point of *contrast*, we might have pitied and compassionated the awkward perpelxity he must have found himself in: but when we find him actually lugging it in for the nonce, all we can say is, that he shows himself a most blundering Malaprop of an advocate, and a very great blockhead.

We have expressed ourselves with far greater vivacity than Mr. Habershon does, for he does not apply *verbis ipsissimis*, the epithets we have made use, yet what he says clearly enough proves they are richly merited; therefore the only difference between us is, that he has more of the *suaviter in modo*, than we care to display towards an offender like Welby Pugin,—one who speaks of all his professional brethren of the present day with contempt, stigmatizing them in a lump, without a single exception in favour of any one architect or any one building, but cautiously abstaining from mentioning or alluding, in any way, to what he cannot hold up to ridicule. Criticism he does not even once attempt; for, in all that he says, there is nothing that amounts to more than a brief and decisive enunciation of censure, without any attempt to specify or even explain the grounds for it. Adopting a very different course, Mr. Habershon distinctly answers all his allegations; completely anatomizes his contrasts, and examines his plates one by one, in doing which he convicts our amiable "Mrs. Candour" of the most jesuitical sophistry and cunning, and of a direct—most laboured effort to represent modern architecture in a very degraded state by making the most far-fetched and strained comparisons. According to Mr. P.'s rule, we should be justified in contrasting a village alms-house of the fourteenth century with Greenwich Hospital, the old gateway leading into Bartholomew Close with the archway at the corner of the Green Park, and Oxford Cathedral with St. Paul's, by way of showing the great progress since the time of the Reformation.

Nay, we very much question whether Mr. P. is quite sincere, because his zeal looks quite over-acted, and very much like that of a barrister who feels that he has undertaken to defend an exceedingly bad cause. As the triumph would have been infinitely greater, we naturally suppose that could he possibly have done so, he would have brought forward some of the *very best* specimens of modern gothic and confronted them with only second-rate ones of the earlier period he selects from, in order to show the prodigious superiority of the original style; whereas by resorting to a directly opposite mode of comparison, he has acted highly indiscreetly, and incautiously, and thrown a slur upon the cause he professes to defend. When he compares together Bishop Skirlaw's chapel and the one at Somer's-town; the compliment to the former is of a strangely equivocal kind, somewhat akin to that of telling a well-dressed woman she looks far more like a beauty and a fine lady than a slatternly dowdy dogs.

Setting aside, however, all unfairness of this kind, there is one circumstance which, in his "candour," the author of the contrasts ought most assuredly to have noticed and borne honest testimony to, namely, that so far from our being at all insensible to the beauties of gothic architect, the study of it has been greatly encouraged among us during the last half century, and that an acquaintance with it is now considered almost indispensable to every professional man. He might further have admitted that, considering the style was hardly begun to to be brought again into practice until the commencement of the present century, a greater proficiency has been attained to in than could reasonably be expected; and of this he might have found very satisfactory proofs had he, instead of going to the worst and most paltry modern specimens he could pick up, referred us to the buildings and designs of such men as Barry, Buckler, Rickman, Salvin, which have not merely a knowledge of, but a true feeling for the style. Nay, were all the reproaches heaped by him on Protestants and no modern architects greatly more merited than they are, from him do they not come with the best possible grace, and might therefore, at all events, be less acrimonious in tone—or has he altogether forgotten the flattering, yet certainly well-merited reception which the publications of the late Augustus Pugin met with from the very class of persons he reviles. If, after seriously considering all this, and what has been urged against him, both by Mr. Habershon and many others, Mr. Welby Pugin should still persist in the opinions he has put forth, without in any degree qualifying them, in consequence of not having duly attended, in the first instance, to all the mitigating circumstances; then we say he owes it to himself—to his character, to say so in the most direct and explicit manner, and so as to leave no room for its being imagined,—to afford no opportunity for its being said that he has neither the courage or else the ability to defend his assertions, nor the generosity to confess his errors and exaggerations. If he was at all sincere in professing to have been "actuated by no other feeling than that of advancing the cause of truth over that of error," it certainly behoves him now to admit that he had been somewhat too hasty in forming his estimate of modern English talent from the specimens which somehow or other obtruded themselves upon his notice, and caused him quite to overlook others of a far superior quality. Neither would it be altogether amiss were he to afford us the means of judging of his own taste and ability in design, by letting us see something that he himself has executed.

We have been led on to say so much more concerning Mr. Pugin than we at first intended to do, that we must now defer our remarks on Mr. Habershon's work, till our next number. All, therefore, that we have to add is, that we consider him to have greatly the better of the argument over the author of the contrasts, in every respect, and shows himself to be well informed in other matters, besides those connected with his profession. He makes a terribly hard hit at the vaunted unity of the Roman Catholic church, which once presented to Europe the singular spectacle of rival anti-popes, both of course equally infallible, *uniting* in cordially anathematizing each other. As to schism among the people, that is effectually prevented by the repression of all private opinion on matters of religion; and Mr. Habershon has expressed this so pointedly and convincingly, that we will give his own words:

"Order reigns at Warsaw," was the cruel irony of a minister in the Chamber of Deputies, after the extermination of the capital of Poland by the Russians. The Church of Rome in her extermination of the Albigenses, in her St. Bartholomew massacre, in her dragonades under Louis XIV., in the still darker acts of her inquisition, has endeavoured to destroy all who have *dared to think*—and then, drawing tighter her gags, and closing firmer her dungeons, lest a sound should escape, she repeats courageously: "See the divisions of the Protestants and the unity of the Catholics.'"

Specimens in Eccentric Circular Turning, with practical instructions for producing corresponding pieces in the art. Illustrated by Copper Plate Engravings and Cuts. By John Holt Ibbetson, Esq. *Third Edition.* London: Longman and Co.

Mr. Ibbetson is an amateur mechanic and turner, and from the appearance of the work before us, he has paid very considerable attention to his favorite art of turning. The engraving at the commencement of the volume, and explanation of a compound eccentric chuck invented and made by himself for the purpose of turning, displays considerable ingenuity in its construction, and the various engravings throughout the work, show its endless application.

We are sure all turners, whether they be amateurs or otherwise, will derive considerable pleasure and instruction from a perusal of this work, which will suggest to them, many new applications of thier art.

Boileau's Traverse Tables.

We have examined these tables, which appear to be in every respect worthy of the confidence of those who employ the method of surveying, to which they are applicable.

The author has appended several useful tables to the work, among which, are tables for converting chains into yards and feet, and *vice versa*, and he also shows how his traverse tables may be applied in setting out railway curves; but from our own experience in these matters, we are of opinion, that the practical application of the authors method is by no means easy, on account of the natural obstacles which every where present themselves to the proceedings of the engineer.

A series of Lithographed Drawings of the London and Birmingham Railway by John C. Bourne, *with Topographical and Descriptive Accounts, by* John Britton, F.S.A. Parts III. & IV. *containing* 18 *Drawings.*

This is a splendid specimen of railway art, and is a work which does credit to the artist, and communicates an interest to the railway. The two parts now before us complete the work, and are given with the letter-press to the whole; the lithograph drawings are beautifully executed, and are faithful representations. It is in fact a work which to the engineer is a splendid memorial of cotemporaneous skill, while by the nobleman and the admirer of the fine arts, it deserves preservation as a unique specimen of art, and illustrative of one of the most striking enterprises of this wonder-working age.

An Essay on the Boilers of Steam Engines, by R. Armstrong, C. E. London, John Weale.

We feel much pleasure to see the re-appearance of this very useful, excellent, and practical work, we shall not fail to notice it fully next month.

Mr. Richardson's work on Elizabethan Architecture will be noticed in the next Journal.

A second part of the Practical Treatise on Bridge Building, by Edward Cresy, Architect, &c., is just published.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

May 16.—J. G. Children, Esq. V.P., in the chair.

A paper was read, entitled

'On the Visibility of certain rays beyond the ordinary red rays of the Solar Spectrum.' By J. S. Cooper, Esq., *in a letter to* M. Faraday, Esq.

The author states his having observed an extension of the red portion of the solar spectrum, obtained in the ordinary way, beyond the space it occupies when seen by the naked eye, by viewing it through a piece of deep blue cobalt glass. He finds that the part of the spectrum thus rendered perceptible to the right is crossed by two or more very broad lines or bands; and observes that the space occupied by the most powerful calorific rays, coincides with the situation of the red rays thus rendered visible by transmission through a blue medium. The author expresses a regret that he has not had sufficient leisure to pursue the investigation of these phenomena.

May 30.—The Marquis of Northampton, P.R.S. in the chair.

Profs. C. Hansteen, M. Melloni, L. A. J. Quetelet, and F. Savart, were elected Foreign Members; Edward D. Davenport, Esq., James O. Halliwell, Esq., G. W. Mackmurdo, Esq., and the Venerable Charles Thorp, D.D., were elected Fellows.

The papers read were:—

'Fifth letter on Voltaic Combinations; with some account of the effects of a large Constant Battery;' addressed to M. Faraday, Esq. By J. F. Daniell, Esq.

The author, pursuing the train of reasoning detailed in his preceding letters, enters into the further investigation of the variable conditions in a voltaic combination on which its efficiency depends: and the determination of the proper proportions of its elements for the economical application of its power to useful purposes. He finds that the action of the battery is by no means proportioned to the surfaces of the conducting hemispheres, but approximates to the simple ratio of their diameters; and hence concludes that the circulating force of both simple and compound voltaic circuits increases with the surface of the conducting plates surrounding the active centres. On these principles he constructed a constant battery consisting of seventy cells in a single series, which gave, between charcoal points, separated to a distance of three-quarters of an inch, a flame of considerable volume, forming a continuous arch, and emitting radiant heat and light of the greatest intensity. The latter, indeed, proved highly injurious to the eyes of the spectators, in which, although they were protected by grey glasses of double thickness, a state of very active inflammation was induced. The whole of the face of the author became scorched and inflamed, as if it had been exposed for many hours to a bright midsummer's sun. The rays, when reflected from an imperfect parabolic metallic mirror in a lantern, and collected into a focus by a glass lens, readily burned a hole in a paper at a distance of many feet from their source. The heat was quite intolerable to the hand held near the lantern. Paper steeped in nitrate of silver, and afterwards dried, was speedily turned brown by this light: and when a piece of fine wire-gauze was held before it, the pattern of the latter appeared in white lines, corresponding to the parts which it protected. The phenomenon of the transfer of the charcoal from one electrode to the other, first observed by Dr. Hare, was abundantly apparent; taking place from the *zincode* (or positive pole) to the *platinode* (or negative pole). The arch of flame between the electrodes was attracted or repelled by the poles of a magnet, according as the one or the other pole was held above or below it; and the repulsion was at times so great as to extinguish the flame. When the flame was drawn from the pole of the magnet itself, included in the circuit, it rotated in a beautiful manner. The heating power of this battery was so great as to fuse, with the utmost readiness, a bar of platinum, one-eighth of an inch square: and the most infusible metals, such as pure rhodium, iridium, titanium, the native alloy of iridium and osmium, and the native ore of platinum, placed in a cavity scooped out of hard carbon, freely melted in considerable quantities. In conclusion, the author briefly describes the results of some experiments on the evolution of the mixed gases from water in a confined space, and consequently under high pressure; with a view to ascertain, first, in what manner conduction would be carried on, supposing that the tube in which the electrodes were introduced was quite filled with the electrolyte, and there were no space for the accumulation of the gases; secondly, whether, decomposition having been effected, recombination would take place at any given pressure; and lastly, whether any re-action on the current-force of the battery would arise from the additional mechanical force which it would have to overcome. These experiments the author purposes pursuing at some future time.

'*An experimental Inquiry into the Influence of Nitrogen in promoting Vegetable Decomposition, and the connexion of this process with the growth of Plants*,' by R. Rigg, Esq.

The author considers it as a general fact, to which there are very few if any exceptions, that vegetable bodies in the state in which they are produced in nature, undergo spontaneous decomposition when kept under circumstances favouring such an action; and that from the decomposition of each compound products peculiar to that substance result.

June 6.—F. Baily, Esq., V.P. in the chair.

George Barker, Esq., was elected a Fellow. The paper read:

'*Experiments on the Chemical Constitution of several bodies which undergo the Vinous Fermentation, and on certain results of the Chemical Action*,' by R. Rigg, Esq.

The special object of this paper is to show, first, that sugar is not constituted of carbon and water only; secondly, that during the vinous fermentation water is decomposed; thirdly, that neither pure carbonic acid nor alcohol, in the common acceptation of the term, is the product of this chemical action; and fourthly, that fermented liquors owe some of their valuable qualities to peculiar products formed during fermentation.

June 13.—J. W. Lubbock, Esq., Treasurer, in the chair.

The following papers were read:—

'*Researches on the Tides. Tenth Series. On the Laws of Low Water at the Port of Plymouth, and on the Permanency of Mean Water*,' by the Rev. W. Whewell.

In this memoir, the author investigates the question, how far the *mean water*, that is, the height of the tide midway between high and low water, is permanent during the changes which high and low water undergo. That it is so approximately at Plymouth, having been already ascertained by short series of observations, it was desirable to determine the real amount of this permanency by induction from longer series of observations. A period of six years was chosen for that purpose; and the method of discussing these observations was the same, with slight modifications, as in former researches. The height of low water, cleared from the effects of lunar parallax, and very nearly so from those of lunar declination, and compared with the height of high water, similarly cleared, enabled the author to ascertain whether the mean water also was affected by the semi-menstrual inequality. The results of the calculation show, that the height of mean water is, within two or three inches, constant from year to year; and that, for each fortnight, it has a semi-menstrual inequality amounting to six or seven inches;—the height being greatest when the transit is at 6 h., and least when at 11 h.,—the immediate cause of this inequality being, that the semi-menstrual inequality of low water is greater than that of high water: this inequality, however, is probably modified by local circumstances. These researches have also verified the theoretical deduction, that the height both of low and of high water being affected by the moon's declination, their mean height partakes of the variations in this latter element, in successive years, consequent on the change of position of the moon's orbit. At Plymouth, the increase in mean low water amounts to about two inches for each degree of increase in the declination. In the high water, this change is less marked. The parallax correction of the height of low water is obtained from all years alike, by taking the residue of each observation, which remains when the semi-menstrual inequality is taken away, and arranging these residues for each hour of transit, according to the parallax. The declination correction is obtained in a manner analogous to the parallax correction, from each year's observations, with some correction for the variation in the mean declination of the moon in each year.

2. '*Researches on the Tides. Eleventh Series. On certain Tide Observations made in the Indian Seas*,' by the Rev. W. Whewell.

This paper contains the results of the examination by the author of certain series of tide observations made at several places in the Indian Seas, which were forwarded to the Admiralty by the Hon. East India Company. These localities were Cochin, Corringa River, Surat roads in the Gulf of Cambay, Gogah, on the opposite side of the same Gulf, and Bassadore, in the Island of Kissmis, in the Persian Gulf.

3. '*On the Electrolysis of Secondary Compounds*,' by J. F. Daniell, Esq.

The discovery of definite electro-chemical action naturally suggests the inquiry into the relative proportion of that part of a voltaic current which, in the case of its decomposing a saline solution, is carried by the elements of the water, and that part which is carried by the elements of the saline compound, and into the definite relations, if any such there be, subsisting between the two electrolytes so decomposed. This question was the origin of the investigation which formed the subject of the present communication.

'*Experimental Researches on the mode of operation of Poisons*.' By J. Blake, Esq.

In this paper the author examines more particularly the action of those poisons which appear to produce death by affecting the nervous system.

June 20.—John William Lubbock, Esq., V.P. and Treasurer in the chair.

Sir Thomas Dyke Acland, Bart., M.P., Edwin Guest, Esq., and John Hogg, Esq., M.A., were elected Fellows.

'*On the conditions of Equilibrium of an Incompressible Fluid, the particles of which are acted upon by Accelerating Forces*,' by James Ivory, Esq., K.H., M.A., F.R.S., &c.

The intention of this paper is to examine the principles and methods that have been proposed for solving the problem of which it treats, with the view of obviating what is obscure and exceptionable in the investigation usually given of it. The principle first advanced by Huyghens is clearly demonstrated and is attended with no difficulty. This principle requires that the resultant of the forces in action at the surface of the fluid in equilibrium and at liberty, shall be perpendicular to that surface: and it is grounded on this, that the forces must have no tendency to move a particle in any direction upon the surface, that is, in a plane touching the surface. In the Principia, Sir Isaac Newton assumes that the earth, supposed a homogeneous mass of fluid in equilibrium, has the figure of an oblate elliptical spheroid of revolution which turns upon the less axis: and, in order to deduce the oblateness of the spheroid from the relation between the attractive force of the particles, and their centrifugal force caused by the rotatory velocity, he lays down this principle of equilibrium, that the weights or efforts of all the small columns extending from the centre to the surface, balance one another round the centre. The exactness of this principle is evident in the case of the elliptical spheroid, from the symmetry of its figure: and it is not difficult to infer that the same principle is equally true in every mass of fluid at liberty and in equilibrium by the action of accelerating forces on its particles. In every such mass of fluid, the pressure, which is zero at the surface, increases in descending below the surface on all sides: from which it follows that there must be a point in the interior at which the pressure is a maximum. Now this point of maximum pressure, or centre, is impelled equally in all directions by all the small columns standing upon it and reaching to the surface; and as the pressure in every one of these columns increases continually from the surface to the centre, it follows that the central point sustains the total effect of all the forces which urge the whole body of fluid. It follows also, from the property of a maximum, that the central point may be moved a little from its place without any variation of the pressure upon it: which proves that the forces at that point are zero. Thus the point of maximum pressure is in stable equilibrium relatively to the action of the whole mass of fluid: which establishes Newton's principle of the equiponderance of the central columns in every instance of a fluid in equilibrium and at liberty. The two principles of Huyghens and Newton being established on sure grounds, the next inquiry is, whether they are alone sufficient for determining the figure of equilibrium. Of this point there is no direct and satisfactory investigation: and in applying the two principles to particular cases, it has been found that an equilibrium determined by one, is not in all cases verified by the other; and even in some instances, that there is no equilibrium when both principles concur in assigning the same figure to the fluid. Further researches are therefore necessary to dispel the obscurity still inherent in this subject. In a mass of fluid in equilibrium, if we suppose that small canals are extended from a particle to the surface of the mass, the particle will be impelled with equal intensity by all the canals: for, otherwise, it would not remain immovable, as an equilibrium requires. It has been inferred that the equal pressures of the surrounding fluid upon a particle, are sufficient to reduce it to a state of rest. Hence has arisen the principle of equality of pressure, which is generally admitted in this theory. Now, if the matter be considered accurately, it will be found that the only point within a mass of fluid in equilibrium which is at rest by the sole action of the surrounding fluid, is the central point of Newton, or the point of maximum pressure. The reason is that, on account of the maximum, the pressure of all the canals terminating in the central point, increases continually as the depth increases; so that, besides the pressures of the canals, there is no other cause tending to move the particle. With respect to any other particle, the pressure caused by the action of the forces in some of the canals standing upon the particle, will necessarily increase at first in descending below the surface, and afterwards decrease; so that the effective pressure transmitted to the particle, is produced by the action of the forces upon a part only of the fluid contained in such canals. If a level surface be drawn through any particle, it is proved in the paper, that the equal pressures of the surrounding fluid on the particle, are caused solely by the forces which urge the portion of the fluid on the outside of the level surface, the fluid within the surface contributing nothing to the same effect. Thus a particle in a level surface is immoveable by the direct and transmitted action of the fluid on the outside of the level surface; but it will still be liable to be moved from its place unless the body of fluid within the level surface have no tendency to change its form or position by all the forces that act on its own particles. What has been said not only demonstrates the insufficiency of the principle of equality of pressure for determining the figure of equilibrium of a fluid at liberty, but it points out the conditions which are necessary and sufficient for solving the problem in all cases. The pressure must be a maximum at a central point within the mass: it must be zero at the surface of the fluid: and, these two conditions being fulfilled, there will necessarily exist a series of interior level surfaces, the pressure being the same at all the points of every surface, and varying gradually from the maximum quantity to zero. Now all the particles in the same level surface have no tendency to move upon that surface, because the pressure is the same in all directions: wherefore if we add the condition that every level surface shall have a determinate figure when one of its points is given, it is evident, both that the figure of the mass will be ascertained, and that the immobility of the particles will be established. Maclaurin's demonstration of the equilibrium of the elliptical spheroid will always be admired, and must be instructive from the accuracy and elegance of the investigation. That geometer was the first who discovered the law of the forces in action at every point of the spheroid; and it only remained to deduce from the known forces the properties on which the equilibrium depends. These properties he states as three in number: and of these the two, which relate to the action of the forces at the surface and the centre of the spheroid, are the same with the principles of Huyghens and Newton, and coincide with two of the conditions laid down above. The third property of equilibrium, according to Maclaurin, consists in this, that every particle is impelled equally by all the rectilineal canals standing upon it and extending to the surface of the spheroid. Now it does not follow from this property that a particle is reduced to a state of rest within the spheroid, by the equal pressures upon it of all the surrounding fluid; because these pressures may not be the effect of all the forces that urge the mass of the spheroid, but may be caused by the action of a part only of the mass. Maclaurin demonstrates that the pressure impelling a particle in any direction is equivalent to the effort of the fluid in a canal, the length of which is the difference of the polar semi-axis of the surface of the spheroid and a similar and concentric surface drawn through the particle, which evidently implies both that the pressures upon the particle are caused by the action of the fluid between the two surfaces, and likewise that the pressures are invariably the same upon all the particles in any interior surface, similar and concentric to the surface of the spheroid. Such surfaces are therefore the level surfaces of the spheroid; and every particle of the fluid is at rest, not because it is pressed equally in all directions, but because it is placed on a determinate curve surface, and has no tendency to move on that surface on account of the equal pressures of all the particles in contact with it on the same surface. Maclaurin seems ultimately to have taken the same view of the matter, when he says that "the surfaces similar and concentric to the surface of the spheroid, are the level surfaces at all depths. (Fl. §. 640.) It thus appears that the conditions laid down above as necessary and sufficient for an equilibrium, agree exactly with the demonstration of Maclaurin, when the true import of what is proved by that geometer is correctly understood. The general conditions for the equilibrium of a fluid at liberty being explained, the attention is next directed to another property, which is important, as it furnishes an equation that must be verified by every level surface. If we take any two points in a fluid at rest, and open a communication between them by a narrow canal, it is obvious that, whatever be the figure of the canal, the effort of the fluid contained in it will be invariably the same, and equal to the difference of the pressures at the two orifices. As the pressure in a fluid in equilibrium by the action of accelerating forces, varies from one point to another, it can be represented mathematically only by a function of three co-ordinates, that determine the position of a point: but this function must be such as is consistent with the property that obtains in every fluid at rest. If a, b, c, and a', b', c', denote the co-ordinates of the two orifices of a canal; and $\phi\ (a, b, c)$ and $\phi\ (a', b', c')$ represent the pressures at the same points; the function $\phi\ (a, b, c)$ must have such a form as will be changed into $\phi\ (a', b', c')$, through whatever variations the figure of a canal requires that a, b, c must pass to be finally equal to a', b', c'. From this it is easy to prove that the co-ordinates in the expression of the pressure must be unrelated and independent quantities. The forces in action are deducible from the pressure; for the forces produce the variations of the pressure. As the function that stands for the pressure is restricted, so the expressions of the forces must be functions that fulfil the conditions of integrability, without which limitation an equilibrium of the fluid is impossible. Thus, when the forces are given, the pressure may be found by an integration, which is always possible when an equilibrium is possible: and as the pressure is constant at all the points of the same level surface, an equation is hence obtained that must be verified by every level surface, the upper surface of the mass being included. But although one equation applicable to all the level surfaces may be found in every case in which an equilibrium is possible, yet that equation alone is not sufficient to give a determinate form to these surfaces, except in one very simple supposition respecting the forces in action. When the forces that urge the particles of the fluid, are derived from independent sources, the figure of the level surfaces requires for its determination as many independent equations as there are different forces. In the latter part of the paper the principles that have been laid down are illustrated by some problems. In the first problem, which is the simplest case that can be proposed, the forces are supposed to be such functions as are independent of the figure of the fluid, and are completely ascertained when three co-ordinates of a point are given. On these suppositions all the level surfaces are determined, and the problem is solved, by the equation which expresses the equality of pressure at all the points of the same level surface. As a particular example of the first problem, the figure of equilibrium of a homogeneous fluid is determined on the supposition that it revolves about an axis, and that its particles attract one another proportionally to their distance. This example is deserving of attention on its own account; but it is chiefly remarkable because it would seem at first, from the mutual attraction of the particles, that peculiar artifices of investigation were required to solve it. But in the proposed law of attraction, the mutual action of the particles upon one another is reducible to an attractive force tending to the centre of gravity of the mass of fluid, and proportional to the distance from that centre; which brings the forces under the conditions of the first problem. The second problem investigates the equilibrium of a homogeneous planet in a fluid state, the mass revolving about an axis, and the particles attracting in the inverse proportion of the square of the distance. The equations for the figure of equilibrium are two; one deduced from the equal pressure at all the points of the same level surface; and the other expressing that the stratum of matter between a level surface and the upper surface of the mass, attracts every particle in the level surface in a direction perpendicular to that surface. No point can be proved in a more satisfactory manner than that the second equation is contained in the hypothesis of the problem, and that it is an indispensable condition of the equilibrium. Yet, in all the analytical investigations of this problem, the second equation is neglected, or disappears in the processes used for simplifying the calculation, and making it more manageable; which is a remarkable instance of attempting to solve a problem, one of the necessary conditions being omitted. The equations found in the second problem, are solved in the third problem, proving that the figure of equilibrium is an ellipsoid.

The Society adjourned over the long vacation, to meet again on the 21st of November.

COLLEGE FOR CIVIL ENGINEERS.

We direct the attention of our readers to the prospectus of the above institution, which is appended to our Journal; we have not time or space to devote to it so largely as we should wish this month, but we shall not omit to make our remarks in the next. We shall merely mention now, that before the promoters can expect to have the support of the profession, there must be some alteration made in the mode of instruction, and an addition to the council; besides, we do not like the wholesale way of manufacturing engineers from the cradle, as it would appear by the tables in the prospectus is the intention of the promoters.

The Royal Academy of Sciences of Berlin appreciating the utility of the works published by the Count De Pambour, and particulary of his theory of the steam-engine which has just appeared in this countey, has, in its sitting of the 6th of June, elected him, by unanimity of votes, member of the academy.

STEAM NAVIGATION.

The British Queen.—In the notice of this splendid vessel in our July number, we omitted to state that the decorations of the saloon and passengers apartments were entrusted to Mr. Simpson, of the West Strand, London, who has displayed considerable taste in the finishing. We will here give a short description of the apartments. Immediately leading from the principal staircase and the state-room are two saloons, the one adapted for a dining, and the other as a drawing or ladies' room, either of which are especially spacious and agreeable. The dining-room, 60 feet long and about 30 feet wide, is most elaborately fitted up and decorated in the Elizabethan style, with devices and historical subjects painted in a very superior manner on a new material which gives to the painting the appearance of being worked in tapestry or worsted work; it is further enriched by additional carvings of flowers, ornaments, gilding, &c., and is, *en masse*, exceedingly chaste and unique. The staircase is of a novel description in a ship, having a double flight of stairs descending on either side, and is very richly carved in English oak. The drawing or ladies' room is much smaller than the preceding, but decorated very neatly in white with gold mouldings and arabesque hangings in corresponding colours, so that for extent, as they form a vista or nearly 100 feet in length, for variety and elegance, it can be safely said that this suite of rooms has never yet been surpassed.

Government Steamers.—It is not generally known that a steamer of very large tonnage is about to be launched from Chath m Dockyard. It will have been begun and finished in the incredibly short space of eight weeks. We are informed that this extreme expedition is an experiment under direction of the Government, in order to ascertain the shortest possible time in which such a vessel can be completed. The number of hands has been unlimited; in fact, the men are working on her at the present moment as thick as bees in a hive, and they are allowed to make as many working hours per day as they can. The sum apportioned for the labour, we understand, is 4,000*l.*; and should it not cost that, the overplus is to be divided among the men. The experiment has excited the greatest possible interest in the neighbourhood.—*Greenwich Gazette.*

The Cyclops Steam Frigate.—This magnificent vessel, the largest steam man-of-war in the world, was lately launched from Pembroke Dockyard. Her dimensions are as follows:—Length, 225 feet, beam between paddles 38 feet, depth of hold 21 feet. Her tonnage is about 1,300, being 200 tons larger than the Gorgon, launched from the same slip about eighteen months since. Her equipment, as a man-of-war, will be the same in all respects as a frigate, having a complete gun or main deck as well as an upper or quarter deck. On the main deck she will carry eighteen long 36-pounders, and on the upper deck four 48-pounders and two 96-pounders on swivels, carrying a ball of ten inches diameter, and sweeping round the horizon 240 degrees.—The Cyclops, like the vessel already referred to, will be commanded by a post captain, these two being the only steamers taking a frigate's rank. Her crew will consist of 210 men, 20 engineers and stokers, and a lieutenant's party of marines, who will have charge of the guns, all of which move upon slides and fixed pivots, thereby taking a much wider range than the ordinary carriage can give. She will be schooner rigged, but her foremast will be of the same scantling and height as that of a 36-gun frigate. Her draught of water, with all on board, including six months' provisions, completely armed, and with twenty days' fuel, will be fifteen feet. This quantity of fuel (400 tons) will be carried in the engine room, but there is space in the fore and after holds for ten days' more coal, making in all sufficient fuel for a thirty days' run. She has an orlop deck below the gun deck, of dimensions so magnificent that there is room to stow with comfort eight hundred troops and their officers, so that, taking her all in all, the Cyclops may be considered the most powerful vessel in her Majesty's service.

Steam to India.—The *Vernon*, a splendid frigate-built East Indiaman, was launched on Saturday, Aug. 3, from the building yard of the Messrs. Green, at Blackwall; she has a powerful steam engine to propel her in calms, at the rate of five knots an hour, so as to accomplish the voyage from the Lizard to Calcutta in seventy-five days.

Launch of an Iron Steamer.—On Friday, 9th ult., one of the most handsome steam vessels of her size ever built was launched from Mr. Borrie's slip adjoining his foundry. Considering that this is the first vessel of the kind constructed by Mr. Borrie, her mould and appearance bear unequalled testimony to his scientific skill. She glided into the water amid the cheers of a large concourse of spectators. The following are the dimensions of this vessel:—Length of keel, 116 feet; length on deck, 130 feet; breadth within the paddle-boxes, 21 feet; breadth over all, 37 feet; depth of hold, 9 feet; measurement, 300 tons; draught of water when launched, 15 inches. Her calculated draught, when her engines, boilers, compliment of passengers, &c., are on board, is 30 inches; but it is expected that it will not exceed 28 inches. This is, we believe, the lightest draught of water ever attained by any vessel of her size in Great Britain. She will be propelled by two engines of thirty-five horse power each. The engines have expansion valves attached, for diminishing the consumption of steam in the cylinders; and the boilers combine two arrangements in their construction, the one calculated to consume the smoke, and the other to ensure a more rapid generation of steam than any marine boilers hitherto in use. The symmetry of this vessel is greatly admired, and seems to be as near perfection as can be attained. She must be a very fast smooth-water sailer, for which alone she is adapted. Altogether the vessel is a new laurel to Mr. Borrie's increasing reputation as an engineer.—*Dundee Chronicle.*

The iron steam-boat, Robert F. Stockton, will not answer for service in the Delaware and Raritan canal, for which she was built, on account of her draught of water, which is upwards of seven feet. Her cost was more than 20,000 dollars.—*New York paper.*

Launch of an Iron Sloop.—On Monday, 12th ult., a handsome iron sloop, built by Messrs. James and Charles Carmichael, was launched from their building-yard in the Iron Works, Sea Braes. She is named the Tinker, and measures sixty tons. She appears to be an excellent vessel; and all present at the launch admired her buoyant appearance in the water. This is the first iron sailing vessel which has been built at this port; but it is probable that the trade of building iron vessels to be propelled by sails, as well as by steam, will speedily increase, and be carried on to a great extent very soon. In the yard from which the Tinker was launched there is the frame-work of an iron steamer of 200 tons, which, we understand, is to be employed on the Mid-Lothian and Fife Ferries.—*Dundee Chronicle.*

PROGRESS OF RAILWAYS.

Great Western Railway.—The works between Bath and Bristol are proceeding most satisfactory, two out of the three tunnels are all but complete. The arch of the bridge over the Avon 100 feet span is turned, and the piers of two other bridges are formed, large quantities of timber for the permanent way are ready, and every thing indicates that this portion of the railway will be opened in the ensuing spring.

Manchester and Birmingham Railway.—The viaduct across the valley at Stockport, one of the heaviest contracts on the line, is now rapidly progressing. This work consists, in part, of 23 arches of 63 feet span. These arches, or rather the centres on which the arches are to be turned, require 3,500 cubic feet of timber for the construction of each, and there are to be eight arches completely finished before the centre of the first is struck. It will, therefore, require 30,000 feet of timber in the construction of this part of the work. The brick work is theee feet in thickness. The highest arch will overtop Mr. Fernley's seven-story mill about 12 feet.—*Staffordshire Advertiser.*

Midland Counties Railway.—The contract for the erection of the station at Leicester has been undertaken by Messrs. Waterfield and Smith, in conjunction with the building company, and it is expected to be covered in by November next. The amount of the contract is under £15,000. The tunnelling under the freemen's common is now extended to nearly twenty yards, but would have been much more ere this, had it not been for the falling in of the shaft some weeks ago. The soil is hard clay.

Liverpool and Manchester Railway.—The fifteenth half-yearly meeting of the shareholders was held on Wednesday, the 24th July. By the balance sheet it appears that the total receipts for the half-year ending the 30th of June, 1839, were £123,814. 6*s*. 8*d*.; the expenses £75,602, 7*s*. 1*d*; giving a net profit for the half-year of £48,211. 19*s*. 7*d*.; to which is added, £5,089. 15*s*. 8*d*., balance from the last account, leaving a disposable sum of £53,301. 15*s*. 3*d*. From which sum the directors recommended a dividend of £4. 10*s*. per share, amounting to £49,023. 4*s*. 6*d*., leaving a balance of £4,278. 10*s*. 9*d*. to be carried to the credit of the next half-year's account, which proposition was unanimously agreed to by the proprietors.

Glasgow, Paisley, and Ayr Railway.—We have much pleasure in stating that eleven miles of this line (from Ayr to Irvine) were yesterday week passed over by an engine and train, with a party of the directors and their friends. The engine was one of those furnished by Stark and Fulton, of Glasgow, and performed remarkably well. The road was uncommonly smooth and firm for one so recently laid, part of it having only been finished the previous evening. This part of the line will be opened to the public on Thursday next. The whole line from Ayr to Glasgow, including the Arklestone tunnel and other works constructed by the Glasgow and Ayr, and Glasgow and Greenock Companies jointly, will, it is believed, be completed very early in the summer of next year.—*Railway Times, July 27.*

Lancaster and Preston Railway.—The operations of this line of railway are in a very active state of progress. At this end of the line the works are already beginning to assume a very interesting and railway like appearance. The viaduct across Water-lane promises to be a very handsome structure, the arches being exactly at right angles with the road. The skew bridge in Marsh-lane is an excellent and substantial erection, and is in a forward state of progress. On Messrs. Mullins and M'Mahon's contract the operations are proceeding most satisfactorily, and with all possible alacrity.—*Preston Chronicle.*

York and North Midland Railway.—The laying of the second line of rails is proceeding with rapidity, and will be completed from this city (York) to the junction in about four months. The other works from Milford to Altofts are progressing very favourably, and no doubt exists that the contractors will have completed their respective contracts in March next.—*Yorkshire Gazette.*

London, Southampton, and Portsmouth Railway.—Mr. T. Brassey has taken the contract for the formation of the railway from Bishop Waltham to Fareham, and has engaged to complete that portion by May next.

Bristol and Exeter Railway.—On Tuesday, 30th July, the first stone of the Bristol and Exeter railway bridge, over the river Parrett, at Bridgewater, was laid in the presence of some of the directors, and of a numerous body of workmen employed by the contractor Mr. Bromhead. The bridge is to be of stone, a single arch of 100 feet span, and is to bear the name of the "Somerset Bridge."—*Bristol Journal.*

Opening of the Versailles Railway.—This railway branches from the St. Germain railway, and was undertaken in 1838 by the Paris Rothschilds. It has been two years and a half in progress, and passes through a difficult country. It was opened on Sunday the 4th instant, and carried 12 or 15 thousand persons, giving a return of 2000*l*.

Railroads in Belgium.—We are assured that the negociations between the government and the assignees of Mr. John Cockerill are terminated, and that the Minister of Public Works intends to make Seraing the general and sole manufactory for every thing necessary for the continuation, &c., of the iron railroads. The compact, it is said, is drawn up in such a manner as not to require the approbation of the Chambers, the two ministers who have drawn it up having confined themselves to the limits of the votes of credit, which they suppose will be annually given for the iron railroads. This cannot be admitted; for if such an establishment is purchased by the state, the minister cannot apply the sums voted for the iron railroads to the payment of real property, the purchase of which has not been legally sanctioned. In such a case the Treasury would incur risks which connot be recovered by the responsibility of the ministers. A fire or an inundation might destroy Seraing and all it contains. Who then would insure for the loss, if the acts of ministers had not been ratified by a law?—*Brussels paper.*

Railways in Germany,—That part of the Taunus Railway which lies between Frankfort and Höchst was opened on the 7th inst. The first train started at five in the morning. The two places, formerly two hours asunder, have been brought within a distance of eight minutes of each other. On the same day (the 7th) the Emperor Ferdinand's Railway, from Vienna to Brunn, a distance of about nineteen German (eighty-five English) miles, was opened with great solemnity. The first tr in performed the distance in a few minutes over four hours. The day appears ts have been celebrated, particularly at Brunn, as a civic feast, and the ticke s which had been sold were disposed of by the first purchasers of them at a considerable advance, to those who were anxious to be able to boast that they had been among the first travellers by the new railway. We regret to find that the day did not pass over without an accident. In the evening, as one of the returning trains had stopped at a station to take in water, the locomotive engine of the train next in succession ran into the hindermost carriage, by which means several persons were seriously hurt, though none dangerously. The engineer to whose carelessness the accident was attributed, was immediately placed under arrest.

ENGINEERING WORKS.

NEW HOUSES OF PARLIAMENT.

We are happy in being able to state that the works connected with the embankment for the new Houses of Parliament are now rapidly drawing to a conclusion. The twelfth and last course of the granite facing of the river wall has been commenced, and we hope ere long to announce that the entire of this great hydraulic work has been completed. As there has not been any material alteration in the construction from the drawings and specification given in our first vol. pape 31, we refer to them for a full description of this solid and beautiful structure.

The coffer dam, which is one of the largest ever executed, has remained perfectly entire, and, we may say, almost free from leakage since it was closed in December last; the greatest quantity of water collected in it, including land springs and drainage, has not exceeded, we understand, twenty cubic feet per minute, which from a mass of work upwards of twenty thousand feet in area, appears almost incredible. Now that its "occupations gone," we wish to see it removed, for instead of a protection it seems merely a dingy screen to the massive fabric behind.

This undertaking, although great in extent, is we hope merely the commencement of the magnificent scheme for the embankment of the river Thames from Vauxhall to London Bridge, and from the active measures now in progress, we are not likely to be disappointed.

The foundation walls of the new Houses are rising rapidly, and keeping pace with the river wall, they are all now out of danger of the watery element, at present, although they seem merely an intricate maze of brickwork, yet shortly we shall find order and beauty springing out of this apparent chaos of confusion.

Repairs of French Ports.—The French Chambers have passed the law authorising the government to expend 43 millions more (1,700,000*l.*) on the repairs of 17 of the principal ports.

Gigantic Tunnel.—Zanino Volta, an Italian engineer, has brought forward a plan for a railway from the Lake of Zurich to Como, to join the Lombardo-Venetian railway. He proposes to pass the Grison Alps by a long tunnel, which, from his survey, he hopes to be able easily to carry through the granite rocks. M. Volta proposes to form the rails of the granite, which is of a good quality. Two cantons have already given their approbation to the plan, and the engineer hopes to obtain sufficient support to be able to carry it into execution.

Opening of the Willington and Repton New Bridge.—This admirable and useful undertaking, which was commenced about three years ago, has at length been completed, to the praise of the architect who designed and constructed it, to the honour of the spirited gentlemen by whom it was originated, and to the infinite satisfaction and delight of the inhabitants of the neighbouring localities, who set no bounds to their admiration on this occasion. The bridge is universally allowed to be a fine specimen of architecture; it has been constructed under the superintendence of J. Trubshaw, Esq., civil engineer. It consists of five arches. It has been erected at a cost of 6,210*l.*—this sum including the toll-house.—*The Staffordshire Advertiser.*

Ipswich Wet Dock.—The ceremony of laying the foundation stone of the lock connected with this great and important undertaking, took place on Wednesday, 26th June. The stone consisted of a fine block from the Yorkshire quarries, weighing about four tons; on the upper side the following inscription, on a plate of cast iron, was let into the stone:—

IPSWICH DOCK.
The first stone of this Lock was laid on the
2 th day of June, A. D. 1839,
BY
GEORGE GREEN SAMPSON, ESQUIRE, MAYOR,
Dykes Alexander, Esquire, Treasurer of the Commissioners,
Peter Bartholomew Long, Esquire, Clerk.
Engineer of the Works—Henry Robinson Palmer, Esquire, F. R. S.,
Vice-President of the Institute of Civil Engineers.
Contractor for the Works—David Thornbory, Esquire.

NOSTROS IN COMMODA PUBLICA
CONATUS, TU DOMINE SECUNDA.

On the proposed site of the Docks a vast excavation had been made, in which work much difficulty arose from the influx of spring water; but, by the erection of a steam-engine, the inconvenience was in a great measure overcome. The brick-work was then commenced, partly upon piling, and partly upon a concrete formed of gravel and lime. The lower surface of the lock is formed by an inverted elliptic arch, having a span of 45 feet, and depth of 12 feet. This arch extends in length 230 feet. the spaces being excepted in which the lock gates are to swing; of this distance, 45 feet in front of the lock, the space for the gates, and about 50 feet within the lock, are in the course of building. The extreme depth to which the foundation reaches is 16 feet below the level of low water, and will be 33 feet below the top of the coping. The number of bricks required will exceed two millions, and the quantity of stone 660 tons. It is calculated that the weight of all the materials of which the lock is to be composed, viz., brick-work, masonry, and concrete, will be nearly 12,000 tons.

Suspension Bridge across the Danube.—The patent for the construction of this bridge is granted to the Baron Signa, and will be proceeded with immediately. It will cross the Danube between Pesth and Ofen, and will connect Hungary with Austria. Mr. Tierney Clark, who built the Hammersmith Suspension bridge, is to be the engineer.—*Railway Mag.*

Chard Canal.—It is with pleasure we notice the rapid progress of this work. Upwards of fifty men are now employed in different parts of the line, and it is confidently expected that the whole will be completed by the time specified. —*Bristol Mirror.*

Rocester Bridge.—On Thursday the 8th ult., the foundation stone of the bridge about to be erected over the River Dove, was laid with masonic honors by the Earl of Shrewsbury. The bridge will have one arch of 60 feet span and three land arches, and is to be erected under the superintendance of Mr. Fradgley, engineer,

Opening of the Willington and Repton New Bridge.—This admirable and useful undertaking, which was commenced about three years ago, has at length been completed, to the praise of the architect who designed and constructed it, to the honour of the spirited gentlemen by whom it was originated, and to the infinite satisfaction and delight of the inhabitants of the neighbouring localities, who set no bounds to their admiration on this occasion. The bridge is universally allowed to be a fine specimen of architecture. It has been constructed under the superintendence of J, Trubshaw, Esq., civil engineer; and consists of five arches, It has been erected at a cost of £6,210.; this sum including the toll-house. The road from Repton to the bridge is estimated to cost £1,000., £700. of which has already been subscribed by the public; and it is confidently hoped that the remainder will soon be procured. —*Staffordshire Advertiser.*

Granton Pier.—His Grace the Duke of Buccleuch, who has just returned from the Continent, visited Granton Pier on Thursday, 8th ult., to inspect the progress of the works since his departure. Upon examination, his Grace was much satisfied to find that the Pier is now 1,500 feet in length, and we believe is to extend about 270 feet further; and that other three jetties, exclusive of the three already finished, each ninety feet long, with sheds for the receiving and housing of goods, and for the accommodation of passengers, together with two low-water slips, had been begun. His grace afterwards visited the Quarry, where 100 workmen are employed, and gave directions to Mr. Hawkins, resident engineer for the works, for certain alterations and improvements on it, so as to preserve the communication with the new road adjoining that of the Glasgow Railway, contract for water, supply of gas, and other improvements connected with the Pier.—*Dundee Chronicle.*

Port of Liverpool.—A new and commodious dock is about to be constructed by the Ellesmere and Chester Canal Carrying Company, on the site of the Herculaneum Pottery. It is to be to the southward of the spacious dock now being formed by Lord Francis Egerton, and which will be completed in about three months. Instead of railways operating injuriously on canals, as was at first supposed, it seems that they have really benefited them, as the carrying trade both of his Lordship's and the Ellesmere Company have increased so much as to render more accommodation absolutely necessary. At the south end of the town a few private and wealthy individuals have bought all the shore, from the Earl of Lefton and others, from the Brunswick Dock to within a few yards of the Dingle.—*Liverpool Mail.*

NEW CHURCHES, &c.

Consecration of Ketley Church.—This ceremony was performed by the Lord Bishop of Hereford, on the 27th July. The church is a remarkably neat edifice in the gothic style, beautifully situated on an eminence commanding a most extensive view. It is built and endowed at the entire expense of His Grace the Duke of Sutherland.

Wilts.—The foundation stone of Christ Church, at Derryhill, in the parish of Calne, Wilts, was laid on Monday, July 29, by the Marquis of Lansdowne

Isle of Portland.—Subscriptions are raising for the purpose of erecting a new church in the Isle of Portland. Her Majesty has kindly given 300*l.* towards the fund, and an endowment of 1,500*l.* has been also contributed. The sum required for building the church is 2,000*l.*

Abergavenny.—Miss Herbert is building an extra church and a row of alms-houses for the poor at her sole cost.

Wolverhampton.—A meeting was held at Wolverhampton on Tuesday, 29th July, to take the necessary steps for erecting three new churches in that place.

New Churches in the Potteries.—The district committee for Newcastle and the Potteries, appointed by the Diocesan Society of Lichfield, since their appointment, have already received in donations and subscriptions 700*l.*

New Chapel at Hartshill.—On the 23rd July, the foundation-stone was laid of a new chapel for the congregation of Independent Dissenters at Chapel End, near Hartshill, Warwickshire.

Leamington.—The new chapel of St. Mary, was consecrated by the Lord Bishop of Worcester, on Saturday 27th July last. The chapel is a gothic edifice, and will seat about 1,200 persons.

Damage to Ripon Minster by Lightning.—On Monday afternoon, 12th ult. between three and four o'clock, a heavy shower of rain fell at Ripon, attended with thunder and lightning, which appears to have done much damage to the Cathedral.

Elgin, July 25.—The monument on the Lady Hill, to the memory of the late Duke of Gordon, is now almost completed. It is ninety feet high, and has a very fine appearance from the town and country round about. A person from the top can have a clear and distinct view of Lossiemouth and the shipping, besides a long range on both sides of the Frith. The whole does great credit to the contractors, Messrs. Shand and Brander.—*Edinburgh Courant.*

Monument to the memory of Whitfield.—A meeting of the committee who superintend the service on Stinchcombe Hill took place on the evening of the celebration, when the erection of a monument on Stinchcombe Hill, in memory of Whitfield's labours, was suggested. The proposition was cordially received. The monument, if erected, will be visible from twelve counties, and from almost any place within a radius of twelve miles.—*Gloucester Chronicle.*

Paddington.—An additional church is to be built in this parish, for which architects are invited to send in designs.

Rouen Cathedral.—The works of the central tour, intended to replace that destroyed by lightning in 1822, are continued. The plan is an open spire of iron work, to reach to 400 feet from the ground, with spires at the angles half way up the great one.

The Ancient Pilgrims' Chapel at Maidstone.—This interesting little relic of early English architecture, after a lapse of 580 years, is again used as a place of public worship. It was consecrated (or rather reconsecrated) by the Archbishop of Canterbury on the 18th inst The ancient chapel which was 39 feet 6 inches long from east to west, by 25 feet wide, has been carefully restored and enlarged at the west end, from the designs and under the superintendence of J. Whichcord, Esq. It is now calculated to hold 600 persons. The cost of its restoration and enlargement has been defrayed by public subscription, and amounted to between two and three thousand pounds.

Tovil New Church, near Maidstone.—The ceremony of laying the first stone of this church was performed on the 18th ult. by the Archbishop of Canterbury, in the presence of a large body of the clergy and several thousand spectators. The church is in the early English style of architecture, and is to be built of Kentish rag stone. Its interior dimensions are 92 feet by 31 feet 6 inches in the clear, with a gallery at the west end, for the singers and children, and contains 800 sittings. It has a tower at the west end, surrounded with an octagonal spire, being together 110 feet in height. The plan of the church at the east end is in the form of half a decagon, similar to many of the churches on the Continent. The contracts amount to rather more than 2000*l*.—*A Parsonage House* is also in the course of erection, situate close to the church. The land on which both the church and parsonage are building, was the gift of the Right Hon. the Earl of Romney. The funds for the erection of the church and parsonage have been raised by public subscription, aided by a grant from the Church Building Society.

Madley Church.—The Dean of Hereford, whose taste for ecclesiastical architecture is well known, has affected a great improvement in the fine old church. He has had all the rubbish removed that had collected from time to time about the building to that extent that not one portion of its base was visible. He has converted useless materials into matters of utility and ornament; he designed a communion table, a pair of magnificent chairs, kneeling stools, reading stands, and communion rail, and repaired the stalls, all of which he has had most beautifully executed by his parish oner Mr. Davies. He has had all the painted glass arranged that was scattered about in the different windows, and placed the whole in the windows of the chancel, making a most agreeable point in harmony of colour, as well as having collected the Scriptural subjects into that order that they were originally designed for. The good taste displayed by the Dean in the arrangement of these matters, gives an interesting appearance to the chancel; and in addition to these improvemets, the Dean has made further designs in the hope that he shall, with the help of his parishioners, see them executed.—*Felix Farley's Bristol Journal.*

Dunkinfield, a Presbyterian chapel on an extensive scale, is now in course of erection under the direction of Mr. Tattersall, of Manchester. We shall, next month, give a full description of its architectural character.

PUBLIC BUILDINGS, &c.

Brecon.—A new Shire Hall is about to be erected at this place, for which tenders are requested.

Hitchen.—A new Town Hall is about to be erected, for which tenders are requested.

The Union Bank of London.—A spacious building is about to be erected for this Bank, in Argyle-place, Regent-street, under the direction of Messrs. Newnham and Webb, architects.

Chatsworth.—The conservatory which has been erected for his Grace the Duke of Devonshire is 375 feet long, 125 feet wide, and 75 feet high in the centre. We believe it is by far the largest in the world.

The Surrey County Lunatic Asylum.—The works of this building erecting from the designs, and under the general superintendence of Mr. Moseley, the county surveyor for Middlesex, are proceeding rapidly. The building presents a principal frontage of 525 feet to the south-west; the two extreme ends for a length of 112 feet, projecting 117 feet forward; the centre forms three sides of a quarangle, the principal elevation of which is completed by the superintendent's house, which, by advancing 68 feet, and having an increased elevation, sustains the consequence of the centre. The general line to the sky is broken by six towers at the angles, having an additional story, and being surmounted by battlements. The building will contain 350 patients, is fire-proof throughout, being entirely surmounted by an iron-roo:. The stile Elizabithen,—the principal front is faced with red kiln-burnt bricks, with bath-stone rustics to the quoins, plinths, cappings, mullions, reveals, strings, copings, and caps, and bases to the chimnies, and it may be said generally, that (small as the estimate may appear) no expense has been spared in making the building worthy of the rank which its dimensions entitle it to hold, either as to its picturesque or substantial construction. The contract with Messrs Baker and Son, the builders, inclusive of the offices, and airing court, walls, &c., is under 45,000*l*., subsequent contracts have been entered into for warming and heating the baths with Messrs Barlow and Co., and for the apparatus for making and laying on oil-gas throughout, with Mr. Deville of the Strand.

ANTIQUITIES.

Roman Pavement.—Lately in excavating the ground for rebuilding the Hall of the Worshipping Company of Dyers, in College-street, Dowgate-hill, at 13 ft. 8 in. below the level of the street, and just above the gravel, the workmen came to the remains of a Roman pavement, formed of small pieces of tiles about an inch square, bedded apparently on fine concrete; two thin earthen jars or bottles were also found near the same spot, one of which is in a perfect state, and two coins nearly obliterated. The lower part of the ground in which the above were found, for 4 ft. 6 in. in thickness appeared to be the sediment or earthy matter from water, probably of the ancient Wallbrook, and in it, scattered over the surface, was a large quantity, 20 cwt., of animal bones.

Newark Castle.—The interior of this venerable pile of feudal grandeur, which has resisted the storms of war and the fury of the tempest for more than 700 years, is now cleared away, and the site of the ground where the death-stricken and licentious John, the pedantic James, the equivocal Henrietta, and the irresolute and vacillating Charles, bore so conspicuous a part, is shortly to be opened as a cattle market for the borough. The ground is the property of W. F. Handley, Esq. who purchased it at the late sale of the crown lands.—*Nottingham Review.*

Ancient Trundle Wheel.—A part of an ancient trundle wheel was found a few days ago in Chalmerston Moss, on the surface of the clay, and about 15 feet of moss above it; from which circumstance it is supposed that it must have lain there for nearly 2,000 years. The construction is remarkably simple. The various parts are held together without nails, but in a strong and efficient way.—*Stirling Observer.*

Roman Causeway.—Some works for improving the channel of the Scheldt have necessitated several extensive cuttings across the old Roman causeway, called La Chausée de Brunehaut, which connects, in a straight line, the towns of Bavay and Tournay. These cuttings took place on the spot described in the itinerary of Antoninus as the Pons Scaldis. In the course of the work there have been discovered, on various points, remains of constructions and large quantities of materials, which indicate the site of a town or large village, and it appears that in this locality several bridges had been thrown over the Scheldt. This discovery shows that the point given by antiquaries as Pons Scaldis, was not merely a bridge over the Scheldt, but a Roman station, which was probably fortified.

Roman Pavement.—A very interesting discovery was made a few days back in digging a cellar near the High Bridge. The workmen uncovered a large portion of Roman pavement composed of rude material. A layer of stones had first been placed down, and over these, obliquely and about half an inch apart, small flat tiles, the whole being converted into a solid mass by filling up the crevices with a red cement. The pavement was a foot below the present surface, and was evidently the floor of a Roman dwelling-house. It was broken up, and removed; the fragments now lie on Mr. W. Rudgard's wharf.—*Stamford Mercury.*

Hull.—Modern improvement has just destroyed the most ancient building in Hull, except the chancel of Trinity Church, the oldest relic in the town. The space required for the erection of a new watch-house, leased by the corporation of the town to the Commissioners of Her Majesty's Customs, has led to the pulling down of the old Chain House, at the south end of High-street.—*Hull Advertiser.*

Ancient Coin.—In one of the cuttings of the railway near Croydon, a few days since, a workman found a gold noble of Edward III. in excellent preservation. On the obverse side is the king in a ship, crowned and in armour, with sword and shield, the latter bearing the arms of England and France.

MISCELLANEA.

Alloy of Metals.—A curious and valuable discovery has just been made in the alloy of metals. A manufacturer of Paris has invented a composition much less oxidable than silver, and which will not melt at less than a heat treble that which silver will bear; the cost of it is less than 4*d*. an ounce. Another improvement is in steel; an Englishman at Brussels has discovered a mode of casting iron so that it flows from the furnace pure steel, better than the best cast steel in England, and almost equal to that which has undergone the process of beating. The cost of this steel is only a farthing per pound greater than that of cast iron.

Engraving on Marble.—Mr. Rayner, of Derby, has made a discovery in art—a new method of engraving on marble. Some of his pictorial efforts have elicited great admiration. Her Majesty is in possession of a variety of specimens, and the nobility in England and France have introduced them into their drawing-rooms.

Lecture on Architecture.—On Wednesday evening, the 7th ult., the first of a course of six lectures, an Ecclesiastical and Domestic Architecture, was delivered by Mr. Hadfield, of Derby, to the members and friends of the Mechanics' Institution, of Ilkeston. We understand that Mr. Hadfield intends lecturing in every town and large village in the county of Derby, as he is devoting his time to an Architectural survey of its Churches; an accurate description of which he is about to publish in a small work, to be entitled, "An Architectural Gazetteer of the county Derby."

Falling Stars.—During the night of Friday and Saturday the 9th and 10th of August, the heavens were bestrewed with little falling stars of extraordinary brightness. Mr. Forster counted above 600 of them. It is not a little singular that the peasants of France and Saxony have believed for ages past that Saint Lawrence weeps tears of fire, which fall from the sky every year on his fete, the 10th of August. This ancient German tradition, on observation, has led within these few years to the discovery of a fact, which now engages the attention of astronomers. The inhabitants of Brussels can bear witness that in the night of the 10th of August this year Saint Lawrence shed abundance of tears.

A new method of preserving iron-work from rust has been communicated by M. Paymen to the French Institute. It consists in plunging the pieces to be preserved in a mixture of one part concentrated solution of impure soda, (soda of commerce,) and three parts water. Pieces of iron left for three months in this liquid had lost neither weight nor polish: whilst similar pieces immersed for five days in simple water were covered with rust.

Simple Remedy to Purify Water.—It is not generally known as it ought to be, that pounded alum possesses the property of purifying water. A large table-spoonful of pulverized alum, sprinkled into a hogshead of water (the water stirred round at the time), will, after the lapse of a few hours, by precipitating to the bottom the impure particles, so purify it that it will be found to possess nearly all the freshness and clearness of the finest spring water. A pailful containing four gallons, may be purified by a single tea-spoonful.—*Doncaster Chronicle.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 29TH JULY TO 26TH AUGUST, 1839.

WILLIAM COLCHESTER, of Ipswich, merchant, for "*an improved soap frame.*"—Sealed, July 29; six months allowed for enrollment.

CHRISTOPHER NICKELS, of York Road, Lambeth, Gentleman, for "*improvements in cutting India-rubber.*"—August 1; six months.

LOUIS FRANCOIS FENILLET, of George Yard, Lombard-street, Gentleman, for "*improvements in casting type for printing.*"—August 1; six months.

SAMUEL SIDNEY SMITH, of Suffolk-place, Hackney-road, for "*certain improvements in machinery for raising water.*"—August 1; six months.

JOSEPH WEBB, of Huddersfield, for "*improvements in machinery for raising the pile of woollen and other cloths.*"—August 1; six months.

ALPHONSE RENE LE MIRE DE NORMANDY, of Cheapside, Doctor in Medicine, for "*certain improvements in the manufacture of inks and dyes.*—August 1; six months.

WILLIAM ABBOTT, jun., of Wyndham-place, Middlesex, Gentleman, for "*improvements in the manufacture of felt.*"—August 1; six months.

THOMAS KNOWLES, of Manchester, cotton spinner, for "*certain improvements in machinery or apparatus used in the preparation of cotton and other fibrous substances.*—August 1; six months.

WILLIAM MILLER, of Clithero, Lancaster, engineer, for "*certain improvements in grates used in steam-engines or other furnaces or fire places.*"—August 1; six months.

PIERRE JACQUES FERIER, of No. 5, Paul's-chain, Saint Paul's Churchyard, jeweller, for "*certain improvements in the construction of vapour and hot-air baths.*"—August 1; six months.

SAMUEL GUPPY, of the City of Bristol, merchant, for "*improvements in a certain process and apparatus used in the manufacture of soap.*"—August 1; six months.

WILLIAM MORRETT WILLIAMS, of Bedford-place, Commercial-road, for "*an improved lock and key.*"—August 1; four months.

JOHN HUMPHRIES, of Kidderminster, carpet manufacturer, for "*certain improvements in the manufacture of carpets and rugs.*"—August 1; six months.

JOHN MERCER, of Oakenshaw, in the county of Lancaster, calico printer, JOHN DYNELEY PRINCE, the younger, of Manchester, calico printer, and WILLIAM BLYTHE, of Church, in the said county, manufacturing chemist, for "*certain improved processes to be used in the printing, dyeing, or colouring of cotton, woollen, silk, or other cloths and yarns.*"—August 1; six months.

SIR JOHN SCOTT LILLIE, of Kensington, Knight, for "*certain improvements in the application of elastic fluids to the working of machinery.*"—August 1; six months.

JOHN MOORE, of Broad Weir, Bristol, Gentleman, for "*an improvement or improvements in the steam-engine or steam-engine apparatus.*"—August 5; six months.

JONATHAN FELL, of Workington, Cumberland, for "*improvements in building ships and other vessels.*"—August 5; six months.

ROBERT WILLIAM JEARRARD, of Oxford-street, architect, for "*certain improved means of retarding wheeled carriages.*"—August 6; six months.

JOSEPH WHITWORTH, of Manchester, engineer, for "*certain improvements in machinery, tools, or apparatus, for planing, boring and cutting metals or other substances.*"—August 7; six months.

THOMAS BURR, of Shrewsbury, lead merchant, for "*improvements in roll-lead and other soft metals.*"—August 8; six months.

JOHN FITZPATRICK, of Stanhope-street, Clare-market, Gentleman, for "*a new and improved method of making and manufacturing thread and linen, by means of a material not hitherto used for that purpose.*" Communicated by a foreigner residing abroad.—August 10; six months.

ROBERT VARICAS, of Burton-crescent, Middlesex, surgeon, for "*improvements in rendering fabrics and leather water-prooof.*"—August 10; six months.

NELSON JOHN HOLLOWAY, of Pentonville, Gentleman, for "*an improved head for carriages.* Communicated by a foreigner residing abroad.—August 13; six months.

HENRY BROWN, of Mile-end, for "*a new covering or plating for household furniture, picture frames, cabinet and fancy work, and other articles of domestic and personal use, and the mode of making such covering or plating.*"—August 13; six months.

MILES BERRY, of Chancery-lane, Middlesex, Patent Agent, for "*a new or improved method of obtaining the spontaneous reproduction of all the images received in the focus of the camera obscura.*" Communicated by a foreigner residing abroad.—August 14; six months.

JAMES CAPPLE MILLER, of Manchester, Gentleman, for "*certain improvements in printing calicoes, muslins, and other fabrics.*"—August 15; six months.

JOHN MASON, of Rochdale, machine maker, for "*certain improvements in machinery or apparatus for boring and turning metals and other substances.*'—August 15; six months.

WILLIAM BRIDGES ADAMS, of Porchester-terrace, Bayswater, Gentleman, and JOHN BUCHANNAN, of Glasgow, coach builder, for "*certain improvements in the construction of wheel carriages, parts of which improvements are also applicable to machinery for propelling, and also for the purpose of securing ships and other vessels, and for communicating motion between different portions of machinery.*"—August 16; six months.

JOSEPH SCHOLEFIELD, of Littleborough, Lancaster, cotton spinner, and EDMUND LEACH, of Littleborough, aforesaid, manager, for "*certain improvements in looms for weaving various kinds of cloth.*"—August 17; six months.

MATTHEW UZIELLI, of King William-street, London merchant, for "*improvements in the modes of impregnating wood or timber with chemical materials.*" Communicated by a foreigner residing abroad.—August 17; six months.

GEORGE AUGUSTUS KOLLMAN, organist of Her Majesty's German Chapel, Saint James, for "*improvements in railways, and in locomotive and other carriages.*"—August 17; six months.

JAMES VARDY, of Wolverhampton, Gentleman, and MORITZ PLATOW, of Poland-street, Oxford-street, engineer, for "*improvements in making decoctions of coffee and other matters.*"—August 17; six months.

STEPHEN JOYCE, of Croydon, Surrey, artist, for "*certain improvements in stoves for warming the air in buildings, which improvements are also applicable for cooking or for communicating heat for other useful purposes.*"—August 21; six months.

MOSES POOLE, of Lincoln's Inn, Gentleman, for "*improvements in introducing elastic materials into fabrics, to render them elastic or partly elastic.*" Communicated by a foreigner residing abroad.—August 23; six months.

WILLIAM COLES, of Charing-cross, Middlesex, Esquire, for "*improvements in reducing friction of machinery used in propelling vessels, lathes, and other machines.*"—August 23; six months.

CHARLES BARWELD COLES, of Allsop-terrace, New-road, Gentleman, for "*improvements in the method of fixing and carrying fire-arms on horseback.*"—August 23; six months.

JOHN AUGUSTUS TULK, of Seaton and Lower Iron Works, Cumberland, Iron Master, for "*improvements in the manufacture of iron.*"—August 26; six months.

HENRY PUIKUS, of Old Slaughters Coffee House, Saint Martin's-lane, Gentleman, for "*improvements in the methods of applying motive power to the impelling of machinery, which improvements are applicable to several useful purposes.*"—August 26; six months.

JAMES BOGARDUS, of Trinity-square, Tower-hill, Gentleman, for "*improved means of applying labels, stamps, or marks to letters, and such other documents.*"—August 26; six months.

THOMAS MAC GAURAN, of Golden-terrace, Pentonville, for "*improvements in the manufacture of paper from a material not hitherto so employed.*"—August 26; six months.

JOHN MUIR, jun., merchant, of Glasgow, for "*certain improvements in the apparatus connected with the discharging-press, for conducting, distributing, and applying the discharging liquors, and the dyeing liquors.*"—August 26; six months.

TO CORRESPONDENTS.

A Subscriber's queries shall be answered in the next Journal.

The communication relative to Bunnet and Corpe's Concentric Engine, we have been obliged to postpone for want of space until next month. We must plead the same excuse for Lieut.-Col. T.'s *communication, although his article is in type, and the drawings engraved.*

Nelson Memorial—*We have received some additional particulars of designs exhibited at the St. James's Bazaar, for which we cannot find space in the present number. They shall appear next month.*

The Journal for next month will contain 8 pages extra, *and contain some important papers connected with the profession, we will then endeavour to bring up all arrears.*

We feel obliged to Mr. Casey of America, for his communication which arrived as our work was going to press. We shall be glad to hear from him again.

The Editor will feel obliged to country subscribers if they will forward any account of works in progress, or any newspapers containing articles or paragraphs connected with the objects of the Journal; it will also be doing a great service if engineers and architects will cause all advertisements connected with contracts to be inserted in the Journal.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, please to direct it to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th *(if with wood-cuts, earlier), and advertisements on or before the 25th instant.*

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD. PRICE 17*s*.

PLANS, SECTIONS, AND ELEVATION OF A ROASTING AND BAKING OVEN.

Fig. 1.—Elevation of Front of Oven.

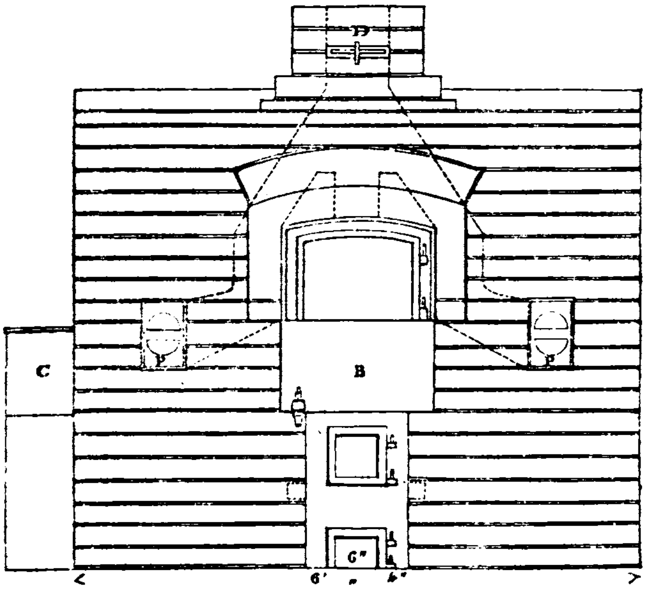


Fig. 2.—Transverse Section through Centre of Oven.

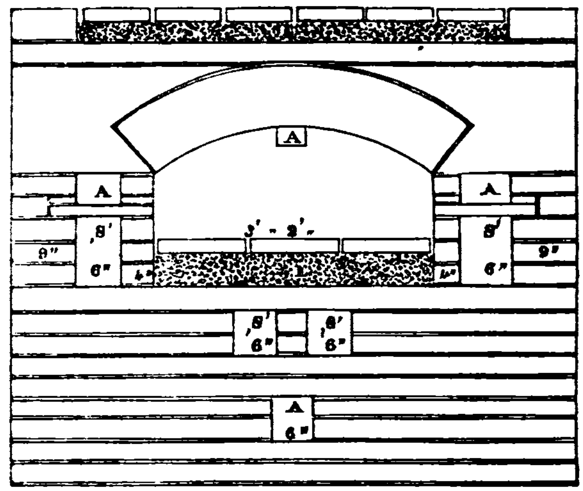


Fig. 3.—Plan showing the Furnace, Smoke Flues, &c.

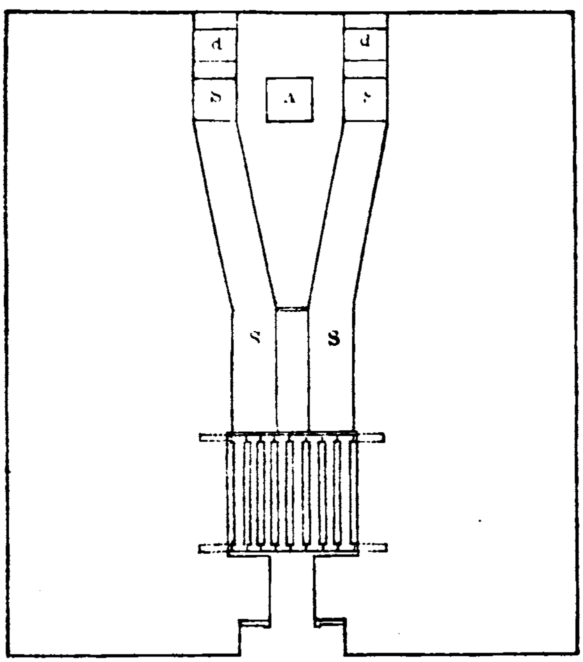
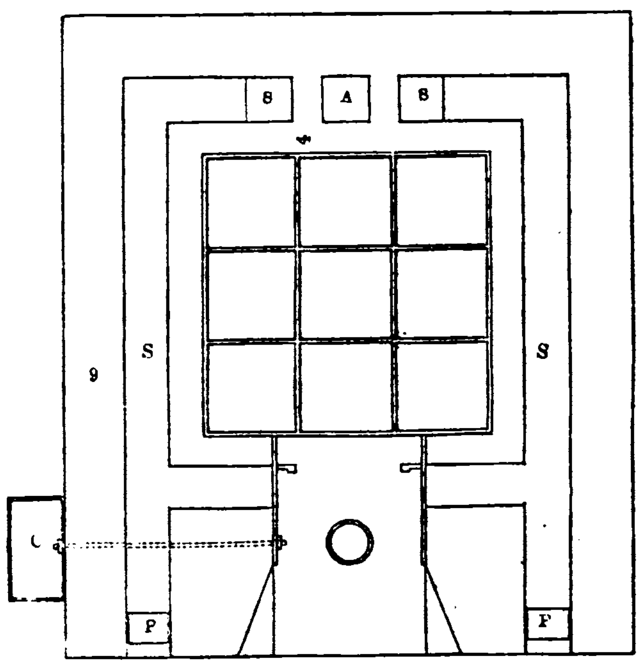


Fig. 4.—Plan showing the Floor of the Oven, Smoke and Air Flues, &c



A, hot air flues. S, smoke ditto. P, stoppers of ditto. W, welsh lumps. B, boiler. C, supply cistern. D, damper.

Scale of Feet.

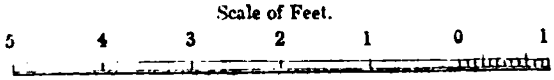


Fig. 5.—Plan showing the Ash-pit and Hot Air-flue.

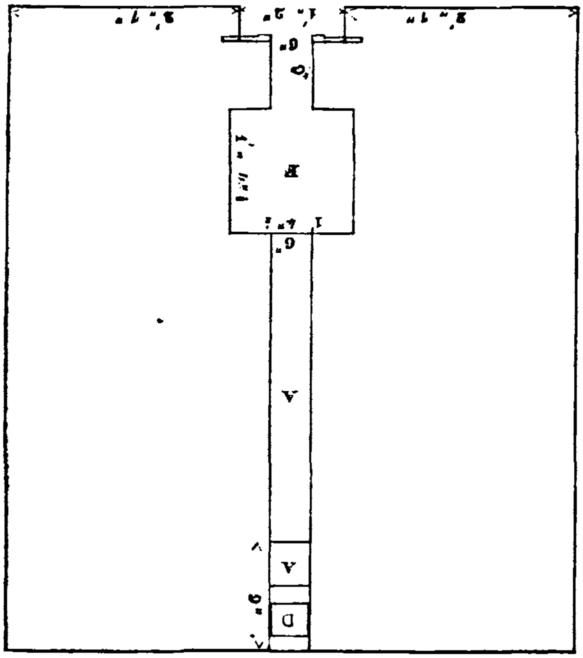
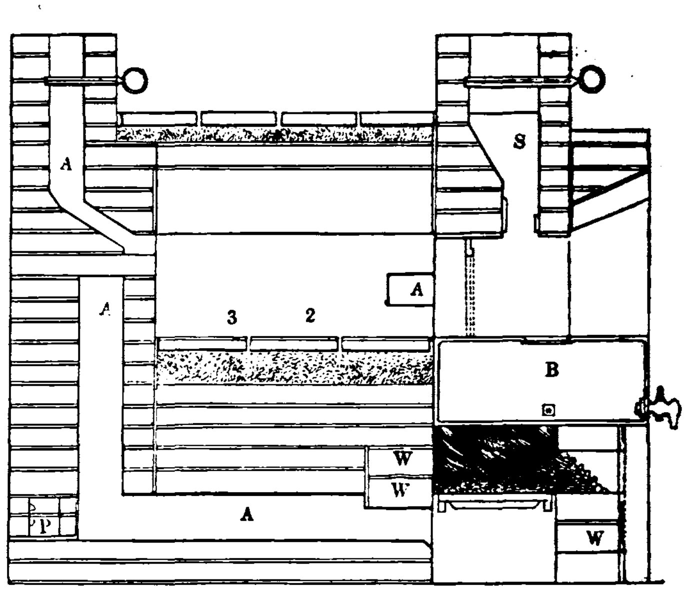


Fig. 6.—Longitudinal Section through Centre of Oven.



A ROASTING OR BAKING OVEN.

Sir—In answer to your call for communications, I feel as a constant reader that it is my duty to contribute occasionally my mite, I will therefore now address you on the subject of Kitchen Fire-places.

Roasted meat is a favourite mode of cookery in England, although not quite so much in vogue as it was previous to 1815. Kitchen fire-places are constructed chiefly for this purpose—but the consumption of fuel is far greater than is required to effect the object in view, consequently there is a waste of material, and an unnecessary inconvenience from excessive heat. The latter is more particularly felt in town-built houses, in which the kitchen is generally on the basement floor. Here the heated air ascends and fills the house with offensive effluvia. Another inconvenience arising from open kitchen fire-places is, that the boiling process cannot be regulated with any certainty. It is a well known fact that violent ebulition is not only not necessary, but is even injurious, and that simmering is the extent required especially in soup-making. Now this medium can never be attained on open fire-places. I would propose to put an end to this waste of fuel, and annoyance to all parties, from the cook upwards, by doing away with open kitchen fire-places entirely, and substituting a mode of roasting which would be more effectual, and under a perfect controul.

The difference between meat roasted before an open fire-place, and baken in an oven, consists in this, that in the one case it has been exposed to a change of air, and in the other case the meat has been dressed in the same air, and in a confined space. Now if we can construct an oven which shall have a constant current of heated air passing through it, I conceive that meat can be more effectually roasted in it than it could be before an open fire-place, and that such an oven will be more convenient in all respects, more economical, and not liable to the objections which I have hinted at as consequent on open fire-places.

Annexed are six drawings of a roasting or baking oven which I designed in 1833, and I will now proceed to explain its mode of action.

The boiler B to be made of cast-iron 2′ 6″ × 1′ 9″ × 1′ 0″ having an opening into it on the top of 6″ diameter, for the purpose of cleaning it out, and for receiving a steaming vessel for cooking vegetables, &c., a cock to draw off boiling water, and a pipe to supply cold water from a small cistern C, having a ball cock or other contrivance, so that the supply may be self-acting. The upper surface of this boiler forms the plate under the oven door.

The furnace is placed under the boiler. The smoke flues S proceed horizontally by two openings, each 6″ × 6″ on the level of the 7th and 8th courses of brickwork, (from the floor line), inclining to the right and left until they clear the hot-air flue A; here they rise perpendicularly to the level of the tenth, eleventh, and twelfth courses, passing on each side of the oven, and separated from it by 4 inches of brickwork, until they reach the cast-iron frame of the oven door, which is placed on the boiler; here they again rise, and they ultimately join in one flue 9″ × 9″ over the centre of the door, and under the damper S. The opening into the furnace 6″ × 6″ is by a cast-iron door in which is an opening of 2″ × 1″ having a sliding shutter, by which it may be partially, or wholly closed.

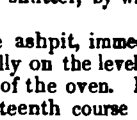
The hot-air flue A 6″ × 6″ enters from the ashpit, immediately under the bearing bar, and proceeds horizontally on the level of the third and fourth courses, until it clears the back of the oven. Here it rises perpendicularly until it reaches the fourteenth course (and a part of the thirteenth), where it branches to the right and left immediately over the smoke flues, and separated from them by a tile. The joint between the tile to be protected by a piece of slate or thin iron, to prevent any smoke from rising into the hot-air flues. These flues proceed horizontally until they reach the side of the oven near the door, where they are admitted into the oven by two openings 6″ × 4″ each, the upper part of the openings being on the level of the springing.

The hot-air makes its exit at the back of the oven, close under the soffit of the arch. From thence it may be carried up into a drying closet, or the hot-air may be made available for any other useful purpose.

The entrance into the ashpit may be closed partly or wholly, by means of the cast-iron door having an opening in it of 2″ × 1″, and a sliding shutter, similar to that of the furnace door.

According to this mode of construction the smoke never enters the internal part of the oven; but when the gross particles of the coals have been carried off through the smoke flues, and the fire burns bright and clear, the action of the furnace may be reversed by pushing in damper of the smoke flue S, opening the damper of the hot-air flue A, closing wholly the ashpit door, and opening the shutter of the furnace door. By these means nearly the whole of the heat produced by the combustion of the fuel will be carried into the internal part of the oven, through the hot-air flues.

The hot-air should come in contact with every part of the surface of the meat, both upper and lower, and therefore the meat ought to be supported on the points of iron crows feet of this shape. By these the whole apparatus of spits, smoke-jacks, &c., would be superseded.



Should other additional contrivances be wanted in large establishments for stewing, simmering, or boiling operations, hot plates and confectioners furnaces may be advantageously introduced; but in all these cases the means of ventilation immediately over them should be provided, so that the unwholesome fumes may escape through flues into the open air.

I am, Sir, your humble servant,
Robert Thomson, Lieut.-Col., R.E.

Dover, 12th July, 1839.

IMPROVEMENTS IN BUILDING.

Our indefatigable friend and fellow labourer, Mr. Loudon, during the last summer made a tour in the Midland Counties and collected much valuable information, which he has published in the *Gardener's Magazine*. That part which more immediately relates to the objects of our Journal, Mr. Loudon has kindly given us permission to publish, accompanied by the *wood engravings*.

Milford and Belper, a few miles from Derby, are two of the scenes of the extensive manufacturing operations of the Messrs. Strutt; and here we saw some contrivances, which we think, if more known, would be extensively used. Among these the most important is, the system of warming and ventilating invented by the late Mr. William Strutt, and first used in these works, and described in Sylvester's *Philosophy of Domestic Economy*, 4to, Lond. 1821, and now in general use throughout Britain for large buildings; but there are various others, some of which we shall attempt to describe.

Cottage Window Staybar.—One of the most universally useful of these is a window fastening, or staybar, as it is technically called, for cottage windows, or the windows of manufactories, or, indeed, buildings of any kind where the windows are fixed, and do not slide in grooves, or are not suspended by lines and weights. This contrivance has the merit of being perfectly simple, very economical in its first cost, and not liable to go out of order. The same principle is applicable to the opening and shutting of doors and gates of almost every kind, as well as to windows. To give an idea of the value of this contrivance, it is necessary to observe that, in the latticed windows of cottages, there is very frequently either one entire frame, or a portion in the centre of one, which opens, and is kept open, by an iron staybar with an eye at one end, which moves on a staple attached to the fixed part of the sash, and a hook at the other which drops into an eye in the part of the sash which is to be opened. Now, the objection to this hooked fastener is, that as there is only one eye for the hook to drop into, the window can only be opened to the same width, whether the ventilation required be little or much; and, when the staybar is not in use, it hangs down, and is blown about, and very frequently breaks the glass. The new staybar, on the other hand, opens the window or door to which it may be applied to various widths at pleasure, from an inch to the whole width of the window or door, and the staybar can never hang down, or run the slightest risk of breaking glass. The general appearance of the new staybar, supposing the window to be open to its full extent, is shown in Fig. 95, in which *a* is the staybar, which turns on the pivot *b* at one end, and slides along a horizontal groove under the guide bar *c* at the other.

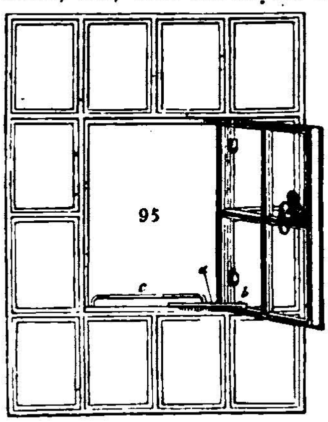


Fig. 96 is a view of the staybar apart from the window, showing the eye *d*, the handle *e*, and the stud *f*, which drops into holes in the horizontal groove, so as to keep the window open at any desired angle.

96

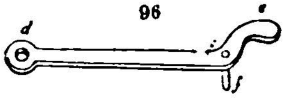
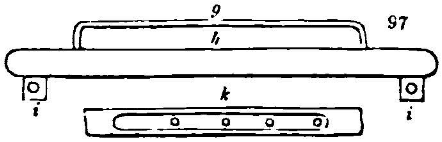


Fig. 97 is a view of the groove and the guide-bar. *g* is the guide-bar or small rod which is for the purpose of keeping the staybar in its place in the groove *h*; *i i* are two plates with holes, by which the groove and guide-bar are riveted to the window; *k*, vertical profile of the groove, the guide-bar being removed, so as to show the holes into which the stud of the staybar drops The groove is of cast-iron, and the guiding iron is of wrought iron let into it and riveted, and both are bolted to the bar of the window by means of the plates *i i*, which are of cast iron.

97



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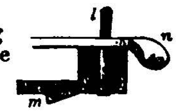
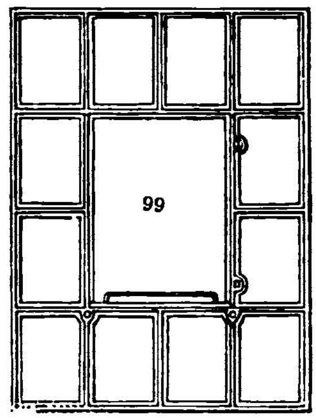


Fig. 98 is a section across the groove, the guiding rod *l*, and the bar of the window *m*, to which the groove is bolted; *n* is the handle of the guide-bar.

The window is cast in two pieces; the larger (Fig. 99,) being 2 ft. 10 in. high, by 2 ft. 1 in. broad, and the smaller (Fig. 100,) being 1 ft. 4 in. high, by 1 ft. broad, exclusive of the lead along the bottom and sides, which forms the rebate, and covers the joint. In casting the smaller window, it is essentially necessary that it be somewhat less in dimensions than the space into which it is to shut, in order that it may always move freely. The air is kept out from the room within, not by the tight fitting of the sides of the small window to the sides of the frame, but by the contact of the edges of the sides of the small window with the beads forming the rebates attached to the inside of the frame; and also by means of the contact of the beads, or rebates, of the small window with the edge of the sides of the large one, or frame into which it shuts. In consequence of the sides never touching, the window moves with the greatest ease, whether expanded by heat in summer, or contracted by cold in winter, and weather-painted and and smooth, or unpainted and rusty.



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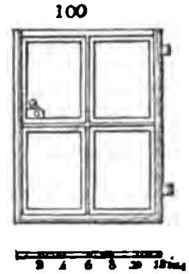


Fig. 101 is a horizontal section across the small window and the two side bars, showing the outside beads at *g g*, and the inside beads at *h h*.

101

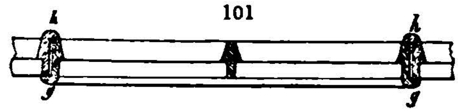
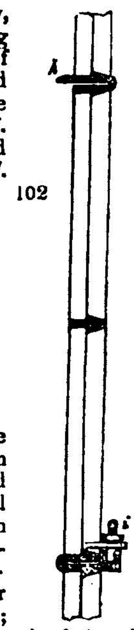


Fig. 102 is a vertical section through the small window, and the top and bottom bars of the fixed frame, showing a weather fillet, or weather table, which projects half an inch from the general face of the window at *h*, and the staybar in the situation in which it rests when the window is shut, and also the groove and guiding rod at *i*.

The total weight of this window before being glazed is about 61½ lbs., and the prime cost in Derby is 12*s*. 4½*d*. thus:—

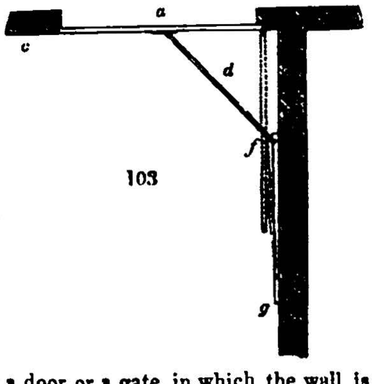
	s.	*d.*
2 castings, 60 lbs. at 1½*d*.	7	6
Ironwork, 1¼ lb. at 1*s*. 1*d*.	1	4½
Fitting up, 6 hours at 24*s*. per week .	2	0
Scurfing castings, 4 hours at 12*s*. per week	1	0
Priming window	0	3
Paint . . . . , .	0	3
Prime Cost	12	4½

102



We consider this by far the cheapest and best cottage window that has been hitherto invented; it has been used in a great variety of buildings for 10 years, and when it is known, it can hardly fail to come into general use in cottage dwellings and manufactories. In London it may be obtained of Messrs. Cottam and Hallen, Winsley Street, Oxford Street, for 13*s*. 6*d*. for a single window, or where there are more than half a dozen, for 12*s*. 6*d*. each; at Messrs. Cubitt's, Gray's Inn Road; and at Mr. Roe's in the Strand, manufacturer of zinc and of tinned iron.

Door Staybar.—To understand how this staybar may be applied to opening doors fully, or, as in the case of hot-house doors, to any degree of width, and to retain them fast at whatever angle it may be desirable to set them open, or to keep them fast when shut, it is only necessary to suppose the groove fixed to the wall horizontally behind the door.

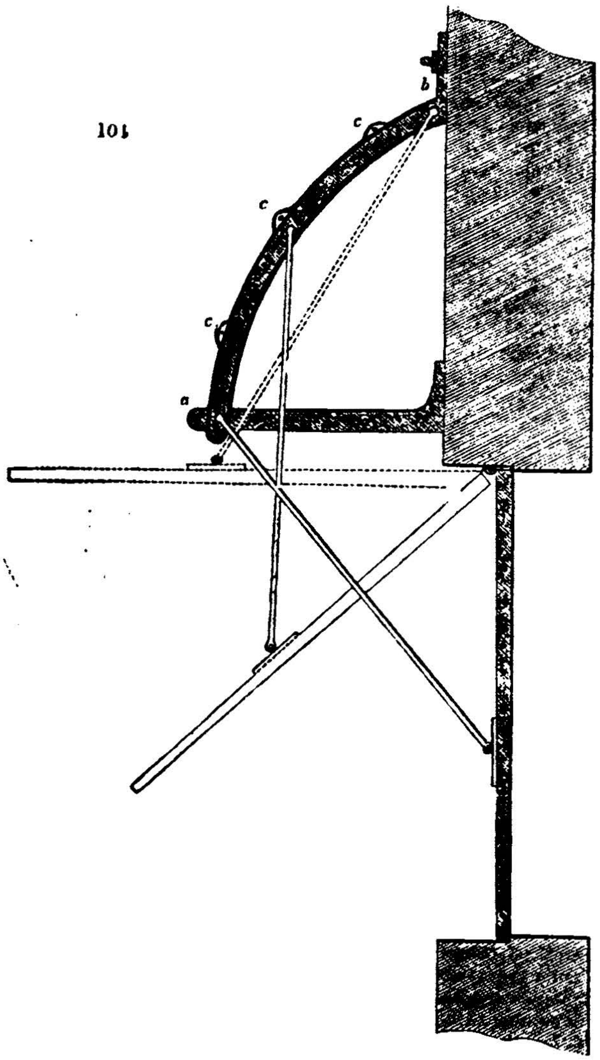


103

Fig. 103 represents a horizontal section through a door (*a*), the wall of the hanging style to which it is hinged (*b*), and the wall against which it shuts (*c*). The door is supposed to be shut, and it is held in its place by the staybar *d*, which moves on a stud at *e*, and along a groove from *f* to *g*. All the rest requires no explanation to any one who has understood the description of the window.

Fig. 104 shows a staybar for a door or a gate, in which the wall is on the same plane with the door. In this adaptation of the staybar, the groove in which it slides is made curvilinear, merely to facilitate the operation of sliding, because it would slide if the groove were straight. The curve *a b*, therefore, may have any radius that may be

104



convenient, provided that it commences at *b* and terminates at *a*. The points *c c c* represent projections from the groove, having holes for screwing on a wooden guide-bar, to prevent the staybar from rising out of the groove.

105

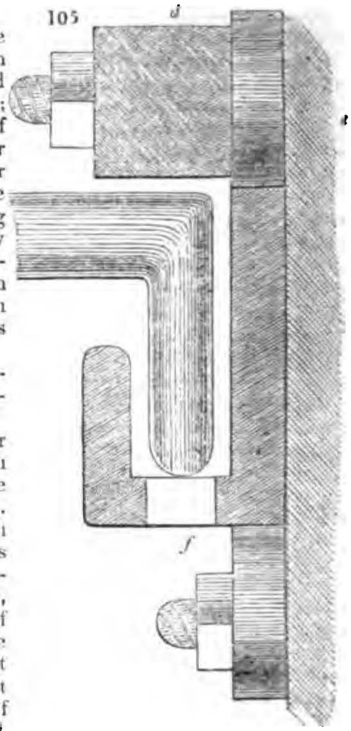


Fig. 105 is a section of the groove of half the proper size, in which *d* is the guide-bar of wood screwed on to the groove at *c*; *f* is the opening in the bottom of the groove into which the staybar drops. These openings may either be made at each end of the groove only, for the purpose of opening the door to the full width, or they may be made also at the intermediate points *c c*, so as to open the door to different angles, which may be convenient in hot-houses for ventilation.

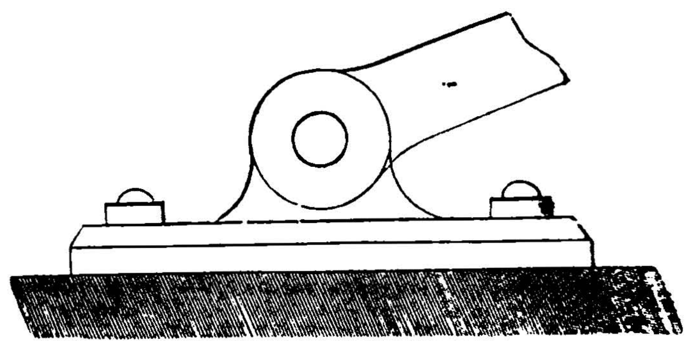
Fig. 106 shows a vertical profile of Fig. 107, *i* being the guide-bar, and *k* the door.

Fig. 107, of half the proper size, shows the manner in which the guide-bar *g* is attached to the door *h*, the fitting not being tight.

It is to be observed that both the straight and curved grooves require a sort of cover or guide-bar all the length of the groove, placed so as to allow the hook of the stay or propping bar to be lifted out of the hole, but not out of the groove. In the straight groove (Fig. 103, *e f*), a piece of wood 1¼ by 2½ in. does very well for the cover; but in the curved groove a wrought or cast iron cover has been used, and the little tubes or projections marked *c c* in Fig. 104, are cast on the groove to fasten the wooden covers to securely.

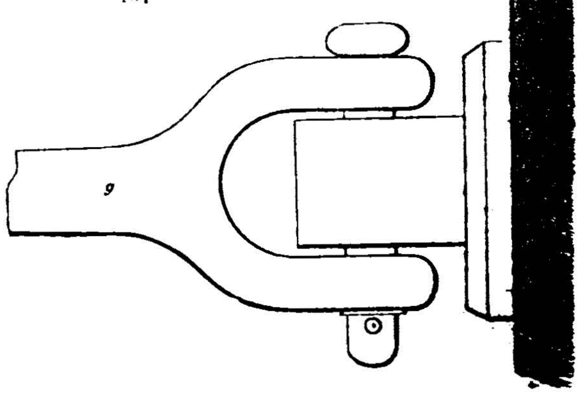
Gates and doors for back sheds, and for various departments connected with the kitchen-garden and offices of an establishment, may be most advantageously formed with staybars, instead of locks, bolts, or hooked or other fastenings. In rural architecture, the use of these staybars is calculated to be still more extensively useful than in gardening.

106



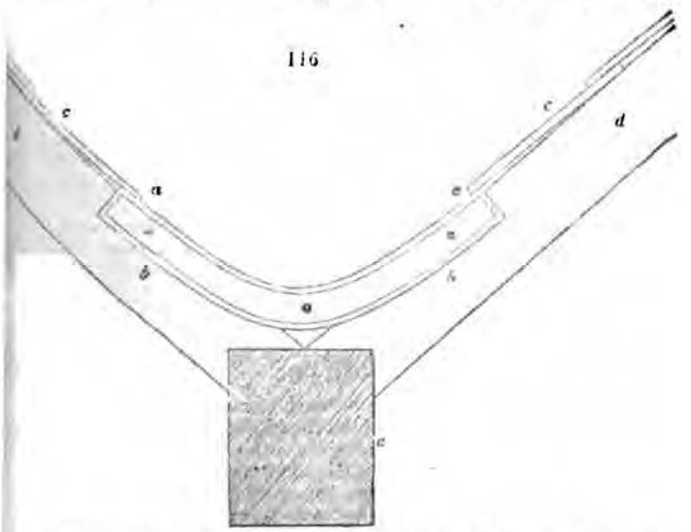
k

107



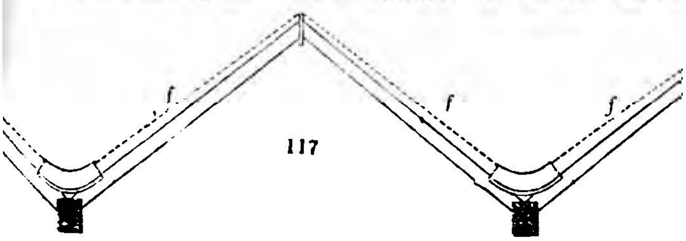
An Iron Nosing for the Steps of Stairs, or to serve as a kerb for foot pavement in streets, is the next article that occurs to us. The object is to change steps of wood or brick into steps of greater durability than if they were of stone or iron, and at a small expense. For this purpose a nosing, or rebated piece of iron, is made fast to the step of wood by iron studs, or by being let into the walls at the ends of the steps, and this retains in their place flat tiles of terro-metallic earth, which are much longer before they wear out than any description of stone; which produce a step much lighter than if the whole were of stone or iron; and which can be renewed at pleasure. Such steps are well adapted for granaries and other agricultural buildings, and, in some cases, for the stairs of offices to mansions and cottages. The most economical application of this contrivance is, of course, in cases where the steps are made of wood.

Cast Iron Gutters to Roofs, as a substitute for leaden ones, are found economical and effective. Fig. 116 is a section of a gutter between two roofs, in which *a a* is the gutter, with a flange *b b* for joining the



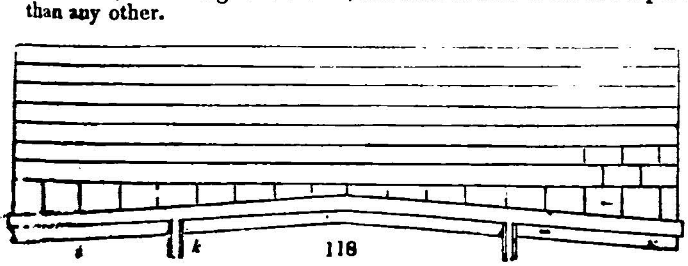
116

different pieces together; *c c* are the slates; *d d* the rafters; and *e* the gutter beam. The fall requisite to carry off the water is found to be from a half to three quarters of an inch in the yard, and this necessarily occasions the plane of the roof to rise towards the centre of the building, as shown in the section Fig. 117, in which the rise is indicated by the dotted lines *f f f f*. All the care that this



117

requires in slating or tiling is, to bring the upper edge of the lower course of tiles to a level, as indicated in the longitudinal section through the gutter, Fig. 118; in which *g* is the gutter, *h* the lower course of tiles, *i* the gutter beam, and *k* hollow posts for supporting the gutter beam, and serving as pipes for conducting away the water from the gutter. Cast-iron gutters of this sort will be found peculiarly adapted for ridge and furrow hot-house roofs: and we shall hereafter show that, for all large hot-houses, this kind of roof is better adapted than any other.



118

THE PIETA.

A collossal group designed for the Catholic Church in Francis-street, Dublin, by HOGAN,* *communicated by the* COUNT HAWKS LE GRICE, *Member of the Academy of St. Luke, and of various Academies of Art and Science.*

THIS group of the Descent from the Cross is, as is usually the case, composed of two figures, the principal of which is the Virgin seen seated on a large stone. The entire figure is draped, the under tunic falls to her feet; and the mantle over it is confined to the body by a band round the waist; and the sleeves of the mantle are confined by armlets, and reach down to the wrist; a veil covers the head, falling over the shoulders and on the left arm; it is collected in a large mass on the ground. The veil shades the left part of the face, and falls partly over the extended arm, the hand is open, and the fingers are slightly bent; the left arm rests on her knee, and with one hand she holds the arm of her son. The figure is in an upright seated posture; the feet separated and the limbs incline slightly to the right side; the hair is parted on the forehead, and the face looks down on the figure of Christ, which appears at her feet, with its back leaning against a mass of stone; the body reclines towards the left side of the Virgin, whilst the head falls on the left shoulder; the right arm falls perpendicularly and the hand is bent at the wrist, with the fingers resting on the ground. The left leg is out-stretched, and the right slightly bent; passing under the left leg a little below the knee; the drapery is spread out under the body.

The figure of the Virgin is very imposing—seated lonely in her grief, she seems to submit with pious resignation to the will of heaven, yet still hangs, with all the anguish of a fond mother, over the body of her beloved son, extended in death at her feet. No arrangement could be better calculated to strike awe into the mind of the spectator—to arouse the Christian to feelings of piety and veneration. The group does not produce a momentary surprise; but on long contemplation we find a quiet solemnity about it which awakens the mind, by degrees, to all the better emotions of the heart, we are moved with pity, devotion, and respect—we seem lost, for a time, in meditation; and know not which most to admire—the sentiment or the execution of the whole.

Beautiful as it confessedly is, in the present state, yet few can form an idea how much superior the effect of the group will appear when executed in marble. A plaster model always seems hard in its parts, and the outlines cutting, nor can those delicacies be given, or spirited touches be executed by the modelling tool—the light and shadow also furnish too great a contrast, and want the subdued warmth of the marble. The group should be executed in a slightly transparent marble, and the light coming from the top of the building, through an amber coloured glass window. This might produce a charming effect, by softening the shadows into half tints, and then making the figure appear to start forth into roundness, glowing under a glory of light. The grand effect of this group will be apparent to the most ordinary mind, but the means by which that grandeur is effected can only be appreciated and understood by a few.

It becomes therefore the province of the critic to examine the whole in detail, and to endeavour to show the parts which contribute to its value, as well as to point out where changes would have enhanced its beauty. The bold and masterly character of the naked portions, the spirited touches of the drapery, and its ample folds, are all judicious, especially when we consider that the group is to be raised to some considerable height above the spectator, where all parts, but particularly the extremities, will appear more delicate, and the drapery richer in the folds, and finer in effect of *chiaro-scuro*.

The detaching of the body of Christ from the principal figure is admirably conceived, for when the group is viewed from its proper situation, the whole will appear more compact, as the broad shadow from the figure will fill up the void between the two statues. Few sculptors would have foreseen that this architectonic arrangement was necessary to produce a good distant effect. It however shows that Hogan is learned in his art, and has paid attention to the optical science, which was commonly observed by the ancients in adapting their bassi-relievi or statues to any situation, and had Thorwaldsen thought of this, he might have much improved the figure of the Pope in his monument of Pius VII. in St. Peter's, at Rome.

The naked proportions of the figure of Christ are beautiful—the marking of the muscles, and the insertions of the bones are anatomi-

* This Irish artist has obtained great eminence in Rome, so as to hold the next rank to Gibson, among those of our countrymen there. The Irish have extended to him a patronage which they are not remarkable for giving generally to their well deserving citizens, and have given him many important commissions. He is the modern Barry, and well sustains our name at Rome.

cally correct—the whole is moulded with more than ordinary care. The integuments and the muscles have the soft and relaxed appearance belonging to a dead body, but the *pectoralis*, the *deltoides* and the *biceps* are a little too rounded, and appear like muscles developed by manual labour; however the thighs and legs are sufficiently delicate—yet the appearance of the body strike one as too plethoric. The contour of the face, and the high forehead have the usual traditional character, such is employed in pourtraying the Saviour. The countenance is certainly divine, and its expression seems relaxed into the cold but placid sleep of death.

The head drooping on the left shoulder gives a lifeless appearance to the body, and materially assists the compositions. The right arm hangs nerveless from the trunk, and the bended fingers on which it rests have the stiffness of death itself. The graceful sway of the body, and the right leg bent under the left, is well conceived, breaking as it does the uniformity of the lines of the composition. The shelving rock on which the body reclines is calculated to display its form to the best possible advantage; the dark shadows detach the contour from the ground, and a broad light shows the figure off with the greatest effect. The drapery on which the body reposes is admirable.

The drapery also of the figure of the Virgin is disposed with judgment, the style is grand, and the execution shows great talent,—the action of the body and limbs is consistent, but the figure has more dignity than grace. The expression of the face is perhaps a little forced for the grave character of sculpture; it however is significant, and reminds us of the Niobe.

In the composition we remark that all the lines are skilfully contrasted, there is nothing angular or obtuse, each figure forming a pyramidal outline, and the whole group falling within the limits of an equilateral triangle. In short the composition generally considered is both grand and novel, a masterpiece of art, and reflects the greatest honour on its designer.

CANDIDUS'S NOTE-BOOK.
FASCICULUS IX.

I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please.

I. What the Eglintoun mummery may have cost I have not heard, nor do I pretend to guess; but if newspapers are of unimpeachable veracity 1200*l*. were expended on the temporary pavilion alone, for the late Dover festival. Well what is that to me? Nothing, still it is a very great deal indeed to *us*, since such prodigal expenditure for the hurried, feverish festivity of a few hours, contrasts most strikingly with not the economy, but the downright shabbiness and penuriousness on occasions where even extravagance would be meritorious. If a public edifice that ought to be an ornament and honour to the country is to be erected, it must be pared down, denuded, impoverished in order to make a beggarly saving that would be swallowed up in a single public dinner. Did not the matchless Lawrence collection of drawings absolutely go a begging, though offered at little more than half of what Messrs Woodburn are now likely to make by the dispersion of them, not because there are no persons in this country who could afford to make such an acquisition, but because they are destitute of spirit or taste, if not both! Was it our poverty or our apathy that prevented us from being now in possession of the Egina marbles? If we really cannot afford to be liberal towards art, at all events we might be consistently frugal and parsimonious,—which however is what we are not, but rather totally the reverse,—alternately spendthrifty, and penurious, with no other sort of consistency than that of being egregiously absurd, let us be what we may. For some fête or *feat* of tomfoolery—the second term is as applicable as the first—tens of thousands are considered a mere bagatelle; no cost is grudged, no estimate required on such occasions; but if it is for any thing more lasting, John Bull becomes wonderfully prudent, begins bargaining and cheapening, and calculates how many odd sixpences he has in his pocket to go towards the *job*.

II. Bargains in art generally turn out like most other bargains to be confoundedly dear in the end. John Bull, however, or those who have the laying out of John's cash, do not think so; as would plainly appear were any one to write the secret history of some of our buildings;—Buckingham Palace, to wit, which with most transparent kind of make-believe, it was pretended was to be nothing more than an alteration of Buckinham House. What is the consequence? why all that has been expended upon it,—which is something more than a bagatelle, has, as far as art is concerned, been utterly flung away. Instead of having any thing to be proud of, we have a good deal to be ashamed of. Theodore Hook says no, but in spite of ten Theodore Hooks, I maintain yes. Then there was—most blessed past time! there *was*, Kew Palace: what was expended on that mass of cockneyism in stone and mortar, I know not:—that whatever it was was all thrown away, is what we all know. Then there was Carlton House, of which the only redeeming part, outside or in was, the portico: all the inside especially was costly paltriness, or if to paltriness there might be here and there an exception, it was only where there was some prettiness; for everywhere there was the stamp of littleness. The Hall was any thing but princely in its taste or style, therefore it was rather a Lilleputhian compliment—quite a minikin one when on entering the hall at Holkham, the Prince assured the present Earl of Leicester, that what he beheld quite eclipsed Carlton House. And yet it may fairly be questioned whether the sums expended from time to time in altering, refurnishing, &c. would not have built and furnished two such palaces as Holkham is. It has been said that George IV. was a liberal patron of the arts; it is impossible to add that he was an intelligent one also. To say the truth it puzzles me to understand how he ever got the reputation of a patron of art at all, since every one of whom I have at times inquired have been puzzled to explain, or even to bring forward a single instance to show that he really was one. Hardly can his *protection* towards such a piece of coxcomb mediocrity as Cosway be cited in proof of it;—indeed if all stories be true, he liked Cosway as a mere convenience. Or hardly can his putting implicit confidence in such a person as Nash—but hold! I must beware of *The Hook*.

—Yet hold again, I cannot forbear *hooking* on to this section an epigram which I have somewhere met with, and must now trust to memory for repeating as correctly as I can.

'Twixt Florence and London the difference is this,
Nor think that I speak it in malice:
The first has the palace that Pitti is call'd,
The second—the *Pitiful* palace.

Theodore likes a joke: so there is one for him.

III. *Festina lente* seems to be the motto of the architect of the British Museum, at least of his employers, since it is now more than twenty years that that building has been in progress, and it threatens to linger on full another twenty years before it is completed; whereas within the last ten or twelve, about as many buildings have been begun and completed at Munich, almost any one of which would throw all ours into the shade. In comparison with the apartments of the Glyptotheca the sculpture rooms at the British Museum, may be said to be only whitewashed walls. In comparison with the Pinacotheca our National Gallery is a mere cheese-paring affair,—and even the façade little better than a *moonshine* imitation of Greek architecture, bare and unfinished in all but the columns; while as to the interior—why! the *loggie* alone of the Munich gallery, with its five and twenty domes and lunettes, presenting a display of fresco painting, about four hundred feet in extent,—though in itself only an accessory portion of the building, causes ours to look no better than a set of auctioneers' show-rooms in comparison. Not to be tedious, but passing over the Königsbau, the Festbau, the arcades and frescos of the Hof-garten, the Ludwigs-kirche, the Public Library, &c. &c. to come to the Allerheiligan Kapelle—an edifice begun and completed within ten years—years, too, during which so many other important buildings were in progress, not to include among them, the Walhalla, or the restorations and embellishments of the Regensburg Minster,—yet that one is constellation of art. What magnificence!—above, below, around—no matter where you look or where you tread, the whole is gorgeous, but its gorgeousness is majestic and solemn,—solemn is perhaps too weak a term, for there is a sort of severe and awe inspiring pomp, approaching to sublimity, both in the architectecture and the painting. Perhaps its character may be best expressed in the words of my friend ——, who calls it a transfiguration of a building. What a blaze of gold is the entire surface which serves as a ground to the figures painted in fresco on the domes, the large arches, vaults, and all along the upper part of the walls. Unnatural! it will be said: true; and it is precisely this unnaturalness that gives propriety and architectonic fitness to the painting as decoration, just as it is precisely the splendour of the gold ground that imparts not gaiety but dignity and solemn richness to this unparalleled interior. Infinitely more unnatural and contradictory, would any more positive and imitative mode of painting be, however ably it might be executed. This doctrine is, it must be owned, far more suited to the meridian of Munich than of London. It would be very foolish for the lovers of matter-of-fact painting to make a pilgrimage to the capital of Bavaria to behold what has there been done in fresco-painting. It is rumoured that Leo von Klenze, the celebrated Munich architect,—at whom, by the bye, Joseph Gwilt turns up his nose, is commissioned to prepare designs for a new Museum at St. Petersburgh; and the rear of the Hermitage is spoken as the proposed site, which, however, seems contradictory with the idea of any particular magnificence externally.

IV. The prevailing vice of our modern Greek or Pseudo-Grecian school is that notwithstanding its professed accuracy—not to call it servility of imitation, its correctness extends to little more than columns alone. Even as far as the mere order is concerned, all above the capitals of the columns is quite neglected—left offensively bare and unfinished,—the frieze a mere blank, pediment ditto. It avails not to say that the sculptures of the friezes and pediments of the examples professed to be followed, are not to be considered as belonging to the architecture itself, but merely extraneous decoration, that may be applied or omitted as most convenient. A very little stretching of that principle might be made to serve as an excuse for dispensing with the foliage of Corinthian capitals, for what else is it but mere useless decoration? Indeed it would be only consonant with both reason and good taste, where we cannot afford to keep up consistency of style by making the cornice and other parts of the entablature of the same degree of richness as the columns, to adopt as the only legitimate alternative that of making the columns consistent with the plainness of all the rest. Instead of which, while the entablature is suffered to present little more to the eye than a few naked mouldings and shelf-like cornice, the columns themselves have fluted shafts, and highly enriched capitals. That I do not speak merely at random, is easily proved by referring to the portico of the National Gallery and that of St. Pancras,—certainly not the worst specimens of the kind. Indeed the difficulty is not to find examples in confirmation of the defect alleged, but of exceptions to it. At present I can recollect only one, either in London or elsewhere, namely, St. Mark's chapel in North Audley-street. As for the greater part of our modern Grecian buildings, what they chiefly show is the utter want of all relish for the style on the part of those who profess to follow it. To say nothing of the omission of sculpture,—when did the Greeks ever terminate a cornice not beneath a pediment with a mere corona. If the enriched cymatium added to the raking cornices of the pediment were not always continued along the horizontal ones on the sides of the building, decoration was invariably supplied by the antefixæ, and the ridges of the marble tiling behind them. Yet our modern Greeks make no scruple of leaving a plain corona cornice as a termination to the building, should there happen to be no pediment. I do not say that we need precisely copy antique examples in all their particulars; but if we pretend to imitate them at all, the very least we can do is to do so consistently, and to take care that—no matter how—the same degree of effect be kept up throughout. If that cannot be done—that is, is not allowed to be done, but niggardliness calling itself economy steps in and say it can't be afforded: the next best thing to be done, is to dismiss columns altogether,—and in nine cases out of ten they are quite as useless in themselves, as owing to the treatment of it, the order is rendered valueless as decoration. But, the cry will be, if we give up our columns we surrender up every thing. Take away our columns and how shall we be able to astonish people by our classical taste? True, very true:—O MY PUBLIC of what gullible stuff are ye made!

ON CHARACTER AND STYLE IN ARCHITECTURE.

MINDS incapable of perfection, yet aiming at it, must be constantly in the situation of students. But since the obligations of society prevent the greater part of mankind from continuing in the schools during the whole of their lives, casual information must be the chief source of improvement. The meaness therefore of an instructor should deter none from accepting instruction. With this apology for offering any remarks to my betters, I have satisfied myself and hope to propitiate others, especially as I demand nothing for my trouble but the pleasure of seeing an error corrected.

Since competition has become a prevalent method of selecting an architect, it is desirable that persons who wish to have designs offered them, should be able to express their wishes so as to be completely understood by those gentlemen to whom they address themselves. From the frequency of such competitions, the formulary of particulars has become familiar to most. Yet many incorrect expressions are made use of in some of the best instructions.

An error which I should be glad to point out occurs in the instructions given by the Council for the New Assize Courts at Liverpool. These are the words made use of, "the character of the building is to be Grecian or Roman architecture."

Suppose I were standing with the author of this sentence on a precipice of the Alps, overhanging a dark and dreadful chasm, each side of him arising lofty mountains piled one on another, the uppermost peaks lost in the clouds. While his heart beat audibly, and his hand grasped fearfully the projecting tree, were I to ask him what was the character of this scenery, he would answer, dreadfully grand! He would hardly, I think, say that its character was that of the Peak, or of the Andes. Or again presenting him to a warrior hoary with age and toil, and crowned with victory, would he tell me that the character of face was that of a Wellington, and not rather that it was noble and venerable. In both cases rightly discriminating between the container and the thing contained. The term character when applied to a building has a precisely similar signification as when applied to scenery or to a countenance.

A style is a method of conveying a character, and is as distinct from that character as the human form, the soul of which it is the external representative; it is the means of explaining to the senses some (insensib'e) idea; in short is the *matter*, some moral quality being its analogous *mind*.

An author desirous of explaining to the world his speculations on any subject, makes use either of prose or of poetry, as one or the other is best capable of conveying his thoughts. If prose be chosen, he considers whether his subject demands to be expressed in didactic, argumentative, or colloquial phraseology. If poetry be selected—does he desire to reform morality by a display of virtue, herioc measure will best forward his intention. Does he sing of love, a tender ode is a happy metre in which to tell of Cupid's deeds—or does he lift his soul in adoration, the sacred hymn is now the vehicle of his praise.

Painters too, have their styles varying with almost every artist. The happiest efforts of Turner's "Sunny style" would ill represent the lively energy so admired in Landseer's animals, or the domestic repose of Wilkie's firesides.

The Greeks and Romans had each a method (style) of building peculiar to themselves. With the Greeks the Doric order was expressive of extreme grandeur or *sublimity;* the Corinthian of perfect richness or *beauty*. Among the Romans the Tuscan order represented the former quality; the Composite the latter. The same qualities are represented by the same forms among us, with the addition of a quality drawn from our feelings with regard to the people from whom we received these forms. What this quality is, persons of greater taste than myself should determine; but I should say that the Greek style suggests the idea of mental power, and cultivated genius; the Roman of physical strength and commanding weight. Ecclesiastical Gothic architecture suggests feelings of religious reverence. Domestic Gothic suggests the liveliest ideas of pleasure that an Englishman can receive, in connection with the word home.

The aim then of an architect is to make such an arrangement of the parts and detail of a building as shall produce certain sentiments in the minds of beholders. The quality connected with these sentiments is the character of the edifice. Thus the sentiments desired to be called forth on beholding a palace are those allied to splendour and majesty; the character then of the building should be splendid and majestic.

Accordingly as one feature predominates in one style, or method of building, is that style selected to illustrate that feature. As the author selects poetry or prose, or any subdivision of either, for expressing his thoughts, so the architect uses Grecian, Roman or Gothic, and any subdivision of either to express his.

The author too combines narrative with conversation, and the poet song with epic verse. The architect composes a design of Ionic and Corinthian, or of the Doric and Ionic. The true taste of both consists in maintaining one character through the whole, and so combining as to produce harmony without monotony, and so contrasting as to produce variety without confusion.

The failure in our modern edifices is not so much, that our construction is bad or our detail faulty, as that our architects have either not greatness of soul to imagine, or completeness of education to express, an appropriate character in our buildings. Thus we have a palace of royalty degraded into a residence better adapted for Venus; and our private houses elevated into temples. Churches now fit for houses and now for stage-plays. Sometimes to spend his patrons money and display his own taste, an architect! relieves our monotonous streets by a house adorned with church windows, in the richest style of tracery. A rich feast for connoisseurs, but that, alas! the mullions and tracery are executed in cast iron of a quarter of an inch thick. Cast iron indeed reigns triumphantly every where, adorned with the garments of its cast down rivals, stone, wood, and brick. One would think from the cold and starved appearance of many buildings that the artists hearts were cast iron too.

But to conclude, if I have explained to one person ignorant of the fact, that there is a difference between character and style I am satisfied. *——*.

THE DAGUERROTYPE.

The love of the marvellous is so very apt to induce persons to exaggerate—to stretch a *leetle*, in their account of new discoveries, while the belief of those who listen to them is in its turn so very stretching and elastic that very seldom indeed does any invention turn out to be the magnificent prodigy it was at first described. Yet although they have been deceived times innumerable after this fashion, the public are ever ready to give credit to the cry of Wolf! Wolf! or, to borrow another allusion, believe that the mountain is about to be delivered of some portentous gigantic monster, though it afterwards proves to be a mere mouse. Hence I myself am rather sceptical and slow of belief, being of opinion that it is all in good time to exult when we are quite certain that we have got something worth exulting at. It is surely better to find one's-self in error on the safe side and that the object of our anticipations greatly exceeds rather than at all falls short of them. Who is there who has not some time or other in the course of his life been grievously disappointed in a person officiously described to him as prodigiously handsome, or clever, or engaging, and whom but for such description, he might have discovered to be so, but whom, when his expectations are thus excited, he finds does not at all answer to the idea he had preconceived, and in consequence sometimes falls into the contrary mistake, and sets down the *rara avis*—the phœnix in human shape, as no more than a very so-so-ish creature after all?

But what has this to do with the Daguerrotype? nothing—that is, something;—perhaps much: for what is related of it, certainly does stagger belief. To come to the most material point at once, is it merely that sort of hyperbole which is to be taken *cum grano salis*, or rather with a peck of salt?—or is it a fact that in the pictures so produced the minutest details are expressed, although not visible to the naked eye, yet capable of being rendered so by the assistance of a powerful lens or microscope. Supposing, for instance, a view to be taken of Henry VII's chapel by the Daguerrotype, besides the utmost fidelity as to all that would be discernible in the building itself, seen at the same distance, would it be possible by means of a magnifying glass of sufficient power, to make out every moulding, every carving, every lineament in short, no matter how minute, existing in the edifice itself? If such really be the case the discovery is of incomparably greater importance than it has been described. A drawing or series of drawings of the kind, would place any building, or any other work of art under our immediate inspection, at any time, and all its details might be examined far more closely than in the building itself, and the carvings of a cornice or ceiling might be seen quite as distinctly as the parts just on a level with the eye—the figure on the top of the York column as distinctly as the pedestal. Such buildings as the Alhambra—which it has cost years of patient industry on the part of artists to give us any adequate idea of, even with regard to only its more important parts, may now, it would seem, be revealed to us in the most vivid reality, with the sole exception of colour.

I am afraid that all this is by far too good to be true;—that a very serious deduction indeed must be made from it to bring it to the truth. Leaving to others to endeavour to explain or comprehend *how* it can be accomplished, I should be very well satisfied with having evidence that it *is* accomplished, and that whether the causes can be explained or not, such is the *fact*. If it be—and Sir J. Robison's account (in the Edinburgh New Philosophical Journal) of drawings made by the Daguerrotype, which he had himself examined, goes to assert quite as much,—so far from being at all overated, the discovery is rather underrated, and the very extraordinary results thus to be obtained from it, have been noticed far more briefly and cursorily than they deserve. We are told that "a crack in plaster, a withered leaf lying on a projecting cornice, or an accumulation of dust in a hollow moulding of a distant building, though not perceivable to the naked eye in the original objects," may be detected in the drawing when examined through a magnifier! Yet beyond the mere mention of it, that by far the most wonderful and important circumstance of all, is hardly dwelt upon. Is it not probable after all that such minutiæ have been beheld only through the magnifying lens of imagination?—in short, have not people fancied they have seen a good deal more than they really did?

Allowing, however, such to be the fact, we are not distinctly informed, whether it is limited to the original drawing or not;—and yet, we must suppose that it is, since hardly could, what is not visible to the naked eye, but requires to be examined through a microscope or lens, be expressed by any graver. This therefore materially restricts the application of such mode of drawing, owing to the inconvenience of keeping any considerable number of such plates, more especially, should it be requisite that each should have a glass before it to protect it from injury—as seems to be the case, for I understand that a mere touch of the finger will obliterate any part it comes in contact with. Another circumstance that, I must own, is rather puzzling to myself, is that the extraordinary powers ascribed to the Daguerrotype should not have been exemplified ere now by some more worthy subject of interior architecture than one where the "threads of a carpet" seem chiefly to excite admiration. Why not at once have taken a view of some gallery or museum filled with works of art, each of which—the most remote, it seems, as well as the nearest—would be transcribed with all its details, no matter how intricate, or however minute. No less strange is it that opportunity should not have been afforded to the public of this country, of gratifying their curiosity and removing their doubts by the evidence of their own eyes, as might have been, had a few successful and well selected specimens been procured for the Polytechnic Institute and Adelaide Gallery of Science. Why has not such a subject as the Barrière de l'Etoile been taken, if it really be true that all its sculptures, all the details of its workmanship, can be so represented with a fidelity which the hand of the ablest draftsman cannot even aim at? Still it must be admitted that the circumstance of its not having been done is no direct proof of the impossibility of its being accomplished; but merely proves the very great considerateness of those who wish to apprize us by degrees of what the Daguerrotype is capable of performing, instead of startling us too suddenly by all at once manifesting it.

However, staggering and incredible as may be what has been asserted with respect to this discovery, I must presume it is a most extraordinary one in itself, because unless it in some degree answers to what has been reported of it, all that has been said with the view of prepossessing us in its favour, would be not only useless but perfectly ridiculous. Therefore, although I must be allowed to hold back my own belief, until ocular demonstration be afforded me, I am willing here to suppose that the Daguerrotype can achieve the miracles attributed to it. This granted, let us now look at the consequences, and as far as one department at least of architectural drawing is concerned—namely, that which consists in the portraiture of actual buildings—a total revolution must take place, the labour and skill of the draftsman being entirely superseded by a natural operation, whereby the view itself—the image produced by the camera is fixed and perpetuated. In comparison with such pictures, the most correct and most elaborate *hand-drawings*, would be unsatisfactory; how much more so, those of which the authors are content to give us a mere general resemblance of a building, or what is frequently no resemblance at all, nor affords any information as to details. How frequently architecture is now slurred over in what some profess to be architectural views,—how grossly incorrect they often are as to very important particulars, and how grateful we have hitherto been for tolerable accuracy where inaccuracy seems to have been the general rule, need not be told. But from this time, those evils will be altogether corrected; not only every detail, but every degree of shadow, every tone of light will be shown us as in the real object; truth will be substituted for specious falsification, mathematical precision for blundering of the eye and hand. Instead of a greater or less degree of perfection—a greater or less approximation to truth, we shall have perfection—truth itself. No longer shall we be at the mercy of the draftsmen. They may now cry out "Othello's occupation's gone." Hardly will people be content with loose though even spirited indications of what they may behold in exact images of the objects themselves. The further consequence of which will be, that when their eyes are accustomed to such accuracy of delineation, persons will not overlook as they now do defects of perspective, and drawing in pictures, and such works of art where the Daguerrotype will be of no avail. But—and in truth it is a most tremendous *but*, it yet remains to be seen whether this vaunted discovery can fairly and honestly accomplish all that it is said to do. At present we have only hearsay—except indeed that some like myself may have a very great deal of doubt besides. For my own part, I have very strong doubts indeed, not because I wish the invention may not be found to answer, but because I am greatly afraid expectations have been raised that can never be gratified.

Candidus.

Spurn Telegraph.—The apparatus is now fixed, and the telegraph will be in operation in a short time. The benefits derivable from this institution will, we doubt not, be duly appreciated. The Hull Shipping Company, and others, have already ordered signals.—*Hull paper.*

Banquet in the Thames Tunnel.—On Saturday afternoon, the Directors of the Thames Tunnel Company gave an elegant dinner in the Tunnel to the persons employed in that undertaking, to celebrate their having reached low water mark. Mr. Hawes, M.P. was in the chair, and 230 persons sat down to table. On a raised platform, about 500 visitors, the majority of whom were ladies—were provided with places to view the gratifying scene.

THE ROYAL ACADEMY.

Without touching upon the general question which has lately been agitated in several political and other journals, "How is the Royal Academy to be dealt with?" and which has been settled, for the present at least, by a majority of only five against Mr. Hume's motion, —without asking what are the merits or demerits of that body as regards the other two fine arts, it must be allowed, I conceive, by every one, that as far as architecture is concerned, the assistance it affords it is the smallest possible, indeed barely nominal. A corner allotted rather grudgingly to architectural drawings, at the Academy's exhibitions, and a series of half a dozen lectures annually, constitute almost the whole of all it has ever done, or affected to do, for architecture; and even this little has been considerably abridged, since for several years the annual lectures have been suspended, owing to the infirmities of the late and present *Professor of architecture, and the office itself has been allowed to become a nominal one. Most assuredly neither of the individuals alluded to ought for a moment to be reproached for his heavy personal afflictions; yet it is justly matter of reproach to the Academy, that no one else is appointed to discharge those duties for which continued ill health incapacitates him who, by virtue of his office, ought to do so. We meet with nothing parallel under similar circumstances any where else; if a master is disabled from attending to his school, he must either depute some one else to do so for him, or his school must break up. But in the Royal Academy they manage matters differently; provided there be nominally a Professor of architecture, it is all-sufficient. If he can give lectures, he does so; if not, the students must dispense with them. Yet what is this but saying that it is a matter of perfect indifference whether lectures of the kind are delivered or not? whether the duties of that professorship are punctually discharged or remain altogether in abeyance? Granting for a moment that such really is the case, the question then suggested by common sense is, wherefore should there be any such professorship, or any such lectures at all. If they are useless, let them be abolished; if not useless, why does the Academy presume to treat them as if they were so? That *is* the question, and one which, I suspect, it would puzzle them greatly to answer, even should they summon all the *nous* they have among them.

As painters, the majority of the Academicians may not care one jot about architecture and its interests; yet although they may individually be perfectly indifferent to it, as a body it is as much their duty that they should attend to it as to any other part of their institution. Here, therefore, another question starts up, namely, how happens it that architecture is so inadequately represented in the Academy as to be looked upon as a mere cypher? Is it because, although a partner in the firm with painting and sculpture, architecture has only a very small share indeed in the concern, perhaps not more than one fiftieth part of the whole? Is it not worthy to be put upon the same footing with its co-partners? is there anything in the Academy charter to such effect? is it there expressly stipulated that the painters are to have the lion's share, and architecture be content with being admitted to the honour of participating by looking on?

I do not accuse painters, it is the Academy I accuse, for defrauding architecture of its just rights, to which they are bound as much to attend and to see supported, as those of painting itself. If architecture is to be treated merely as "a poor relation," taken in out of *charity*, to be subjected to continual insult; to be banished to a side table in a corner, or even sent down to the second table, when there are visitors at dinner, the sooner it shows its independence, and gets out of the clutches of such charity, the better. Better for it to be independent, and alone, than to be treated as the fag-end, the rag-tag and bobtail of the Royal Academy.

I shall, no doubt, be reminded that architecture has now a home and establishment of its own in the Royal Institute of British Architects. To which I reply, all the more discreditable to it, it is, then, that it should submit to the indignities put upon it by the Academy. Neither does the circumstance just alluded to, warrant the latter at all in treating it as it plainly does. So long as architecture continues to belong to the Academy, it ought to insist upon justice from it. If, on the one hand, the Academy are very willing to get rid of architecture, and architecture can afford to be independent of the Academy, why do they not part by mutual consent? or why does not architecture fairly sue for a divorce?

Let the painters have the Academy and its exhibitions to themselves. If the architects care for having an exhibition at all, let them have a proper one; if not, let them go without one. If they remain with the Academy, and the latter can afford them no better accommodation than it now does on the upper floor, let other and sufficient rooms be appropriated for the exhibition of architectural drawings on the lower floor of the building. By being kept quite apart from the pictures, and none suffered to intrude among them, the architectural drawings would be benefitted. Yet this is not all; additional and adequate space is not the only improvement which is required: some of the present regulations ought to be altered Instead of its being insisted upon that architectural designs should have backgrounds and be coloured, to make pretensions as pictures, the contrary rule ought to be established, and no other colouring than shadowing with sepia or neutral tint should be allowed in designs, except in cases where colour is essentially part of the design, as in interiors, and perhaps in perspective views of buildings already executed; drawings of which class should be in a separate room from the others. In many instances colouring becomes really the *lenocinium artis*, particularly when those extravagantly unnatural hues are resorted to, and those captivating, but deceitful, and exaggerated pictorial effects put into geometrical designs, which every exhibition at the Academy witnesses, and which only serve to draw the attention from architectural merits and defects, and fix it upon circumstances that have nothing to do with either. To be what it ought to be, an architectural exhibition would be upon a very different footing, from what that portion of theirs is at the Royal Academy; it would be greatly more comprehensive as regards design, as it would embrace every thing connected with the decorative part of architecture; while it would also be more select, no drawing being admitted but what had some kind of value or interest. That any improvement will ever take place at the Academy in this respect is altogether hopeless. But then, it will be asked, am I so conceited and so silly as to imagine that what I have said will stir up architects to do for themselves what the Academy and the painters will not do for them. By no means; I no more expect it than I do to hear that St. Paul's has made a trip across the Atlantic in a steamer. Then why do I touch the subject at all? because I am anxious that, at all events, people should understand the disgraceful position in which architecture stands at the Royal Academy, and that no one should be able to say that, be it ever so bad, there is no remedy for it. Architecture can shift without any favour and *patronage* from the Academy; if not, it must be in a truly pitiable plight, seeing what kind of support and patronage it now receives from it. Whether in other respects the Academy be more than a mere club of artists, as some have affirmed, I leave to the consideration of others; and only add that, whatever may have been the case formerly, there is, now that the Institute has been established, not the slightest reason wherefore architecture should continue to submit to the contumelious treatment it receives at the hands of the Royal Academy.

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* At the time this article was written Mr. Wilkins was living.

ANCIENT STATUES.

On the different Materials employed by the Ancients for Statues, and on the Varieties of their Marbles. Translated from the French of the Count de Clarac, Knight of various Orders, Keeper of the First Division of the Royal Museum of Antiquities in the Louvre.

There are few substances capable of being subjected to the chisel and of receiving a form, which the ancients did not employ in the sculptural art.* Clay and wood, on account of the ease with which they are wrought, were doubtless the first materials employed in the infancy of sculpture, which only employed itself upon stones and metals when its processes were more advanced and matured. These first and rude essays were probably clothed with real stuffs, in order to give them a greater appearance of truth, until the period arrived when the chisel could attain the representation of drapery. As it is natural, also, in the infancy of art, to consider that the natural colour of objects adds greatly to the fidelity of their representation, it may easily be conjectured that when metals and stones were used, those colours were sought which presented the nearest approach to the objects wished to be imitated. Thence originated polychromic sculp-

* For authorities on this subject see Pliny, *Hist. Nat.* l. 36; Junius, *de Picturâ Veterum*, p. 276-296; Blasius Caryophilus, *de Marmoribus Antiquis*; Ferber, *Lettres Mineralogique sur l'Italie*; Tozzeti, *Voyage de Toscane*; Quatremere de Quincy, *Jupiter Olympien*, p. 24 et seq. 132-163; Brard, *Traité des Pierres Precieuses*, vol. 2; Levrault, *Nouveau Dictionnaire d'Hist. Nat: Diction. Classique d'Hist. Nat.*, articles Alabaster, Breccia, Brocatelle, Granite, Lumacelle, Marble, Porphyry, Serpentine, &c.; Winckelman's History of Art, B. 1, c. II, and B. 7, c. I; *Le Dictionnaire de l'Antiquité de l'Encyclopedie*; Facius's Collection of all that Plutarch has said upon Art, Leipsic and Coburg, 1805; Heyne, *Antiquarische Aufsaetze*; Bottiger, *Amalthæa*; and the *Essay on the Technical Part of Ancient Sculpture*, prefixed to my *Museum of Ancient and Modern Sculpture.*

ture, or that which united substances of different colours, and polylithic statues, or those composed of several stones.* These kinds of sculpture, which are rejected by modern artists, had a great sway among those of antiquity, even in the brightest periods of the art, and were held in greater estimation than monochromic sculpture, or that which made use of only one colour. As the periods in which the greater part of the sculptural substances have been used are unknown, a chronological arrangement becomes impossible, and we have therefore arranged them alphabetically in their several classes.

Clay.—This unctuous and binding earth was used in the first essays in modelling, as in the case of Dibutades, 900 years before Christ. In Greece there still existed, in the time of Pausanias, many very ancient statues and bas-reliefs in terra-cotta.

WOODS MENTIONED IN THE ANCIENT AUTHORS.

Box.—Statues were made of this, and the living tree also was cut into the figures of men and animals. We see instances of this appropriation of the box and the yew in the ancient paintings of the Museum of Portici, now at Naples, where these trees are represented cut and disposed in compartments, serving as ornaments in the Roman gardens, in the same way as they are used in modern times. Tablets of box, and also those covered with wax, were used for drawing in the time of Apelles.† Cedar, was regarded as incorruptible. A resin was also extracted from this tree, which was applied to wood and other objects wished to be preserved. It was often used as a kernel or core of statues of gold and ivory—according to some authors the Diana of Ephesus was of this wood. Citron.—This was a kind of cedar, and was used in making valuable tables of large dimensions. Mr. Monges read at the Institute, some years ago, an interesting paper on this wood and on the tables. Cork.—The bark of this tree was one of the first substances used for small figures. Cypress. Ebony was much esteemed. Dipœnes and Scyllis of Egina made many statues of it, and as a religious idea was attached to the colour of certain objects, it was probably used as a substitute for black marble. Fig-tree, being white and easily worked, was also used for certain divinities. Fir was used for the wood-work of the horse of Troy. Lime-tree. Lotus. Maple. Myrtle.—At Lemnos, there was, according to Pausanias, a statue of Venus erected by Pelops in female myrtle. This was probably a kind of log or rude idol, covered with real drapery. Oak. Olive. Palm replaced the cork, although, from its fibres and knots, it could not have been favourable to sculpture. Wild Pear-tree.—Of this wood there was a Juno at Samos. Peach. Pine. Poplar. Vine.—The wild vine, and that of Cyprus, were particularly used. The Diana of Ephesus was, according to some authors, of this wood. Although there are vine stocks of large dimensions, it is not easily to be conceived how statues could be made of them, on account of the number of knots; the wood also is stringy, and not easily worked. Yew. Willow. Osier. and Sallow.—An Esculapius of Sparta, and a Juno of Samos, are mentioned as being made of wicker, but they must have been as rude as scarecrows. The colossal figures called Arga, thrown yearly into the Tiber, were made of these trees; as also the immense Colossus in which the Germans burned their prisoners in honour of Teutates.

METALS AND OTHER MATERIALS.

Adamant.—A statue of Venus is spoken of as composed of adamant, and attracting a mass of iron. Aurichalcum or Orichalcum, was an alloy of copper and gold, esteemed for its brilliancy and hardness. To prevent bronze from changing, and to give it a good colour, it was rubbed with the *amurca* of olive, or with bitumen. Bronze, or Copper.—The manner in which we employ this metal, gilding it, or covering it with a colour which it should derive only from time, prevents us from investigating those mixtures which would give it greater brilliancy or beauty. At present, however, at Paris, much more care is used in the proportions of the alloys. Bronze or brass, more solid than copper, is only this latter metal united to tin or zinc in certain proportions; the ancients who executed an immense quantity of statues and works in bronze, made a great variety in their alloys. The brass, bronze or copper most celebrated, were those of *Cyprus* (Kupros), from which is derived the name of copper—of *Corinth*, the alloy of which is attributed to chance, to the melting and mixture of several metals during the burning of that city; but it appears that this is hardly possible, and that the bronze is more ancient. In the time of Pliny it was imitated with an alloy of copper, gold, and silver. —of Delos and of Egina was much esteemed, as well as that of Tartessus in Betica; Polycletes preferred the bronze of Delos, and Myro that of Egina. The different kinds of copper, of *Cordova* or of *Marius*, of *Sallust*, found in the Alps, and of *Livy*, mined in Gaul, were much sought after, and derived their names from the proprietors of the mines who worked them in the time of Cæsar. There was also a black bronze, and also that which, being of a liver colour, was called *hepatizon*, from *hepar*, a liver. It was believed for a long while that the ancients dipped bronze in water to harden the arms which were made of it; but M. d'Arcet has proved that tempering softens bronze, and that it is only by alloying copper with tin in certain proportions, and by forging it, that it acquires hardness and elasticity, and becomes sonorous. Electrum, which is mentioned in Homer, was either natural or artificial. It was made by mixing a fifth of silver with four fifths of gold. This alloy was much esteemed, because it was found to shine more with lights than either gold or silver. Pliny says that vases made of it assumed the colour of the iris or rainbow. The name of electrum was also given to yellow amber. Gold. Iron.—Several statues of this material are mentioned, both wrought and cast.* Lead.—The statue of Mammurius, who made the ancillæ or sacred bucklers in the time of Numa, was of this metal. Obrizum was the purest gold, which, after having passed several times through the fire, acquired a brighter colour. Some statues were made of massive gold, but in general they were embossed (called *Sphurelaton*) from a thin plate. Gold was thus used in statues where it was joined to ivory; and often statues in metal or wood were only plated or gilt. Gold of several colours were used, and sometimes also painted ornaments or precious stones were used in conjunction with it. Silver is frequently mentioned by authors as a material for statues; it is, however, less adapted for sculpture, and was less used than gold, of which several preparations were known. Tin is enumerated by Homer among the metals in the shield of Achilles; but it is more than doubtful whether this description and others relating to the arts were written by the great poet.

Ivory was used in great quantities and at a very early date for statues, both by itself, and in conjunction with gold. It seems, according to some authors, that the ancients found out the means of moulding it, or at least of softening it. By sawing in the length, and by cutting out hollowing cylinders in the ivory, they obtained plates large and thick enough to be used even for colossal statues, of which the core or interior framing was of wood. The humidity of these statues was kept up by the application of oil, either externally or internally. The tooth of the hippopotamus was also used for small statues, probably in the place of ivory. Bone, and among others that of the camel, were appropriated to the same use. The Palladium was reputed to be made of the bones of Pelops.†

Wax was employed as well as *plaster* for models and moulds. Statues or figures were also made of it; and the Romans used it for the busts of their ancestors (thence called *ceræ*), which on days of ceremony were decorated with clothes and ornaments.

Pitch.—A statue of Hercules of pitch is cited as having been made by Dedalus.

Yellow Amber, Succinum, or Electrum.—Of this a statue of Augustus was made. Incense and Spices.—A statue of Sylla was made of such compounds, and burned at his funeral. Empedocles, the Pythagorean, and Olympic victor, distributed to the people a bull made of myrrh. Mention is even made in the ancient authors of great

* This prevailed even down to the period of the decline of Roman art, and the examples are so many that it is almost useless to refer to any individual instances. Among others is the well known panther in the Museum at Naples, of white marble with black marble spots, a Plautilla in the Museum of the Campidoglio at Rome, also in white marble, but with a moveable wig of black marble. The hair of the Venus de Medicis was gilt. In the Louvre is a polychromic statue of Rome, of which the body is in porphyry, and the head and arms in gilt bronze. In the frieze of the Parthenon in the Elgin collection, are the holes by which ornaments and instruments in gilt bronze were affixed. The ground-work also of the bas-reliefs was painted sky blue, in order to throw out the figures. At Pompeii, in the temple of Isis, was also found a marble Venus with gilt hair, and most of the cornices of the rooms are of a red or blue ground. The same is observable in most of the ancient temples of Sicily. The hair of the statues of the daughters of Balbus at Herculaneum is painted red. The Minerva in the British Museum, with a black helmet, is a modern restoration.—[Note of Translator.]

† Box is used by the wood engravers; pear-tree was used by Albert Durer; and bamboo is used by the Chinese in their plates for printing.—[Note of Translator.]

* It is much to be regretted that iron is not used as a material for statuary in England, seeing that it has been so much used at Berlin and Paris.—[Note of Translator.]

† Our author makes no mention of the use of mother-of-pearl. The pearl itself in different forms was used extensively by the jewellers, and half pearls under the name of tympana, were used for ear-rings. At Pompeii ear-rings have been found of the form of scales, the scales being represented by pearls.—[Note of Translator.]

figures made of *flour paste*, of *hay*, and of *wood*. These kind of effigies were used also for sorcery; those called *neuropastes* and *oscillæ*, were moved by means of thread, like our puppets; and some were also moved by quicksilver.

(To be continued.)

FRENCH FURNITURE, MANUFACTURES, &c.

Upon a former occasion we called attention to an article in the second number of the Foreign Monthly Review, and we now do so to the fourth number of the same journal; not for the purpose of bestowing any notice upon the capital, the witty, and humorous paper on Esskunst, or the *Philosophy of Eating*, which has generally been pointed to as the most attractive of all the articles; but in order to lay before our readers some extracts from that entitled "French Manufactures."

"These works (L'Exposition, Journal de L'Industrie, and L'Album de L'Industrie,) are directed to accurate representations and descriptions of all the best modern works of art (painting and statuary, properly so called, excluded), as well as of manufactured products that either exist in France, or are on the point of appearing. Does a new moulding for a marble chimney-piece appear—does a new bronze boss for a door-handle, &c., come out—is a house erected in more than ordinary good taste—is a new lamp sold anywhere—has a splendid carriage been seen in the Bois de Boulogne—in a few week's time it is laid before the manufacturing public, in full detail, by these useful publications, engraved with the utmost care on steel, and coloured *au naturel*. For example, one of the numbers contains a very elaborate plate of the interior of Musard's café, a beautiful specimen of Gothic work of every kind; another has Marshal Soult's coronation carriage; a third has the front of a *modiste's* shop in the Rue de Richelieu; a fourth presents us with some curious pumps and other hydraulic instruments; and all of them are embellished with representations of various articles that have figured in the great exhibition of arts and manufactures in the Champs Elysées."

To go even no further than this, we have here a very striking proof of the much greater taste for art generally in France, and for works expressly intended to represent its productions; whereas such publications would not find sufficient market in this country. Unless they belong more or less to the class of antiquarian specimens, subjects of the kind would meet with no purchasers among ourselves. Indeed, there is reason for suspecting that even works having architecture professedly for their object meet with very inadequate encouragement, or rather with discouragement, with chilling coldness and indifference. To be at all a saleable commodity, architecture must be served up in picture books, where the interest of the plates is made to lie not in the buildings so much as in the figures and costumes introduced, and in that sparkling effect of light and shade which may be made to set off the ugliest just as well as, perhaps better, than the most tasteful piece of architecture.

However let us drop these reproachful comments, and proceed with our extracts. "The new stuff woven of silk and glass, or glass alone, attracted much attention in these galleries. According as the glass threads are coloured, yellow or white, they imitate gold or silver brocade with the greatest nicety, and they have the advantage of never tarnishing. *Their effect for furniture is most splendid.* The price is from 25 to 40 francs the ell."—Here then, is a perfect novelty, which will probably lead to some changes in decoration. If, as we presume, tissues woven entirely of glass are not likely to be at all injured by heat or flame, they might be applied to draperies and canopies, over chandeliers and lustres in a ball room, where, if tastefully designed and arranged, they would produce a striking and appropriate effect.

"In furniture, the prevailing taste of the *Renaissance* had it all its own way—at least for all cabinets, tables, bookcases, &c. No other furniture in the world can be compared to that of France—we do not say in solidity, but in taste and appearance. To these two qualities the Parisian manufacturers have recently added those of good workmanship, of artistical design and execution, and of moderation of price. In many articles, ingenuity has been greatly on the rack, and some of the beds which turned into sofas or tents, and might accommodate half-a-dozen sleepers or one as the case might be, with others that shut up in a common portmanteau, were highly creditable to their inventors. The carpets that come in for so important a share in English house-keeping expenses, were here in wonderful abundance, and at comparatively moderate prices; the Aubusson carpets were nearly as sumptuous things as what the Gobelins or Beauvais could turn out. The cabinets, the commodes, the tables, whether in oak, in ebony, or in rose-wood, (mahogany is entirely gone out of fashion,) were all carved in the most sumptuous and expensive style, richly ornamented with gilt bronze, and incrusted with plates of various coloured marbles, or mother-of-pearl."

Though we ought to desist from quoting further, we cannot refrain from extracting what is said relative to an invention by M. Colas. "This process admits of very speedy and cheap application to all works of art, and as an instance of its use, we may mention that a great quantity of wooden gothic panel-work being wanted at a low rate for the restoration of the church of St. Germain, L'Auxernois, the inventor has contracted to furnish many thousand feet, sculptured in the most exquisite manner, after the original model taken from the old church, *at little more than the value of the material*" ! ! After this we need not say that the article deserves to be perused by all our readers; and we should be glad if any could confirm what is stated as to the new process for copying gothic panel-work, since, unless very greatly exaggerated, it must be a most important invention, and one likely to improve our modern church architecture in that style.

SPEED ON RAILWAYS.

A COMMUNICATION BY THE COPTE DE PAMBOUR TO M. ARAGO.

The resistance of the air to bodies which travel through the atmosphere with a rapid motion, having given room to some persons to imagine that locomotive engines could never attain a very great velocity on railways, I think it will be interesting to you to know, that in an experiment I have just made (on the 3rd August,) upon the Great Western Railway between London and Maidenhead, we attained a speed of 55·4 English miles per hour. The experiment was performed by the "Evening Star" locomotive, manufactured by Mr. Robert Stephenson, of Newcastle: it has wheels of 7 feet diameter, and drew only the tender loaded with 8 persons. It maintained easily, during 7 or 8 miles, a speed of 45 miles per hour, afterwards, for a distance of 3 or 4 miles, a speed equal to 48 miles per hour, and at last, two miles were travelled over, each in one minute and five seconds, which gives a velocity equal to 55·4 miles per hour. Although this very rapid motion gives one the idea that we are left to the mercy of chance, by the difficulty there would be to stop the engine in time, in consequence of the almost complete instantaneousness with which obstacles present themselves, to overcome this difficulty it would be necessary to increase the inspection of the state of the railway, and to employ rapid means of transmitting to a distance, by signals, the state of the road.

With the engine employed for the experiment we were not able to go beyond the speed stated above, because the pump was not sufficiently large to feed the boiler, consequently we were obliged to suspend the vaporisation, and to decrease the speed, until the boiler was again replenished with water; but there is no doubt that in only enlarging the diameter of the pump and feeding pipes, we might be able to maintain the greatest speed for a long distance—and even to go beyond it. Speed equal to what I have reported has already been mentioned in some journals, but as these statements are often made upon hearsay evidence only, I have thought that it would be useful to you to be informed of it by the experimentalist himself. I have not given here the different dimensions of the engine, because my only object now is to make known the facility that there is in attaining considerable speed. I shall only add that the Great Western Railway is sensibly a level.

OBSERVATIONS ON THE RESTORATION OF RUINS.

Many who imagine themselves antiquarians consider it as a perfect desecration to remove the verdigris and dirt from a coin, so as to render the device plain and distinct, or to clean the pages or renovate the binding of a *Caxton*.

Now this opinion, no matter how common, is generally admitted by those whose authority in such matters is unquestioned, to be a most mistaken and absurd one. In what possible way can it be defended? If a coin possesses any value from its antiquity, it is because we have in it a specimen of ancient workmanship and device, and also because it is the same object which was familiar to those who have long since ceased to exist. Therefore the more that coin resembles in its appearance what it was when in circulation, the more distinctly shall we see in it the workmanship, the device, and the image, that were familiar to those who lived when it was in circulation. And not only is the value thus highly increased by the greater distinctness of the image, but a new and not ideal value in some instances originates. By the study of these devices we are able to check the accuracy of the historians of the age in which they were made, and Capt. Smyth, R.N. has lately written a book on coins (which from such a title might have been expected to be a treatise interesting only to a very few), whereas it may be considered as a *historical* work, and one too of a novel and most interesting description.

In the same way the most inveterate *boke worms*, although they justly give the preference to an original binding, never hesitate if a book is dirty, "soiled or sullied," or has an irreparably "frail" or tashed binding, to get it cleaned and reinstated in a vellum, Russia, or such other binding as most befits the date and nature of the work.

Although the best authorities therefore are clear as to coins and books, I do not think the same feeling exists with regard to the repair of ruins, although I cannot but think that all the three cases are parallel.

To destroy the picturesque effect of an old abbey or church, seems generally to be considered as a sort of murder of antiquity, the atrocity of which no inducement can palliate. Although it is impossible to deny that a dismantled tower may have a more picturesque effect at a distance than if it were entire, and also that shattered masonry does frequently assume a romantic outline which is no where else to be found, still a complete building may have in some degree a picturesque as well as architectural outline, and these advantages, when combined with that of perpetuating the perfection of the design to future ages, and its restored utility, are, I think, quite enough to warrant judicious restitution.

I need hardly say that I do not approve of such Vandalism as to complete an imperfect building in a different style of architecture from the original, as may be found in Llandaff cathedral, where the alterations, as far as I recollect, are in the Grecian order, which contrasts wretchedly with the original.

The most interesting spot in the three kingdoms I take to be Westminster Abbey, and I am sure all will agree that were that building allowed to fall into a ruinous state—to lose its roof and so forth, it would not in any way possess the same interest. When we enter a *veritable* ruin, destitute of all the minor details which it once possessed, we have to *cause* with ourselves in order to awaken a suitable interest, and after all, that interest cannot but fall short in intensity of that which we at once and irresistibly feel on entering an old richly decorated cathedral, with its curiously carved oaken stalls, its lofty roof, and all the other adjuncts of an ancient building, which the storms of troublous times have not yet swept away from our view. And this is what makes the cathedrals and religious houses of England triumph so much in interest over similar buildings in Scotland, where the fire of intemperate zeal has, in too many instances, left its records in shattered pillars and broken walls, the wrecks of glorious specimens of architecture. How tenfold interesting, if entire, would have been the cathedrals of Melrose, Dryburgh, St. Andrews, Aberbrothwick, Elgin, Iona, and many more, where now enough only is left to show us *how much* we have lost. And if no new interest and opinion is formed on this subject, we shall, I fear, find such relics grow gradually less interesting. Every blast adds to the rubbish, and every winter curtails their extent.

The object I have in view in these remarks is to waken, if possible, such an interest in ruinous churches, as shall determine *those who have an influence in the erection of new churches, rather, when possible, even although at a much greater cost,* TO RESTORE OLD ONES THAN BUILD NEW.

What gave rise more immediately to the preceding remarks was a visit to the island of Iona, where the Duke of Argyll, with his characteristic benevolence, has recently erected, and I believe endowed, a church, which, however, cannot be said to possess the slightest claims to architectural effect. In such a case, then, how much more suitable would it have been to have restored (with proper advice) part, if not the whole, that remains of the ancient cathedral, which St. Columba erected soon after his arrival at the island in A.D. 563, and which was so miserably ransacked at the time of the Reformation, whereby Scotland lost her "ancient annals and MSS." (which were kept at Iona, "in hidden presses of the church,") and "large parchments signed by the king's own hands, and sealed either with seals of gold or wax."*

I trust that these remarks will at least get a little consideration from those to whom they are more especially addressed; and should it happen, as in many instances it may, that no drawings are in existence to shew the original plan of a building now much dilapidated, the best course is to take the advice of some architect who is thoroughly acquainted (as every one should be) with the styles of architecture which distinguished different ages, and with this advice to complete the building in keeping with those parts which still remain.

In conclusion I may be permitted to observe, that although I have no doubts as to the orthodoxy of the general principles herein advocated, I am nevertheless willing to admit that many specious and even reasonable objections may, in particular cases, be brought forward—nay more, I allow that even in the case of Iona, I *may* have formed an erroneous opinion, as I had not time, during my visit, to examine either the old cathedral, or new church with that degree of care which, had my time permitted, I should have done.

Sept. 10, 1839. L.

* Sir George Mackenzie, *Def. of Roy. Line of Scotland.* Lond. 1685, p. 30. Transl. of Paulus Jovius.

BUNNETT AND CORPE'S CONCENTRIC STEAM ENGINE.

Sir.—Referring to the June and July numbers of your valuable Journal, I beg to dissent from the conclusions you have drawn, respecting the merits of Messrs. Bunnett and Corpe's Concentric steam engine.

I am not disposed to deny the accuracy of the tables you have given; the results noted therein, might naturally be expected from the manner in which the relative powers of the new, and old modes of application were decided; my object is to show that one main feature in the case has been overlooked, which, when taken into account, will considerably diminish, if not altogether do away with, the advantages which at first sight appear in favour of the Concentric engine; for whatever additional power is exerted by it, a corresponding expense of steam will be the necessary consequence, which is tantamount to no advantage at all.

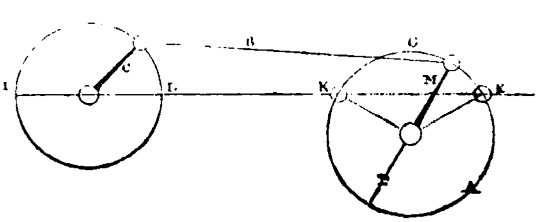
If this can be shown to be true, I am humbly of opinion that it cannot be claimed for this machine, that any power is gained by its adoption, as we are only entitled to consider that we have gained power by new combinations, when these enable us, *at the same expense*, to produce greater effects than with the old.

In the Concentric engine there is nothing new in principle; the arrangement of its parts differs little, and that only mechanically, from those at present in use. Desirable as it may be, and often is, to modify the mechanical powers, to suit the various purposes of machinery; all the changes we can ring upon them will never help us to an increase of power, beyond the lessening of friction through simplicity of construction.

In order to illustrate what is meant by these remarks, let me call your attention to the annexed diagrams, which are nearly similar to those in the last number of the Journal already referred to:—

Fig. 1.

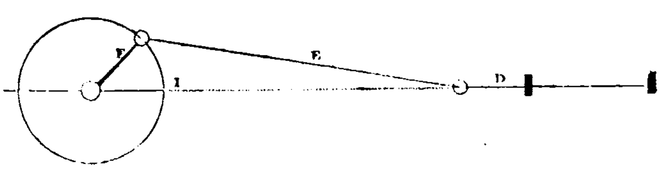
Representing the new mode of applying the power.



A the annular piston rod, B the connecting rod, C the crank, P the piston

Fig. 2.

Representing the old mode of applying the power.



D the piston rod, E the connecting rod, F the crank, equal to the crank C.

It is evident, from the construction of these diagrams, that the annular piston-rod A, will move through a greater space than the piston-rod D requires to do, in producing revolutions of their respective cranks, C and F. The stroke of the piston D will be as the length of the straight line I I, or as the lines K K and L L, these three lines being equal to one another. On the other hand, the stroke of the annular piston-rod A will be as the curved line K G K, which is much greater than the straight line K K.

Now assuming that the impulsive force is a constant quantity, and alike at each instant on both pistons, it follows from the above, that the effects on the cranks will be respectively as the length of the curve K G K is to the straight line K K; in other words, the length of the stroke of the pistons will be as the length of these lines individually, thus involving an expense of steam in the Concentric engine, equal to the advantage which would seem to arise from the use of it.

Another view of the case may be taken, somewhat simpler than the foregoing, by which it may be shown that the mode of communicating power by the Concentric engine is a matter of every day occurrence.

Let the lever M represent one half of the beam of an ordinary beam steam engine, B its connecting rod working the crank C; these together delineate movements almost inseparable from the use of the crank, and nearly coeval with the steam engine itself, as it came from the hands of its great improver; the parallel motion alone is wanting to fill up the picture: and if it is to this circumstance, that the superiority of the Concentric engine is to be attributed, I fear its days are numbered as an engine "by which great power is gained;" that it may take its place with many of the best locomotive engines now in use, is not to be denied: but I beg respectfully to protest against the possibility of its exerting more force than others from the same quantity of steam.

It is under these impressions, that I have ventured to address you, and in the belief that these imperfect observations will account for the different results, obtained from the experiments made on the two engines; I am also inclined to believe that their appearance in the Journal, would be useful in counteracting whatever erroneous views may have been formed by the perusal of the tables.

I am, Sir, with great respect,
Your obedient servant,

Carron, August 16th, 1839. JOHN MAC DONALD.

CURVES ON RAILWAYS.

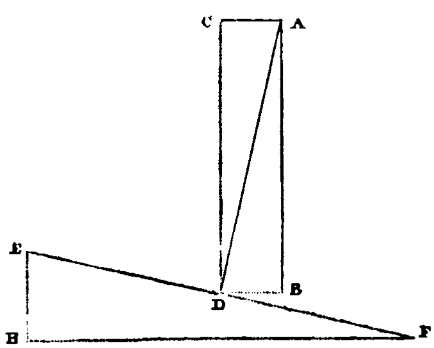
SIR—I beg to forward to you the following remarks on a point which has not been noticed in any of the numerous essays on this subject which have appeared in your Journal.

It is one of considerable importance, and is not (that I am aware of) to be found in print, except in Pambour's work on locomotive engines; the formula there given produces the same practical result as that which I have deduced, but is, I think, somewhat less simple in its application.

Your's respectfully,
M.

How much must the outer rail of a curve be raised above the inner, in order to counteract the centrifugal force of a carriage?

Let A be the centre of gravity of the carriage; draw a vertical line A B, and a horizontal line A C, representing the weight and centrifugal force respectively; then A D, the diagonal of the rectangle, will be the resultant force of the two.



Now if a line (E F) be drawn at right angles to A D; and D E, D F, be taken upon it each equal to half the distance between the rails, the force A D, being perpendicular to the line of support, has no tendency to press the flange of the wheel against either of the rails E or F. This position of the rails, therefore, will answer the conditions of the problem.

Draw F H horizontal, and E H vertical.

Let W = weight of the carriage.
Wf = the centrifugal force.
R = radius of curve in chains.
V = velocity in miles per hour.
r = radius of curve in feet.
v = velocity in feet per second.
$g = 16\frac{1}{12}$.
E F = a in feet.
E H = x in feet.

Then the centrifugal force $= \dfrac{W v^2}{2\,gr}$ (see any work on Mechanics,) $= Wf$.

$$\therefore f = \frac{v^2}{2\,gr} = \frac{(\frac{22}{15}\,V)^2}{2 \times 16\frac{1}{12} \times 66\,R} = \frac{V^2}{R} \times \cdot 00101324.$$

By the similar triangles A B D, F H E,

$$AB : BD :: FH : EH$$

$$\text{or} \quad W : Wf :: \sqrt{a^2 - x^2} : x$$

$$\therefore 1 : f^2 :: a^2 - x^2 : x^2.$$

$$\therefore 1 + f^2 : f^2 :: a^2 : x^2$$

$$\therefore x = \frac{af}{\sqrt{1+f^2}}$$

Example.—What must the elevation be for a curve of 60 chains, (3960 feet), radius and velocity of 30 miles an hour, (44 feet per second,) the distance between the rails being 4·75 feet?

Here $f = \dfrac{44^2}{2 \times 16\frac{1}{12} \times 3960} = \cdot 0152$, and $\sqrt{1+f^2} = 1 \cdot 00011$;

$$\therefore x = \frac{4 \cdot 75 \times \cdot 0152}{1} = \cdot 0722 = \cdot 8664 \text{ of an inch.}$$

The above formula is extremely simple, as the value of $\sqrt{1+f^2}$ will be very nearly 1 in almost all practical cases.

ON WARMING OF BUILDINGS.

SIR—Upon reading your remarks upon the warming apparatus at Mr. Babbage's house, described in my pamphlet, I find you consider that the part which is not effective is owing to the malformation of those pipes which branch from the multiple cock; as this is not by any means the case, you will perhaps have the kindness to notice the following few remarks in explanation. Mr. Babbage confined his experiments to a certain small amount of fuel, working his apparatus at the low heat of 250° Fahr., this was not sufficient to cause a quick circulation through the whole extent of pipe, the four different courses containing 890 feet.

The furnace being placed in one of the servants' sleeping rooms, it was more important to keep this room cool than to warm the rooms in the upper part of the house.

Mr. Babbage succeeded in his two principal objects, 1st, the making use of every particle of heat that was practicable, sufficiently with creating a draft in the chimney. 2nd, The perfect self action or regulation of the apparatus. It is his intention to extend his experiments next year, in order to obtain *(without producing any additional heat in the furnace room)* with a greater amount of fuel, increased effect in the bedroom circulations.

I remain, Sir, your most obedient servant,
C. J. RICHARDSON.

24, *Manchester Street, Sept.* 10, 1839.

*** Notwithstanding Mr. Richardson's remarks, we are still of the same opinion, that "it would be far better if the connection of the branches were made with curves instead of at right angles;" if Mr. R. will consult any hydraulic engineer, we have no doubt but what he will have the same feeling on the subject.—EDITOR.

MECHANICAL BRICK MAKING.—At the meeting of the British Association at Birmingham, Mr. Cottam exhibited a model of a brick and tile-making machine invented by the Marquis of Tweeddale, by which it was stated 30 bricks a minute, or nearly 30,000 bricks a day, might be made, whilst a good moulder could only mould from 5000 to 8000 a day. The clay was put into the machine at one end, and passing between two rollers was rolled into a long bar, which was cut into the required length of the bricks by a cutter worked by the same wheel-work. The bricks, on coming out at the opposite side of the machine, were carried by it to a distance of 200 yards, thereby saving a great amount of time and money in carrying, an operation usually performed by boys and women. As a proof of the superiority of the machine-made brick, it weighed 8¾ lbs., while a common brick weighed only 5¾ lbs., and the machine-made brick carried eight times the weight which the common brick would sustain.

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Referred to in report in last month's Journal, page 331.

TABLE A.

WE have arranged this table differently to what it appears in the original report, and we have classified the quarries in districts and counties; which will enable our readers to see more readily those parts of the kingdom which have been examined.

The Table contains THE NAME OF THE QUARRY—its situation and county—*The Mineral designation of the Stone;* its component parts—*and colour.* Weight of a cubic foot of stone in its ordinary state—the entire depth of workable stone in the quarry; description of the beds, and size of blocks that can be procured.—Where known or reported to have been employed and general remarks—Prices of block stone at the quarry; description and cost of carriage *(c)* to the pool of London; cost of stone delivered in London per cubic foot; and cost of plain rubbed work as compared with that upon Portland stone in London per foot superficial, Portland being taken at 1·0.

DISTRICTS IN ENGLAND.

(NORTH.)

Durham.

PENSHER.—Pensher Colliery, Durham; *sandstone;* coarse quartz grains, with an argillo-siliceous cement, plates of mica; *pale whitish brown;* 134 lbs. 5 oz.; depth 40 to 50 feet; thickest bed, 20 feet; blocks any practicable size—Pensher chapel, Scotch church, Sunderland, St. John's chapel, Bishop Wearmouth, Wynyard Mansion-house, Sunderland pier, Seaham harbour, Victoria bridge on the Wear, &c.; 8¾d *per ft.* at quarry; *c.* by railway, 1 mile and a half to river, thence to Sunderland, and thence by sea to London, total cost 13s 2d per ton, or 1s 7d per foot in London; plain work 1·0.

REDGATE.—Redgate, Durham; *sandstone;* fine quartz grains with a calcareo-argillo-siliceous cement, mica in planes of beds; *light ferruginous brown;* 139 lbs. 9 oz.; depth 20 feet; the beds vary from 1 to 8 feet thick; the quarry is neglected and badly worked. It is said to have been set out sometime since under an inclosure act for the use of the parishioners for ever, who get all the stone from it which they require free of charge for royalty. The head or cover of the quarry is 6 feet thick; plain work 0·9.

STENTON.—Stenton Village, Durham; *sandstone;* fine quartz grains and decomposed felspar, with an argillo-siliceous cement, ferruginous specks, and some plates of mica; *ferruginous light brown;* 142 lbs. 8 oz.; depth 35 feet of rock quarried; irregular beds from 2 to 8 feet in thickness; blocks 15 to 20 feet long—Round keep of Bern rd castle, joint-stock bank and market-house, Bernard castle; sinks are worked out of this stone 6 feet by 3 feet 6 inches by 1 foot 6 inches, also grindstones. Another quarry of stone, in all respects similar to the south-east of this quarry, from Mr. George White, farmer to Robert Brownless. Depth of workable stone 25 feet. Blocks of 8 or 9 feet cube, 4*d.* at the quarry, fine-tooled face, including joints and beds at 4*d.*, if rubbed 2*d.* extra. Quarry joints 2 to 8 feet apart. Dip of beds 4° or 5°. The quarry was opened about 60 years since; 5½d *per ft.* in small blocks at quarry; *c.* by land to railroad east of Bishop Auckland, 8 miles, at 4s per ton, thence to Stockton, by the railway, 2s 6d, thence to London, 8s per ton, in all 14s 6d per ton, or 1s 5d per foot in London; plain work 0·9.

Northumberland.

HEDDON.—Heddon on the Wall, Northumberland; *sandstone;* coarse quartz grains and decomposed felspar, with an argillo-siliceous cement, ferruginous spots; *light-brown ochre;* 130 lbs. 11 oz.; depth 49 feet; beds vary from 4 to 12 feet thick; blocks any practicable size—Church at Heddon, steeple 1764, Norman chancel, columns of portico to theatre, and Grey monument at Newcastle, and nearly all the buildings, ancient and modern, in and about New... clay balls are occasionally met with in this stone as well as laminations of carbonaceous matter. Quarry joints 11 to 30 feet apart. Quarry opened above 200 years since. Quarry cover 10 feet thick; 6d to 10d *per ft.* according to size at quarry; *c.* by land to the Tyne at Newburne, 2 miles, thence to Newcastle, and by sea to London, or 1s 8d to 2s per foot for blocks under 4 tons, in London; plain work 1·1.

KENTON.—Kenton, Northumberland; *sandstone;* fine quartz grains with an argillo-siliceous and ferruginous cement, mica in planes of beds; *light ferruginous brown;* 145 lbs. 1 oz.; depth 25 to 30 feet; beds vary from a few inches to 5 feet in thickness; 10 ton blocks if required; nearly all the new buildings at Newcastle erected by Mr Grainger; this stone is selected particularly for fine work, carving, &c., mill stones are made of it. The upper beds are similar to the York flagging usually brought to the London market.—The bulk of the stone used for ordinary purposes in Newcastle is from the Felling near Gateshead, and the church quarry, Gateshead Fell. Joints in quarry 2 to 20 feet apart. Dip of beds 11°. Quarry cover 15 feet. Quarry opened 20 years since; 6d *per ft.* blocks under 7 feet, 9d blocks under 14 feet, 1s blocks under 20 feet, 1s 4d blocks under 50 feet, at quarry; *c.* by land to Newcastle, the small blocks 2s 6d per ton, large blocks 3s 6d per ton, thence by sea to London, 8s per ton for blocks under 2 tons, or 2s per foot average size blocks in London; plain work 1·3.

Lincolnshire.

ANCASTER.—Ancaster, Lincolnshire; *oolite;* fine oolitic grains cemented by compact and often crystalline carbonate of lime; *cream;* 139 lbs. 4 oz.; depth 13 feet; numerous beds, running into each other, from a few inches to 18 inches, the lowest beds are the most crystalline; blocks 3 to 5 tons—Wollaton Hall, Belvoir Castle, Belton House, and numerous mansions and churches in Lincolnshire; this stone is worked with the same tools as Bath stone, joints in quarry from 4 to 20 feet apart, beds with a moderate dip, quarry cover 7 feet of clay; numerous and extensive quarries of similar stone in the immediate locality, opened several centuries since, now out of work—9*d per ft.* in random blocks at quarry; *c.* by land to Grantham, 7 miles, thence to Boston by canal 1s 1d per foot, thence by sea to London 9d per foot, in all 1s 10d, or 2s 7d *per ft.* in London; plain work 0·5.

GILES (SAINT).—Near Lincoln, Lincolnshire; depth 8 feet; straight and thin bedded, thickest bed 15 inches, two blue beds below bottom of quarry, upper part of quarry alternations of clay or marl or limestones, beds vary much in texture, best bed contains an abundance of shells—Lincoln Cathedral in part; quarry cover 5 feet thick.

HAYDOR.—Haydor, Lincolnshire; *limestone (oolitic);* carbonate of lime with oolitic grains, often crystalline; *brownish cream;* 133 lbs. 7 oz.; depth 13½ feet; thickest bed 18 inches; blocks 14 feet, 3 feet by 4 feet—Lincoln cathedral, Boston church, Grantham church, Newark church, and most of the churches in the neighbourhood, and in the lower part of Lincolnshire, Culverthorpe house, Belvoir castle, &c.: it is essential that this stone should always be set upon its natural bed. This quarry and those immediately adjoining, which are numerous and extensive, are of great antiquity. Quarry cover of clay 14 feet thick; 8d *per ft.* at quarry; *c.* by land to Sleaford 6d per foot, thence through Boston to the Pool of London, from 1s 5d to 1s 8d per foot according to season, or 2s 4d per foot in London; plain work 0·5.

Yorkshire.

BOLTON'S QUARRY.—Aislaby, Yorkshire; *sandstone;* moderately fine siliceous grains with argillo-siliceous cement, plates of mica and spots of carbon disseminated; *warm light brown;* 126 lbs. 11 oz.; depth 46 ft., top beds 26 feet deep for house building, bottom beds 20 feet for docks, &c., beds generally from to 8 feet thick; blocks 100 feet—Whitby Abbey, New University Library at Cambridge, Scarborough and Briddlington Piers, Sheerness and St. Katherine's Docks, &c.; blocks of 100 feet cube have been obtained from this quarry; stone usually sent in two-horse carts to Whitby, carrying 3½ to 4 tons, each cart will make three journeys per diem; joints in quarry 10 to 25 feet apart; beds with a moderate dip; quarry opened 23 years since; 10d to 1s *per ft.* according to size at quarry; land carriage to Whitby 3d per foot, freight varying from 8d to 10d per foot to London, 1s 9d to 2s 1d *per ft.* in London; plain work 0·75.

BRAMLEY FALL (OLD QUARRY).—Leeds (near to) Yorkshire; *sandstone;* quartz grains (often coarse) and decomposed felspar, with argillo-siliceous cement, mica rare, small ferruginous spots disseminated; *brown;* 142 lbs. 3 oz.; depth 45 feet; six beds, the thickest of which is 16 feet; blocks up to 18 tons—In numerous bridges, waterworks, &c.; this quarry is nearly exhausted. The stone is now difficult and expensive to obtain in consequence of the great thickness of head. Blocks of 18 tons have been obtained; plain work 1·2.

BRODSWORTH.—Brodsworth, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, with sub-oolitic grains, friable; *light brown tint;* 133 lbs. 10 oz.; depth uncertain, but very great; regularly bedded, central beds the best, hard beds from 1 to 3½ feet, softer beds 6 to 18 inches, thickest beds 3 feet 6 inches—Doncaster old Church and Mansion House, Brocklesby Hall, &c.; blocks of great size can be procured. Joints in quarry irregular, some 20 feet apart. Beds dip slightly; *c.* by land to Doncaster, and thence by water to London, price of stone at Doncaster 1s 1d, or 2s 1d in London; plain work 0·85.

CADEBY.—Cadeby, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, with sub-oolitic and irregularly formed oolitic grains, friable; *cream;* 126 lbs. 9 oz.; beds from 8 inches to 3 feet 3 inches thick, regularly and straight bedded, central beds apparently the best stone, 4 feet thick—Day and Martin's, High Holborn, Almshouses at Edgeware; joints in quarry 5 to 14 feet apart. Beds nearly level; *c.* by land to Dun Navigation 1 mile, thence to Thorne 14 or 15 miles, thence by sea to London, or 1s 10d *per ft.* in London; plain work 0·8.

ELLAND EDGE.—Yorkshire: *sandstone;* fine quartz grains with an argillo-siliceous cement, micaceous in planes of beds; *light grey brown;* 153 lbs. 4 oz.

GATHERLEY MOOR.—Gatherley Moor, Yorkshire; *sandstone;* quartz grains of moderate size and an argillo-siliceous cement, ferruginous spots, and plates of mica; *cream;* 135 lbs. 13 oz.; depth 30 feet; irregularly bedded, from a few inches to 12 feet thick, some with diagonal cleavage—18 feet of the top rock fit only for backing, 12 feet freestone, fit for ashlar and other works; blocks 1 to 3 tons—Aske Hall, near Richmond, Richmond and Catterick Bridges over the Swale, Purse Bridge over the Tees, Skelton Castle, Darlington Town Hall, Sockburn Hall, and numerous modern buildings; quarry prices for labour and stone—pointed work 7*d.*, chiselled work 8*d.*, and rubbed work 9*d.* per superficial foot; 8d *per ft.* for the 12 feet bed at quarry; *c.* by land to Darlington 6s per ton, thence by railway to Stockton 5s, thence by sea to London 12s, in all 23s per ton, or 2s 1d in London; plain work 0·95.

HILDENLEY.—New Malton, Yorkshire; *limestone;* calcareous, resembling indurated chalk; *whitish-cream;* 137 lbs. 10 oz.; depth 15 feet; in thin beds, much shattered on the face, the thickest bed about 22 inches; quarry—Kirkham priory, for pavings and also for columns in chapel at Castle Howard; if this stone is sent to London a railway should be laid from the quarry to the Derwent, about one mile and a half, and thence in small craft to London. It may be worked freely in all directions. Dip of beds in this quarry 4° to 5°; plain work 0·8.

HOOKSTONE.—Harrowgate, Yorkshire; *sandstone;* quartz grains of moderate size with siliceous cement; *white and dark brown;* 142 lbs. 10 oz.; irregular, from 2 to 6 feet; stone expensive to get on account of the dip of the beds. Occasionally stained with oxide of iron. Quarry joints a few inches to 5 feet apart. Dip of beds 28°; plain work 1·25.

HUDDLESTONE.—Huddlestone, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, semi-crystalline; *whitish cream;* 137 lbs. 13 oz.; depth not ascertained; 30 feet in depth of rock quarried, irregularly bedded, from a few inches to 2 feet 6 inches thick, but beds have been met with 4 feet thick; blocks from 50 to 250 cubic feet—York Minster, Selby cathedral, Huddlestone hall, Sherburne church, Westminster hall, Galeforth hall, &c.; quarry joints free and irregular, 3 or 4 main joints only. Dip of beds very slight. Blocks lately sent to Cambridge from the quarry from 8 to 10 tons weight and 16 feet long, one block sent to Galeforth hall 14 tons. The bottom of the quarry has been bored, 40 feet deep, into a good freestone bed. Hard or glass veins in various directions occur in this stone as well as nodules of indurated matter; 2s. *per ft.* at quarry; *c.* by land to the Leeds and Selby railway 1 mile, thence to Selby, and thence by sea to London, total cost 16s per ton, or 3s per foot in London; plain work 0·95.

JACKDAW CRAIG.—Thiefdale, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia; *dark cream;* irregular beds, from a few inches to 3 feet—York Minster and probably most of the churches in York, also for the late restorations of York Minster; this quarry, which is of great antiquity, is at the top of an arched stratification of the rock, exhibiting only a small portion of the lowest bed, which is the best stone. It is probable that the upper beds were quarried indiscriminately for York Minster and the churches of York.

KIRK SMEATON.—Kirk Smeaton, Yorkshire; *magnesian limestone;* chiefly carbonate o lime and carbonate of magnesia, slightly crystalline; *warm cream;* irregular up to 18 inches, thick and much dislocated; the quarries are on the north side of, and immediately adjoining the Went River, many quarried blocks remain in the quarry, and are covered with lichens (black), some of 2 tons weight—The quarries are now out of work, and were probably forsaken owing to the trouble and cost of getting blocks of good size free from vents; *c.* by land to the Ayr and Calder canal 5 miles, thence by railway, now disused, to Goole, 18 or 20 miles, and thence by sea to London.

LEEDS (NEW).—Near Leeds, Yorkshire; *sandstone;* coarse quartz grains and decomposed felspar, with an argillo-siliceous cement, occasional plates of mica; *light brown;* 147 lbs. 8 oz.; the beds vary in thickness from 2 to 3 feet 6 inches; blocks of large size; calcareous matter met with in the joints in this quarry. These joints are from 3 to 14 feet apart, and there are some cross joints; 10d *per ft.* blocks of 4 or 5 tons, at quarry; *c.* in working weather and under favourable circumstances, to London, will cost about 1s 1d or 1s 2d per foot cube, or 2s per foot in London; plain work 1·2.

LONGWOOD-EDGE.—Longwood-edge, Yorkshire; *sandstone;* quartz grains of moderate size with an argillo-siliceous cement, mica chiefly in planes of beds; *warm light brown grey;* 153 lbs. 7 oz.; depth about 18 feet; beds vary from 6 inches to 4 feet in thickness, a yellow bed 4 feet 6 inches thick; blocks 3 tons; 9d *per ft.* for 2 and 3 ton blocks, at quarry; *c.* by land to Huddersfield, at 3d per foot; plain work 1·25.

MEANWOOD.—Meanwood, Yorkshire; *sandstone;* fine and coarse quartz grains and decomposed felspar, with an argillo-siliceous cement, micaceous, and with a few ferruginous specks; *light brown;* 139 lbs. 14 oz.; from 2 to 10 feet thick; blocks of great size; two blocks in the quarry, each weighing 9 tons, price 2*s.* 6*d.* per foot. Between this quarry and Wheatwood quarry is a quarry, called Addle Smithy, of similar stone, very coarse, where blocks of 10 tons may be procured; 10d *per ft.* for blocks of 1 and 1¼ tons, at quarry; *c.* by land to Leeds, 2d per foot; plain work 1·1.

OSMOTHERLEY.—Osmotherley, Yorkshire; *sandstone;* quartz grains of moderate size, with an argillo-siliceous cement; *dark brown;* depth of excavation 25 feet—best bed from 5 to 6 feet, average thickness—The whole of the village of Osmotherley; quarry opened about 30 years since, now in work for railroad chair blocks, the stone encourages the growth of black lichen. In the vicinity is another quarry, of the same but rather superior stone, worked by George Duck, from which the stone was obtained for the piers of the chain bridge at Stockton; 4d *per ft.* at quarry; *c.* by land to Thirsk, at 8s or 9s per ton, thence to Yarm, 12 miles, 8s per ton, thence to Stockton, at 6s per ton, thence by sea to London, loading, unloading, cranage, &c. 1s per ton.

PARK QUARRY.—Castle Howard, Yorkshire; *sandstone;* fine siliceous grains, with an argillo-siliceous cement; *whitish brown;* depth 10 feet; beds from 16 to 20 inches deep; blocks 27 feet cube—At Castle Howard; the pilasters of the south front of Castle Howard and the stabling are of Appleton stone.

PARK SPRING.—Leeds, Yorkshire; *sandstone;* fine quartz grains and decomposed felspar, with an argillo-siliceous cement, mica chiefly in planes of beds; *light ferruginous brown;* 151 lbs. 1 oz.; depth 10 feet; beds very irregular, thickest bed will work 3 feet; bared face of rock shaky; blocks any practicable size, 3 feet thick—Commercial buildings at Leeds from the old quarry, which is of exactly similar stone to that of this quarry; the old quarry, which is now worked out, was opened about 14 years since. Quarry cover 18 feet thick. This quarry was opened 2 years since; 9d *per ft.* for 1¼ and 2 ton blocks, at quarry; *c.* by land to Kirkstall, thence by canal to Leeds, and thence by sea to London, total cost 1s 7d per foot, or 2s 4d per foot in London; plain work 1·25.

PARK NOOK.—Robin Hood's Well, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, in part crystalline; *cream;* 137 lbs. 3 oz.; depth 15 feet; straight bedded, from 6 inches to 2 feet thick; 8 feet of the workable stone may be considered free from "allum" or "pot holes" containing calcareous spar, to which this stone is subject; thickest bed, 2 feet 4 inches; blocks any practicable size, 10 and 12 feet long—Robin Hood's Well, by roadside (1740), in good condition, Pontefract old church, in a large window Campsall-lodge, Askern Sparr, &c.; sinks and tanks are made of this stone, but the water wastes in them. On the opposite side of the road are two quarries of similar stone in the occupation of George Stevenson of Campsall, and Charles Saul of Askern; 7d *per ft.* at quarry; *c.* by land to Doncaster, including carriage, &c. 10s, thence to the Pool of London 16s. in all 26s per ton, or 2s 1½d to 2s 5d per foot in London; plain work 0·75.

ROCHE ABBEY.—Roche Abbey, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, with occasional dendritic spots of iron or manganese, semi-crystalline; *whitish cream;* 139 lbs. 2 oz.; depth 15 to 20 yards; irregularly bedded, thickest will work 2 feet 6 inches; blocks 8 or 10 tons—Roche Abbey church, Tickhill-castle and church, Blythe church and bridge, Sandbeck-hall, Selby-hall, two churches at Retford, Bawtry church, and numerous churches in Yorkshire and Lincolnshire; no certainty as to large blocks. The stone weathers blacks and in lines according to the bed. In modern buildings it has been employed in Furbeck-church and Furbeck-hall, Christchurch, Doncaster, Osberton and Milton churches, Nottinghamshire, residentiary deanery and cemetery, York, the external sculpture at Buckingham-palace, the screen at Bawtry, two churches at Hull, &c. Quarry joints from 9 to 23 feet apart; 8d *per ft.* blocks of 1¼ tons, of the best quality, from 1s to 1s 6d, at quarry; *c.* by land to Koningsburgh, 4½d per foot, thence to the Pool of London, 1s 1d per foot, or from 2s 1½d to 2s 11½d per foot in London; plain work 1·0.

SCOTGATE HEAD.—Huddersfield, Yorkshire; *sandstone;* quartz grains of moderate size with an argillo-siliceous cement, mica in planes of beds, and occasional specks of carbon; *light greenish grey;* 158 lbs.; depth 12 yards; several beds, some much coarser in grain than the rest, thickest bed 3 feet 6 inches—York castle, Bath hotel, Huddersfield; quarry cover 12 feet thick; 8d *per ft.* at quarry; *c.* by land to Huddersfield, at 4d per foot, or 1s 2d per foot in London; plain work 1·2.

SMAWSE.—Bramham Moor, Yorkshire; *magnesian limestone;* chiefly carbonate of lime and carbonate of magnesia, slightly crystalline; *light yellowish brown;* 127 lbs. 8 oz.; depth 21 feet; irregular beds, from a few inches to 30 inches—the thickest bed, which is the lowest, will work in 20-inch courses; blocks largest got, 8.0 × 3.0 × 3,0—Hull old church, Ripon minster, church at Bishop Burton, St. Mary's church and the minster, Beverley, the minster and several churches, &c. at York, and a new church at Appleby in Lincolnshire; this stone is not considered fit for landings, steps, &c. Depth of freestone below bottom of quarry uncertain, but probably better than any yet got. Stone works crisp and brittle, and requires care in the working. The joints in this quarry are irregular and numerous, the beds are working nearly level. The quarry was opened about 100 years since; 7d *per ft.* blocks of all sizes, at quarry; *c.* from quarry to Selby, 11s per ton, thence to London, 14s 4d per ton, in all 25s 4d per ton, or 2s 1½d per foot in London; plain work 1·0.

VICTORIA.—Stanningley, Yorkshire; *sandstone;* fine quartz grains and decomposed felspar, with an argillo-siliceous cement, ferruginous specks; *light brown;* 145 lbs. 3 oz.; depth 48 feet; entire thickness of workable beds 48 feet, thickest bed 6 feet; blocks 120 feet cube; Catholic church, Leeds: stone well calculated for steps, landings, and fine work, such as pinnacles, &c. Quarry joints 6 to 12 feet apart; 1s *per ft.* at quarry; *c.* by canals, 28s per ton, or 2s 9d per foot, in London; plain work 1·25.

WASS.—Byland, Yorkshire; *oolite;* compact carbonate of lime with oolitic grains and an argillo-calcareous cement, carbon disseminated; *brown;* soft 141 lbs. 11 oz., hard 162 lbs. 8 oz.; numerous and variable in thickness, two beds only of freestone, about 16 inches thick; west front and a large proportion of Byland abbey; now working for railway chair blocks. Main joints of quarry from 3 to 6 feet apart, a few cross joints. Beds nearly level. Quarry cover 10 feet thick. Quarry of great antiquity, long out of work, but recently re-opened; *c.* by land to Oldwork, 14 miles, 8s 6d per ton, thence to York, by canal, 12 miles, thence to Hull, and by sea to London; plain work soft, 1·0, hard 1·45.

WARWICK.—South Crossland, Yorkshire; *sandstone;* quartz grains of moderate size wi h an argillo-siliceous cement, occasional plates of mica; *warm light brown;* 148 lbs. 10 oz.; depth 12 to 15 feet; thickest bed 3 to 5 feet; blocks 12 to 90 feet long, 5 to 7 feet wide—Various public buildings in Manchester, and numerous residences, warehouses in and near that place, and in the vicinity of the quarry; this quarry was opened 15 years since; 8½d *per ft.* at quarry; *c.* by land to Huddersfield, thence to Goole, and thence to London, 23s to 25s per ton, or 2s 7½d per foot in London; plain work 1·1.

WHEATWOOD.—Addingley, Yorkshire; *sandstone;* quartz grains of moderate size and decomposed felspar, with an argillo-siliceous cement, ferruginous spots, and occasionally plates of mica; *light brown;* 143 lbs.; very irregular; of any practicable size, some of 12 tons have been obtained—New Catholic chapel Leeds, parish church Leeds, grand junction canal, and London and Croydon railroad; another quarry of similar stone, belonging to the same quarrymen, half a mile north-east of the Wheatwood; 9d *per ft.* for 1¼ to 3 ton blocks, 1s 6d for 12 tons, at quarry; *c.* by land to Leeds 2d per foot, thence by canal to Goole, and thence by sea to London; plain work 1·1.

WHITBY COMPANY'S AISLABY.—Aislaby, Yorkshire; *sandstone;* siliceous grains of moderate size with an argillo-siliceous cement, some plates of mica and spots of carbon disseminated; *light brown;* 126 lbs. 11 oz.; depth 80 feet; 30 feet in depth, of a very fine grit, one half being white and the other half a warm tint, 50 feet, of a strong coarse grit—thickest bed 15 feet; blocks 40 feet by 25 feet, 40 feet by 15 feet—Some parts of Whitby abbey, Sleights bridge, new library at Cambridge, baths and town-hall at Whitby, cemetery Highgate, Hungerford market market-house, Exeter; 10d *per ft.* random blocks, from 60 to 200 feet, at quarry; *c.* by land to Whitby, 3 miles and a half, 3d per foot, thence by sea to the Pool of London, 9s to 10s 6d per ton, or 1s 8d per foot random blocks, from 60 to 200 feet, in London; plain work 0·75.

WHITBY COMPANY'S EGTON QUARRIES, comprising ARNCLIFFE, JULIAN PARK, PRODDAMS, and LEASE RIGGE.—Egton Manor, Yorkshire; *from pale to dark brown;* depth Arncliffe 40 feet, Proddams 50 feet; a strong grit can be selected of an uniform colour. Thickest beds as follow—Arncliffe 9 feet, Julian Park 8 feet, Proddams 8 feet, Lease Rigge 5 feet; blocks Arncliffe

15 × 10 × 9, Proddams 10 × 8 × 8, Lease Rigge 10 × 6 × 5—Grosmont abbey and bridge, Egton bridge, London and Birmingham railway, Whitby and Pickering railway; 11½d *per ft.* random blocks, from 40 to 150 feet cube, at quarry; *c.* by railway to Whitby, 7 to 9 miles, 3d per foot, thence by sea to the Pool of London, 9s to 10s 6d per ton, or 1s 9½d per foot random blocks, from 40 to 150 feet cube.

WHITBY COMPANY'S SNEATON.—Sneaton, Yorkshire; depth 12 feet; a strong girt, thickest bed 3½ feet; blocks 24 × 2 × 3½—Parts of Whitby abbey, small portion of the parapet of Blackfriars bridge, London; the Percy family; who endowed Whitby abbey, possessed this property, and it is conjectured that great part of the abbey has been built of the stone from this quarry, no other in the vicinity being so much like that which appears in the building. The stone becomes thicker in descending the valley; 1s 1d *per ft.* random blocks, from 40 to 200 feet cube, at quarry; *c.* by railway to Whitby, 7 to 9 miles, 3d per foot, thence by sea to the Pool of London, 9s to 10s 6d per ton, or 1s 11d per foot random blocks, from 40 to 200 feet, in London.

WHITBY COMPANY'S NEWTON DALE.—Newton Dale, Yorkshire; depth 6 feet; a firm and strong girt, thickest bed 18 inches; blocks 6 × 4 0 × 18 inches; Leavisham church; 10d *per ft.* random blocks, from 4 to 30 feet cube, at quarry; *c.* by railway 16 miles, 3d per foot, thence by sea to the Pool of London, from 9s to 10s 6d per ton, or 1s 8d random blocks, from 4 to 30 feet, per foot in London.

(MIDLAND COUNTIES.)

Bedfordshire.

TOTTERNHOE.—Totternhoe, Bedfordshire; *limestone (argillaceous)*; calcareous and argillaceous matter, in about equal portions, structure fine; *greenish white*; 116 lbs. 8 oz.; depth 7 feet; thickest bed 4 feet; blocks 40 cubic feet or upwards, 5 to 6 feet long; Dunstable Priory church, Luton, and many other churches in Bedfordshire, Hertfordshire, Woburn abbey, Fonthill house, Ashridge, Organ-screen at Peterborough minster, &c.; this stone is now almost out of use for external work, since the introduction of Bath stone, it having failed even where used as Ashlar only, protected by Portland dressings; 1s 3d *per ft.* at quarry; *c.* by land to Leighton, 5 miles and a half, thence by Grand Junction canal, total cost 1s 3d per foot, or 2s 5d per foot, in London; plain work 0·45.

Derbyshire.

BALL CROSS.—Bakewell Edge, Derbyshire; *sandstone*; siliceous grains with argillo-siliceous cement, occasionally micaceous, ferruginous; *ferruginous brown, striped, and zoned in deeped tints*; 5 or 6 principal alternations of sandstone and shale, sandstone beds from 3 to 18 feet thick—At Chatsworth and at Bakewell; appearance similar to ornamental wood.

BOLSOVER.—Bolsover Moor, Derbyshire; *magnesian limestone*; chiefly carbonate of lime and carbonate of magnesia, semi-crystalline; *light yellowish brown*; 151 lbs. 11 oz.; depth 12 feet; in numerous beds from 8 inches to 2 feet thick; blocks 56 feet cube—Southwell church, and numerous buildings in the vicinity; this stone is very generally sawn into slabs for paving, &c.; 10d *per ft.* at quarry; *c.* by land to Chesterfield canal at Worksop 8 miles, at 6s per ton, thence by canal and the Trent to Stockwith, and thence by sea to London about 10s, in all 16s per ton, or 2s *per ft.* in London; plain work 1·0.

DUFFIELD BANK.—Duffield, Derbyshire; *sandstone*; quartz grains of moderate size and decomposed felspar, with an argillo-siliceous cement, ferruginous spots, and occasionally plates of mica; *light brown, with dark brown and purplish tints*; 132 lbs. 14 oz.; depth 70 feet; one half of the depth is brown stone, the other half white—the thickest bed is about 4 feet; blocks 150 feet—St. Mary's Bridge, Reporter Office, Mechanics' Lecture Hall, and Bishop Ryder's Church now building, Derby, also Duffield Bridge, &c.,—Chimney shafts, Grammar School, Birmingham; this stone has not yet been sent to the London market. Quarry joints 3 to 30 feet apart, beds with a slight dip. Quarry opened about 40 years since; from 1 to 3 tons 1s 1d *per ft.* of white stone, 9d of brown and white in equal quantities at quarry; plain work 1·1.

DUKES QUARRIES.—Holt, Stanwell Bridge, Derbyshire; *sandstone*; quartz grains, generally coarse, with decomposed felspar, and an argillo-siliceous cement, ferruginous spots; *red, varied with green, brown, and grey*; 144 lbs. 8 oz.; depth not ascertained, at least 40 feet—Penitentiary, Millbank, and internal parts of Waterloo Bridge, London; quarry opened about 30 years since. More than 100,000 chair stones for the Birmingham and London Railway have been supplied from these quarries. Quarry joints from 2 to 20 feet apart. Dips of beds 5° or 6°. Quarry cover 6 to 12 feet thick; 7d *per ft.* at quarry; *c.* by canal to Leicester, and thence by Grand Junction to London, or 2s 8d in London; plain work 1·2.

HOPTON WOOD.—Middleton, near Wirksworth, Derbyshire; *limestone*; compact carbonate of lime with encrinal fragments abundant; *warm light grey*; 158 lbs. 7 oz.; depth 40 feet; in several beds, varying from 3 to 10 feet thick; blocks 100 feet cube—At Chatsworth, Belvoir Castle, Trentham Hall, Drayton Manor, Birmingham Grammar School, &c.; 3s to 4s *per ft.* according to size, at quarry; *c.* by land to Cromford wharf, 3 miles, thence by canal to London, block stones 30s per ton, slabs 40s per ton—by sea blocks, 22s 6d per ton, slabs 30s per ton, or 4s 10d to 5s 10d per foot in London; plain work 1·4.

HUNGERHILL.—Belper, Derbyshire; *sandstone*; fine quartz grains and decomposed felspar, with an argillo-siliceous cement, ferruginous spots, and occasionally plates of mica; *warm light brown*; 135 lbs. 15 oz.; depth not ascertained—Belper new church and all the chief buildings in Belper; parts of the new church at Belper are beginning to decompose. Dip of beds in quarry variable. Quarry cover 6 feet thick. Quarry opened about 10 years since; 1s *per ft.* for blocks of 6 cubic feet, at quarry; *c.* by land to canal, and thence by water to London; plain work 1·1.

LINDROP.—Lindrop Hill, Derbyshire; quartz grains of moderate size with a calcareo-siliceous cement, micaceous; *light yellowish brown*; level bedded, but irregular, the thickest bed may work 3 feet 6 inches or 4 feet—In parts of Chatsworth house; quarry cover of shale and thick-bedded stone 15 feet thick; *c.* by land to Cromford canal, 8 miles, thence by canal to London.

MORLEY MOOR.—Morley Moor, Derbyshire: *sandstone*: fine quartz grains with siliceous cement, a few plates of mica disseminated; *warm brownish grey, often greenish*; 130 lbs. 8 oz.; depth not ascertained—Bank at Derby, Mr. Hackers's and Mr. Holmes's houses at Derby, Berniston house; 10d *per ft.* best stone, at quarry; *c.* by land, 2 miles to Little Eaton, thence by canal to London; plain work 1·05.

SHAW LANE.—Hunger Hill, Derbyshire; *sandstone*; quartz grains, of moderate size, with an argillo-siliceous cement, slightly micaceous; *warm light brown*; 135 lbs. 15 oz.; depth 50 feet; one half of the workable is brown in colour, the other half white, the thickest bed 5 feet; blocks 150 feet cube—Leicester church; 1s 1d *per ft.* if all white, 9d if half white and half brown, at quarry; plain work 1·1.

STANCLIFF OR DARLEY DALE.—Darley Dale, Derbyshire; *sandstone*; quartz grains of moderate size and decomposed felspar, with an argillo-siliceous cement, ferruginous spots, and plates of mica; *light ferruginous brown*; 148 lbs. 3 oz.; depth 200 feet; irregular masses, without regular joints or beds; blocks of very large size—Abbey in Darley Dale, Stancliff-hall, Birmingham grammar school, Birmingham and Nottingham railway station-houses; quarry cover, 5 or 6 feet thick. The quarry was opened 5 years since; 1s. 5d *per ft.* up to 5 tons, at quarry; *c.* by land to Cromford, 4d thence to the Pool of London, 1s 6d, or 3s 3d per foot in London; plain work 1·3.

Nottinghamshire.

LINDLEY'S RED QUARRY.—Mansfield, Nottinghamshire; *sandstone*; fine siliceous grains with magnesio-calcareous cement; *roseate brown*; 148 lbs. 10 oz.; depth 30 feet; irregularly bedded, average thickness about 3 feet, remarkably sound and homogeneous; blocks up to 10 tons; Belton-house (Lord Brownlow); cisterns and sinks are made of this stone, but are not quite impervious to moisture. Quarry joints 30 to 40 feet apart. Quarry cover of red laminated sandstone, 15 feet thick. Quarry opened 80 or 100 years since; 8d *per ft.* blocks of all sizes, at quarry; *c.* by land to railway wharf at Mansfield, 1 mile, 1s 8d per ton, thence to Pinxton, by railway, 2s 10d per ton, thence to Gainsborough, by the Trent and Irwash, 7s 6d, and thence by sea to London, 18s, or 2s 6d per foot in London; plain work 1·1.

LINDLEY'S WHITE QUARRY.—Mansfield, Nottinghamshire; *sandstone*; fine siliceous grains with magnesio-calcareous cement; *whitish brown*; 149 lbs. 9 oz.; depth 30 feet now in work, further depth not ascertained; regularly and nearly horizontally bedded, from 6 inches to 4 feet 6 inches; blocks 10 tons—The Town-hall, Mansfield, Clumber-lodge, at Wollerton, and Belton; some of this stone contains crystals of strontian. Quarry joints about 20 feet apart. Quarry cover of marl 15 feet thick; 8d *per ft.* random blocks, extra price for specified blocks or selected bed, at quarry; *c.* by land to railway wharf at Mansfield, 1 mile, 1s 8d per ton, thence to Pinxton, 8 miles, by railroad, at 2s 10d per ton, thence to Gainsborough, by the Trent and Irwash, at 7s 6d per ton, and thence by sea to London, about 11s per ton, total cost 23s, or 2s 2d per foot in London; plain work 1·1.

Northamptonshire.

BARNACK MILL.—Barnack, Northamptonshire; *oolite (Shelly)*; carbonate of lime, compact and oolitic, with shells, often in fragments, coarsely laminated in planes of beds; *light whitish brown*; 136 lbs. 12 oz.; depth 4 feet freestone, 6 feet common wall stone; in beds from 9 inches to 18 inches; blocks up to 30 feet—Burleigh House, Peterborough Cathedral, Croyland Abbey, Boston, Spalding, Holbeach, and Moulton churches, and the greater proportion of churches in Lincolnshire and Cambridgeshire; the old quarries in the vicinity are in a continuation of this bed, and are very extensive, the stone is used for troughs and cisterns, which are perfectly impervious. Quarry opened 4 years since; 1s *per ft.* at quarry; *c.* by land to Wansford 4 miles 1s, thence to Sutton Bridge by canal, and thence by sea to London 18s per ton, in all 19s per ton, or 2s 3d *per ft.* in London; plain work 0·9.

Oxfordshire.

HEDDINGTON.—Heddington, Oxfordshire; *limestone*; carbonate of lime, friable; the worst or softest beds of this stone appear to have been employed in most of the colleges and other public buildings of Oxford; plain work 1·1.

TAYNTON or TEYNTON.—Taynton, Oxfordshire; *oolite (shelly)*; carbonate of lime, partly oolitic and friable, with very small fragments of shells, irregularly laminated; *streaky brown*; 135 lbs. 15 oz.; depth about 20 feet; beds vary in thickness from 3 to 20 feet, irregular and dislocated in all directions—thickest bed about 7 feet; blocks of any practicable size—In most of the ancient churches and mansions of the neighbourhood. Blenheim, Cornberry park, Barrington park, in the interior of St. Paul's, and many other churches in London and Oxford, in various bridges, Witney, Cutham, Buckland, and most of the ancient and modern mills in vicinity; cisterns, troughs, sinks, copings, and ridges made out of this stone. The oolitic grains are unusually soft and chalky, and easily absorb water; 1s *per ft.*, in large quantities 10d, at quarry; *c.* by land to Cassington wharf, and thence by water to London, 1s 6d per foot, or 2s 4d per foot, in London; plain work 0·9.

Rutlandshire.

KETTON.—Ketton, Rutlandshire; *oolite*; oolitic grains of moderate size slightly cemented by carbonate of lime; *dark cream colour*; 128 lbs. 5 oz.; depth 4 feet; sometimes in one bed, sometimes in two beds—a hard bed above called rag, 3 feet 6 inches thick, covered by crash, 5 feet, covered with clay from 15 to 20 feet thick, level and irregularly bedded; blocks up to 100 feet—

Cambridge, Bedford. Bury Saint Edmunds, Stamford, London, &c., many of the ancient and modern buildings at Cambridge, also in the modern works of Peterborough and Ely cathedrals, also St. Dunstan's church, Fleet-street, London: the rag beds are of a white tint, and the grains are cemented with highly crystallized carbonate of lime, the crash is of a dark brown colour, very coarse, full of shells, distinct ova, and very ferruginous. The ova in the freestone beds are slightly attached or cemented together, consequently the stone is very absorbent. Ketton rag weighs 155 lbs. 10 oz. per cubic foot. This and the neighbouring quarries, many of which are out of work, are of great antiquity. Joints 2 to 7 feet apart. Beds dip slightly; 1s 9d *per ft.* at quarry; *c.* by land to Stamford, 3d per foot, thence to London, about 20s per ton, or if delivered at Wansford the carriage and freight would be about the same cost, or 3s 4d per foot in London; plain work 0·65.

Shropshire.

STANLEY.—Higley, Shropshire; *sandstone;* siliceous grains, of moderate size, with a calcareo-ferruginous cement; *grinding red,* 146 lbs. *building grey,* 141 lbs. 7 oz.; depth 6½ feet; ashlar or building stone 1 to 3 feet, grinding or gun-barrel stone, upper bed 3 to 4 feet, lower bed 3½ feet; blocks 10 feet to 60 or 70 feet—Stourport bridge (1776), Worcester and Bewdley bridges, Gloucester bridge, &c.; in the neighbourhood is another quarry of sandstone. Grains, moderate in size, of various siliceous substances, micaceous, cement, argillo-siliceous, colour greenish brown; 1s *per ft.* building stone, delivered at Gloucester,—2s 3d grinding stone, upper stratum,—2s ditto lower stratum, at quarry; *c.* by the Severn to Gloucester, 20s per ton, and thence by sea to London, 13s, canal dues, &c. 1s 2d, or 1s 9d per foot building stone, under 3 tons, 3s 11d grinding stone, per foot in London; plain work grinding 1·2, building 0 85.

Staffordshire.

HOLLINGTON.—Hollington, Staffordshire; *sandstone;* quartz grains of moderate size with an argillo-siliceous cement, plates of mica; *light-brownish grey;* 133 lbs. 1 oz.; depth 20 to 25 feet; one vein of inferior stone 4 to 6 feet thick in the middle of the quarry, thickest bed of good stone 8 feet; blocks 30 to 40 feet square and 8 feet thick—Trenth m Hall, Drayton Manor Heathhouse, and various public and private buildings in Staffordshire, Town Hall Derby, Meer Hall Cheshire, &c.; 7d *per ft.* blocks 1 to 2 tons, 9d blocks 2 to 4 tons, 1s 4 tons and upwards, at quarry; *c.* by canal in boats 20 tons burthen, by the Grand Junction and Trent and Mersey, total cost per foot 2s 6d; plain work 0·9.

PARK QUARRY.—Tixall, Staffordshire; *sandstone;* fine quartzose grains with a calcarea-argillo-siliceous cement, plates of mica; *light grey;* 124 lbs. 9 oz.; depth 10 to 15 feet; thickest bed, 6 to 8 feet; blocks 15 feet or more in length by 3 to 6 feet—Ruins of a mansion belonging to the late Lord Anson Tixall, Triumphal arch, Earl of Litchfield, Tixall-hall, &c., Saint George's-church Birmingham, Sandwell-hall near Birmingham, &c.; 8d *per ft.* selected stone at quarry; *c.* by canal, 180 miles; plain work 0.85.

(South.)

Devonshire.

BEER.—Beer, Devonshire; *limestone;* chiefly carbonate of lime, friable, and with partial induration; *light tint of brown;* 131 lbs. 12 oz.; depth 10 feet 6 inches; in 8 beds; the uppermost 4 beds are the best, and are about 17 or 18 inches thick, the thickest bed 2 feet, or 2 feet 2 inches; blocks 6 to 7 feet long, 3 feet wide, and 2 feet thick—In the churches of the vicinity, Saint Peter's church Exeter, in exposed parts, Colyton church, Charmouth, parish church in Dorsetshire, rebuilt 4 years since, and at Honiton within the last 2 years; *c.* from the quarry to the beach, one mile and a quarter, and thence by sea to the Pool of London in 50 or 60 ton vessels; plain work 0·55.

Dorsetshire.

PORTLAND (TRADE QUARRY).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with a few fragments of shells; *whitish brown;* depth about 9 feet of freestone; level bedded as follows: rubbish head, dirt bed 1 foot thick, top cap, 3½ to 5½ feet, skull cap, 2 to 3 feet, roach 4 feet, top bed 7 feet, flint bed 6 inches, lower or bottom bed 2 feet; blocks of any practicable size—Various public buildings in London; 1s 4½d *per ft.* at quarry; *c.* by sea to the Pool of London, including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·0.

PORTLAND (King Barrow East End Quarry, adjoining Waycroft).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with a few fragments of shells; *whitish brown;* depth 7 feet of freestone; the beds are as follow—head of quarry 15 feet, dirt bed 1 foot, skull cap 1 to 2 feet 6 inches, roach 2 feet 6 inches, freestone and good weather bed 7 feet; rubbish at bottom of quarry; blocks of any practicable size—Various public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·0.

PORTLAND (Vern Street Quarry).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with a few fragments of shells; *whitish brown;* top bed 134 lbs. 10 oz.; depth 8½ feet of freestone; the beds are as follow—loose head 15 feet, dirt bed 1 foot, top cap 6 feet, skull cap 1½ to 2½ feet, roach 2 feet 6 inches, top bed 8 feet 6 inches, called Birdseye stone; rubbish at bottom of quarry; blocks of any practicable size—Various public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·0.

PORTLAND (Castles Quarry).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with a few fragments of shells; *whitish brown;* depth 9½ feet of freestone; the beds are as follow—17 feet of head, 12 inches dirt bed, 6 feet cap, 1½ feet skull cap, 18 feet workable freestone, containing 4 feet of roach, 3 feet of good oolite, free from shells, 3 feet of roach and flint, and 6½ feet of inferior oolite, fine grained, with cementing matter in a state of powder; blocks of any practicable size; various public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, including lighterage to Westminster, 14s per ton, or 2s 3d per foot, in London; plain work 1·0.

PORTLAND (Waycroft Quarries).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with disseminated fragments of shells; *whitish brown;* top bed 135 lbs. 8 oz.; depth about 13 feet of freestone; level bedded as follows—rubbish head 8 feet, dirt bed 1 foot, top cap 3½ to 5½ feet, skull cap 2 to 3 feet, roach 2½ to 4 feet, top bed 7 to 8 feet, rubbish beds 6 to 7 feet, roach 1 to 3 feet, and bottom bed 5½ to 6½ feet; blocks of any practicable size—Goldsmith's-hall, Reform Club-house, and other public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, 12s per ton, heaving out of the ships 1s per ton, lighterage to Westminster, 1s per ton, or 2s 3d per foot in London; plain work 1·0.

PORTLAND (Maggott Quarry).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with fragments of shells; *whitish brown;* depth 15½ feet of freestone; quarry head of rubbish 8 feet, dirt bed 1 foot, cap 6 feet or 7 feet 6 inches, skull cap 1½ to 2½ feet, roach 2 feet 6 inches, top bed 8 feet 6 inches, loose limestone and flint 7 feet, bottom bed supposed to be 7 feet thick; blocks of any practicable size—Several public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, and including lighterage to Westminster, 14s per ton, or 2s 3d per foot, in London; plain work 1·0.

PORTLAND (Goslings Quarry).—Island of Porland, Dorsetshire; *oolite;* oolitic carbonate of lime, with fragments of shells; *whitish brown;* roach 126 lbs. 13 oz.; depth 8 feet of freestone; quarry head of rubbish 8 feet, dirt bed 1 foot, top cap 6 feet, skull cap 1 foot 6 inches to 2 feet 3 inches, roach 4 feet, top bed 8 feet, rubbish bed with layers of flints, bottom bed very soft, not worked; blocks of any practicable size—Several public buildings in London; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, and including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·0.

PORTLAND (Grove Quarry, Bowers).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with numerous fragments of shells; *whitish brown;* best or lower bed 147 lbs. 10 oz., curf 145 lbs. 9 oz.; depth 6 feet of freestone; top or workable bed very close and compact, 9 feet thick, having a bed of roach on the top of it 3 feet thick, 25 feet of head to this quarry, containing the same beds as in the other quarries, the cap and skull cap being 10 feet thick; blocks of any practicable size—St. Paul's cathedral and several churches in London, built during the reign of queen Anne; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, and including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·1.

PORTLAND (Grove Quarry, Red-Croft).—Island of Portland, Dorsetshire; *oolite;* oolitic carbonate of lime, with a few fragments of shells; *whitish brown;* depth 16½ feet of freestone; the beds are as follow—rubbish forming head 7 or 8 feet, dirt bed 1 foot, roach 1 foot 6 inches, top bed 4 feet, middle or curf bed, 5 feet 6 inches, bottom bed 7 feet; blocks of any practicable size—St. Paul's cathedral and many churches in London, built during the reign of queen Anne; 1s 4½d *per ft.* at quarry; by sea to the Pool of London, and including lighterage to Westminster, 14s per ton, or 2s 3d per foot in London; plain work 1·0.

The following remarks refer to the nine last quarries:—The dirt bed is full of fossil roots, trunks, and branches of trees; often in the position of their former growth. The top cap is a white, hard, and closely compacted limestone. The skull cap is irregular in texture; it is a well-compacted limestone, containing cherty nodules. The roach beds are always incorporated with the freestone beds that invariably lie below them; they are full of cavities formed by the moulds of shells, and occasionally contain oyster shells and beds of flint near the top. The top bed is the best stone; it is a fine-grained oolite, free from shells and hard veins. The bottom bed is similar in appearance to the top bed, and of the same component parts; but the stone ill cemented, and will not stand the weather. A middle or curf bed occurs only in the southernmost of the quarries, on the east cliff; it is soft to the north and hard to the south. Messrs. Stewards have several other quarries, both on the east as well as the west cliff, where the stratification is similar to that of the Way-croft quarry, but with variations in the thickness of the beds and slight deviations in the quality of the stone. Messrs. Weston have also several other quarries, both on the North-east and West Cliffs, where the stratification is similar and th stone more or less like that of the trade quarry. There are also numerous other quarries on the island, worked by various persons, where the stratification and stone accord generally with those of Messrs. Stewards' and Messrs. Weston's. The good workable stone in the East Cliff quarries is generally less in depth than it is met with in the same bed in the West Cliff quarries; but the East Cliff stone is harder, more especially to the south of the island. The bottom part of the top bed in the West Cliff quarries becomes less hard and durable towards the south. The stone in most of the quarries, and sometimes in the same quarry, varies considerably in quality. Such stone as contains flints, or is met with below layers of flints, is inferior, and will not stand the weather. The bottom bed on the West Cliff is not a durable stone, but has been worked to a considerable extent and sold as a good stone in the London market. In every freestone bed the upper part of the bed is the hardest and most durable stone. The best stone is in the north-eastern part of the island, the worst in the south-western part. The most durable stone has its cementing matter in a solid and half crystalline state; in the least durable stone it is in an earthy and powdery state. The annual consumption of the whole of the quarries in the island is equal to an area of one acre of the good workable stone, or about 24,000 t ns; the entire area unworked is about 2,000 acres. There are 56 quarries in the island,

and about 240 quarrymen continually employed; of which number Messrs. Stewards usually employ about 138.

The curf bed in the Red-Croft quarry, is a shelly oolite, divided b a bar of oyster shells, 15 inches from the top, and by a second bar of the same shells 2½ feet below the upper bar. The bottom bed in this quarry is a well-compacted oolite, with very few shells, having a bed of roach 12 inches thick at the top; its characteristic distinctions are streaks of yellow occasionally. It is the hardest bed in the island, but will nevertheless work and saw better than the middle bed, owing to its being more homogeneous. The roach is throughout the island oolitic, with a cement of carbonate of lime, shelly, and full of cavities from casts of shells; colour, whitish brown.

SEACOMBE.—Isle of Purbeck, Dorsetshire; *limestone;* semi-compact carbonate of lime with fragments of shells; *light brown;* 151 lbs.; depth 14 feet; the workable stone of this quarry, which is called "Purbeck Portland," is met with amongst other strata in the cliffs of the south part of Purbeck, about midway from the summit, the thickest bed is 6½ feet; blocks the largest, 6 to 8 feet, by 2 to 3 feet, by 3 to 4 feet—Lighthouse at Margate, the clock-house, Dover-pier, prison at Winchester, at the West India-docks, 40 years since, lighthouse now building on the Isle of Wight, obelisk, Encombe-park, and numerous churches, bridges, &c. in the county; much used for steps, landings, &c.; 1s 2½d *per ft.* at quarry; *c.* by sea to the Pool of London, at 8s per ton, boatage 1s 6d, in all 9s 6d, or 1s 9½d per foot in London; plain work 1·15.

Wiltshire.

BEVIS'S QUARRY.—East Tisbury, Wiltshire; *sandstone (calciferous);* fine siliceous grains with calcareous cement; *greenish brown;* 111 lbs. 2 oz.; quarry head 5 feet, top bed 1 foot 6 inches, under bed 1 foot 5 inches, under bed 4 feet, under bed 4 feet, under bed 3 feet, under bed 3 feet, under or bottom bed 1 foot 6 inches, hard bed 3 feet, full of shell. The thickest bed will work from 2 feet 6 inches to 3 feet; blocks large, 6 or 7 feet long—Salisbury, Hindon, and other places, Kingston, Lary, numerous bridges, churches, &c., in the county; this quarry was opened 30 years since; 1s 6d *per ft.* blocks of all sizes at quarry; land and water carriage to the Pool of London 2s 6d to 2s 9d per foot, or 4s to 4s 3d in London; plain work 0·7.

CHILMARK.—Chilmark, Wiltshire; *limestone siliciferous;* carbonate of lime, with a moderate proportion of silica, and occasional grains of silicate of iron; *light greenish brown;* 153 lbs. 7 oz.; depth 20 feet freestone; quarry head, loose limestone and rubbish 16 feet, 2 beds of rag or roach filled up with carbonate of lime 2 feet, 2 white beds (hard) 2 to 3 feet, trough bed 2 feet thick, green bed 5 feet, slant bed 1 foot, 2 pinney beds each 2 feet thick, cleaving bed 1 foot, and fritting beds 3 feet 3 inches—the thickest bed about 3 feet; blocks from 10 cwt. to 3 tons—some of 5 tons—Salisbury Cathedral, Wilton Abbey, and many other ancient and modern buildings in the vicinity; the white beds are fine grained with crystallized carbonate of lime, the uppermost is the hardest. The trough bed is of the same compound, is very hard, and considered the best bed for standing weather. The green bed is varied in texture, containing shells unequally cemented. The slant bed is very friable. The pinney beds are crystalline, the bottom bed is the hardest—they are most in repute, are free in working, obtainable in large and sound blocks, and stand the weather. The trough and hard white beds are unabsorbent. The whole of the beds can be sawn. Some are intersected with small veins of calcareous spar, others abound in shells, the cavities of which are filled with spar—but neither the veins nor shells are harder than the stone in which they are imbedded; 2s *per ft.* trough bed, 1s 9d bottom pinney bed, 2s hard white bed, 1s 6d other useful stone at quarry; *c.* by land to Eling wharf, and thence by water to London 53s 6d per ton, or 5s 4d trough bed, 5s 1d bottom pinney bed, 5s 4d hard white bed, 4s 10d other useful stone in London; plain work 0 9.

CRANMORE.—Doulting, Wiltshire; *shelly oolite;* carbonate of lime, with a few oolitic grains, and an abundance of small shells commonly in fragments, often crystalline; *light brown;* 134 lbs. 4 oz.; depth 10 feet: in 4 or 5 beds, the thickest will work 20 inches; blocks of large size—Cathedral of Wells, Glastonbury Abbey, &c.; there are 3 or 4 quarries of great antiquity in the neighbourhood of this quarry, where a greater depth of stone is found, and where beds exist that will work in 5 feet courses; 7d *per ft.* at quarry; plain work 0·8.

(SOUTH WEST.)

Gloucestershire.

KNOCKLEY, &c.—Forest of Dean, Gloucestershire; *sandstone;* siliceous grains of moderate size with calcareo-argillo-siliceous cement, plates of mica in planes of beds; *grey;* 159 lbs. 5 oz.; depth 20 feet; 15 to 20 feet in four or five beds—the thickest beds from 6 to 10 feet; blocks up to 50 feet; Cardiff new pier, &c.; troughs and grindstones are made of this stone. There are several quarries in the neighbourhood, such as Nag's Head quarry, Point quarry, &c., in some of which the beds are 6 feet thick. Quarrymen restricted by act of parliament from carrying on railroad blocks above 2 tons. Joints in this quarry 2 to 3 feet apart, in others 3 to 9 feet apart. Quarry cover 25 feet. Quarry opened not long since; 1s to 1s 4d *per ft.* for ton blocks at quarry; *c.* by land to Lidney, 6 miles, 4s per ton, thence to the Pool of London, 16s or 17s per ton, or 2s 6d per foot in London; plain work 1·3.

VINEY HILL.—Forest of Dean, Gloucestershire; *sandstone;* fine siliceous grains with an argillo-siliceous cement, micaceous in planes of beds; *light purplish grey with occasional light greenish spots;* 155 lbs. 11 oz.; depth 40 feet of rock excavated; regular beds, consist of red rock and a silvery grey rock 12 feet in depth, the latter is very hard and divided into several beds, the thickest is 4 feet—the red beds are rather shaky, thickest 3 feet—Cardiff new pier, &c.; the silver grey bed is finely laminated, and fit only for landings, pavings, &c.; 11d *per ft.* for red rock, all sizes, at quarry; *c.* by land to Gatcomb on the Severn, 2 miles, 2d per foot, thence to London; plain work 1·3.

WINDRUSH.—Windrush, Gloucestershire; *oolite;* fine oolitic grains with calcareous cement, and a few fragments of shells; *cream;* soft 118 lbs. 2 oz., hard 135 lbs. 15 oz.; depth 10 to 12 feet; 6 feet shelly rock in 3 or 4 beds, 4 feet freestone in 2 or 3 beds, 1 foot shelly bed—thickest bed 2 feet 6 inches; blocks 5 to 40 feet; Windrush church, Barrington house, and all the old buildings within many miles of the quarry; this quarry is subterranean—greatest distance from the entrance 170 yards. There is another subterranean quarry below it, with 10 or 11 feet of workable stone.—Tombstones in Windrush churchyard, 150 years old, of this stone, and in very good condition; 8d *per ft.* at quarry; *c.* by land to Carrington, 8d per foot, and thence by sea to London, 25s per ton, or 2s 7d per foot in London; plain work soft, 0·7, hard 0·85.

Monmouthshire.

ABERCARNE and NEWBRIDGE.—Monythersloyne, Monmouthshire, *sandstone,* quartz and siliceous grains, moderately fine, with argillo-siliceous cement, micaceous, and with remains of fossil plants; *dark bluish grey;* 167 lbs. 15 oz.; depth 25 feet; thickest bed, 5 feet; blocks 1 to 10 tons—Old churches and modern buildings in vicinity, new docks at Newport and Cardiff; 4½d *per ft.* or 5s per ton at the quarry; *c.* 12 miles to Newport by canal or railway 2s 6d per ton, freight to London 12s per ton, in all 14s 6d, or 1s 5d *per ft.* in London; plain work 1·45.

BARBADOES.—Tintern, Monmouthshire; *sandstone;* fine and coarse quartz and other siliceous grains, with argillo-siliceous cement, ferruginous spots and plates of mica; *light greyish brown;* 146 lbs. 12 oz.; depth 25 to 30 feet; thickest bed, 10 to 12 feet; blocks 1 to 10 tons—Tintern Abbey; 10d to 1s *per ft.* at quarry; *c.* by water to Westminster 17s 0d per ton; plain work 1·25.

Somersetshire.

BATH (LODGE HILL.)—Coombe Down, Somersetshire; *oolite;* chiefly carbonate of lime in oolitic grains; *cream;* 116 lbs.; depth 7 feet; Riddingtop, 7 feet thick, top bed 3½ feet, second bed 4 feet, third bed 4½ feet, bottom bed 2 feet, the top, second, and third beds are weather beds; blocks from 12 to 96 feet cube—On the Kennet and Avon and the Somerset Coal Canal Works, &c., Restoration of Henry the Seventh's Chapel, 20 years since; ridges and troughs are made of this stone. Six quarries now at work on Coombe Down; 6d *per ft.* at quarry; *c.* by land to Dundas Aqueduct 2d, thence by Kennet and Avon canal, &c. to London; plain work 0·7.

BATH (BAYNTON QUARRY.)—Box, Wiltshire; *oolite;* chiefly carbonate of lime in moderately fine oolitic grains, with fragments of shells (weather beds); *cream;* 123 lbs.; depth 45 feet; rubble stone 16 feet, scallet 12 to 15½ feet, black and white rag 5 to 10 feet, corngrit 15 to 20 feet, ground stone 16 to 22 feet, thickest bed 5 feet; blocks up to 10 tons—Laycock Abbey, Longleat, Bowood, South Front of Wilton House, Windsor Castle, &c.; the weather stone is generally used for plinths, strings, cornices, &c., the corn grit for dressings, the scallet, which is the finest in grain, is used for ashlar. Eight quarries on the box escarpment, many of great antiquity; 7d *per ft.* at quarry; *c.* by land to Laycock, 7 miles, 4d per foot, thence by canal, Kennet and Avon, and thence to Pimlico 16s per ton, or 1s 11d *per ft.* in London; plain work 0·7.

BATH (DREWES QUARRY.)—Monckton Farleigh, Wiltshire; *oolite;* chiefly carbonate of lime in oolitic grains of moderate size; *cream;* 122 lbs. 10 oz.; depth 20 feet; Bruckley stone 8 feet, hard rag 4 feet, white rag 12 feet, hard white rag 2 feet, capping 20 inches (fine grained), grey bed 3 feet, white beds, 10 feet, hard weather bed 3 feet, red weather bed 5 feet, the deepest bed about 4 feet 2 inches thick; blocks 120 to 125 feet—Buckingham New Palace, Saint James's Square, Bath; the capping and white beds are usually employed for carving; six quarries of this stone on the Down, all of which are subterranean. Quarry opened 30 years since; 6d *per ft.* at quarry; by land and water carriage, or 1s 10d *per ft.* in London; plain work 0·7.

HAMHILL.—Hamhill, Somersetshire; *limestone (shelly);* compact carbonate of lime with shells, chiefly in fragments, coarsely laminated in planes; beds of *deep ferruginous brown;* 141 lbs. 12 oz.; depth about 30 feet; in numerous beds, the thickest 2 feet, the upper beds are the softest, the bottom beds are very shelly and firm; used very extensively in nearly all the buildings in the vicinity 10 or 15 miles from the quarry, all in excellent condition; the shells in this stone are generally broken and pulverized, but are well cemented with a durable compound, probably of decomposed shells—the lower beds are met with on Norton Hill; 1s 4d *per ft.* at quarry; *c.* by land to load 7 miles, 6s 8d per ton, thence to Langport, Bridgewater, &c.; plain work 0·85.

(SOUTH EAST.)

Kent.

CALVERLEY.—Tunbridge Wells, Kent; *sandstone;* fine siliceous grains with a slightly calcareous cement; *variegated browns;* 118 lbs. 1 oz.; depth 5 feet to 6 feet 6 inches; three beds—upper 2 feet, middle 3 to 3½ feet, lower 9 to 14 inches—upper bed the softest; blocks 70 or 80 feet and upwards to 500—Upper part of new Church at Tunbridge Wells, Catholic Chapel, the Calverley Hotel, new Market House, and Victoria National School, and about 100 houses, &c. at Tunbridge Wells and its vicinity; the largest block lifted contained 500 feet; 6d *per ft.* if limited, 4d if extensive at quarry; *c.* by land to Tunbridge, 6 miles 3½d per foot, thence by the Medway and Thames to London about 6d, and other charges amounting in all to 1s 2d per foot cube, or 1s 2d to 1s 4d *per ft.* in London; plain work 0·7.

Surrey.

GATTON.—Gatton, Surrey; *sandstone;* fine siliceous grains with a calcareo-siliceous cement, containing green silicate of iron and plates of mica; *greenish light brown;* 103 lbs. 1 oz.; in 2 beds—the top bed is from 12 to 15 inches, and contains flints, and is a hard and strong stone, the bottom bed is free from flints, and fit for ashlar, dressings, &c., the thickest bed is 2 feet 2 inches; blocks 35 to 60 feet cube, from 4 to 10 feet long—Hampton Court and Windsor Castle, &c., many churches in Surrey, Town Hall and Almshouse Establishment at Croydon, and several modern buildings in the parish of Gatton; this, and numerous old quarries in the vicinity, now out of use, were formerly the property of the crown—it is very essential that this stone should be laid in buildings upon its bed; 1s 4d to 1s 6d *per ft.* at London; *c.* by land 19 miles, and thence to the Pool of London; plain work 0·7.

WALES.

Glamorganshire.

SUTTON.—Sutton, Glamorganshire; *limestone;* compact carbonate of lime, highly crystalline; *very light cream;* 136 lbs.; depth 20 feet, probable depth 60 feet; thickest bed 12 feet; blocks 6 tons and upwards—Dunraven castle, Ogmond abbey, St. Donats Corty, Neath abbey, and very ancient buildings, both castle and church, in the adjoining counties; depending upon quantity required; *c.* by land to the river Ogmon, 1 mile, thence to London, 15s per ton; plain work 0·85.

DISTRICTS IN SCOTLAND.

Dumbartonshire.

PRESIDENT.—Garscube, Dumbartonshire; *sandstone;* fine siliceous grains with an argillo-siliceous cement, micaceous; *pale brownish grey;* depth 66 to 100 feet; irregular beds, with occasional masses of liver rock of great size, from 6 inches to 12 feet thick; blocks of any practicable size—Bank of Scotland and houses adjoining in Ingram-street, Glasgow, Baron's-court, County of Tyrone, &c.; in the bank and houses in Glasgow this stone assumes a foxy colour, is uneven in tint, with occasional stains of oxide of iron, its surface is porous, consequently dingy from smoke and dirt. The east side of this quarry is cut off by a fault which lowers the rock 50 feet. Plain work upon this stone in Glasgow is 4*d.* per foot, wages 21*s.* per week. Quarry joints 6 to 15 feet apart. Dip of beds from 8° to 10°. Quarry cover 17 or 18 feet thick. Quarry opened 30 or 40 years since; 1s 6d *per ft.* from 16 to 20 feet cube, other blocks more or less in price in proportion to size, at quarry; *c.* by land to the Forth and Clyde canal, a quarter of a mile, thence direct to the Pool of London, at a cost probably of 10s to 12s per ton, or 2s 6d per foot for blocks containing 16 to 20 feet cube, in London.

Edinburghshire.

CRAIGLEITH.—Craigleith-hill, Edinburghshire; *sandstone;* fine quartz grains with a siliceous cement, slightly calcareous, occasional plates of mica; *whitish grey;* 145 lbs. 14 oz.; vary from 3 inches to 3 feet of the bed rock, which contains occasional layers of liver rock, which fine off in all directions and overlap each other, they vary in depth from 6 inches to 12 feet, the whole depth of rock now quarried is about 250 feet, and consists of about 200 beds; a farther depth has been discovered by boring of 60 feet, the thickest bed is 10 feet; blocks any practicable length and breadth, and from 6 inches to 10 feet thick—Used extensively in public buildings at Edinburgh, the College (1580), Registry (1774), Courts of Law, Custom House, Royal Exchange, National Monument, and numerous Churches, &c. as well as in private residences, also for landings, steps and pavings in several public buildings in London, and is now being used in the repair of Blackfriars Bridge; quarry opened about 70 years since, 15 acres of stone are at present bared, and as much more yet to bare. The stone has been exported, and partially used in Hamburgh, Altona, Gottenburgh, and other places on the continent. The proportion of liver rock which is found in lenticular masses is small as compared with bed rock, and its occurrence uncertain. The stone is frequently interstratified with shales on the south side of the quarry. For blocks, if in random sizes, of bed rock an abatement is made in price of 7½ per cent. and if liver rock 15 per cent; 9d to 2s *per ft.* for red rock in blocks from 5 to 30 cubic feet, 11d to 2s 6d for liver rock in blocks from 5 to 30 feet cube at quarry; *c.* by land to Granton harbour, 2 miles, to Leith and thence by sea, total cost from 1s to 1s 3d per cubic foot, or 1s 10½d to 3s 1½ for bed rock in blocks from 5 to 30 feet cube, 2s 0½d to 3s 7½d for liver rock in blocks from 5 to 30 feet cube in London; plain work 1·1.

Flintshire.

TALACRE and GWESLYR.—Llanaga, Flintshire; *sandstone;* fine siliceous grains with an argillo-siliceous cement, mica in planes of beds; *brownish olive;* 150 lbs. 4 oz.; depth 30 to 45 feet; the upper bed is a scythe-stone grit, then shale, &c., and below a freestone bed, thickest about 6 feet; 15 ton blocks, ordinary blocks from 1 to 8 tons—Many old buildings in the vicinity, quoins of Denbigh and Rhuddlan castles, modern mansion of Talacre; 1s *per ft.* under 10 feet, 1s 3d above 10 feet, at quarry; *c.* by land to Mostyn Dock, 3 miles, thence by sea to London, 18s per ton, or 2s 4d per foot under 10 feet, 2s 7d per foot above 10 feet, in London; plain work 1·1.

Forfarshire.

AUCHRAY.—Strathmartine, Forfarshire; *sandstone;* siliceous grains, moderately fine, with calcareo-argillo-siliceous cement, micaceous, chiefly in planes of beds; *purplish grey;* 158 lbs. 14 oz.; depth 40 feet; thickest bed 4 to 5 feet; blocks 4 to 5 tons—In the town and vicinity; quarry opened in 1832; 9d *per ft.* under 2 tons, 11d 2 to 3 tons, 1s 3 to 4 tons, 1s 2d 4 to 5 tons, 1s 5d 5 to 6 tons at quarry; *c.* by railway to Dundee 5 miles, thence by sea to London 17s 6d per ton; plain work 1·3.

GLAMMISS.—Glammiss, Forfarshire; *sandstone;* siliceous grains of moderate size, cement, slightly calcareous, mica abundant in planes of beds; *purple grey;* 161 lbs. 2 oz.; depth 50 to 100 feet; thickest bed 6 feet; blocks any practicable size—Glammiss Castle and Inverquharity Castle, supposed of the tenth century, Cortachy Castle, and in modern buildings, Lendertis house, &c.; 7d *per ft.* blocks under 2 tons, 8d ditto 2 to 3 ditto, 9d ditto 4 to 5 ditto, 1s ditto 5 to 6 ditto, and upwards in proportion to size at quarry; *c.* by railway to Dundee harbour, thence by sea to the Pool of London, total cost about 19s per ton; plain work 1·2.

LIOCH.—Auchterhouse, Forfarshire; *sandstone;* siliceous grains with calcareo-argillo-siliceous cement, micaceous in planes of beds; *light purplish grey;* 159 lbs. 3 oz.; depth 50 to 100 feet; thickest bed 4 to 4½ feet deep; blocks 2 to 6 tons—Used in all the public buildings of the vicinity; quarry opened in 1832; 9d *per ft.* under 2 tons, 11d 2 to 3 tons, 1s 3 to 4 tons, 1s 2d 4 to 5 tons, 1s 5d 5 to 6 tons, at quarry; *c.* by railway to Dundee, 5 miles, thence by sea to the Pool of London, total cost 17s 6d; plain work 1·3.

LOCHEE.—Lochee, Forfarshire; *sandstone;* siliceous grains of moderate size with an argillo-siliceous cement, slightly calciferous, micaceous; *bluish grey;* 158 lbs. 11 oz.; depth 90 feet now ascertained; thickest bed, 5 feet; blocks any size under 5 tons—In the principal buildings of the neighbourhood; this quarry was opened in 1793; 9d *per ft.* under 2 tons, 11d from 2 to 3 tons, and in proportion according to size, at quarry; *c.* by land to Dundee harbour, 3 miles, thence to the Pool of London, about 17s 6d per ton, or 1s 10d per ouft under 2 tons, 2s from 2 to 3 tons, in London; plain work 1·2.

PYOTDIKES.—Near Dundee, Forfarshire; *sandstone;* siliceous grains of moderate size with a calcareo-argillo-siliceous cement, micaceous; *purplish grey;* 162 lbs. 8 oz.; depth 40 to 50 feet; the workable stone is covered by 8 feet of rock in thin layers, thickest bed of freestone 3 to 4 feet; a block of 7 tons has been got—Extensively for the Dundee harbour works; 10d to 1s 2d *per ft.* at quarry; *c.* by land to Dundee, 1s 9d per ton, thence to the Pool of London, 17s 6d, in all 19s 3d, or 2s 1d to 2s 5d per foot, in London; plain work 1·4.

Lanarkshire.

GIFFNEUCH.—Giffneuch Farm, Lanarkshire; *sandstone;* fine quartz grains with a calcareo-siliceous cement, mica in planes of beds; *pale grey;* 143 lbs. 14 oz.; 20 feet of top rock, yellow and inferior, 22 feet of lower rock, well compacted and of a grey colour, irregularly bedded from 12 inches to 8 feet; Woodside terrace and crescent, St. Paul's church in part, and numerous private houses in Glasgow, also the Bank at Greenock, and in the Highlands, Ireland, &c.; price charged in Glasgow for plain rubbed work 4*d.* per foot superficial—masons receive 21*s.* per week. Quarry joints 4 to 30 feet apart, quarry cover 5 feet thick. Quarry opened 30 years since; 7d. *per ft.* for blocks of 10 to 12 feet, and more or less in proportion to size at quarry; *c.* by land to Port Dundas or Bromielaw quay, 3 miles, 2s 4d per ton, thence by sea to London; plain work 1·1.

Linlithgowshire.

BINNIE.—Uphall, Linlithgowshire; *sandstone;* fine quartz grains with argillo-siliceous cement, micaceous, chiefly in planes of beds; *brownish grey;* 140 lbs. 1 oz.; depth 50 feet; three bands of sandstone alternating with shale; upper band, average 14 feet, middle band 18 feet, lower band from 18 feet, bands of shale 14 feet thick—New Club-house, Princes-street, Edinburgh, New Bank, Greenock, and numerous private houses in Glasgow and Edinburgh; joints in quarry from 2 to 9 feet apart, beds dip 10° to the west, quarry head of shale and gravel, 20 to 30 feet thick. Quarry opened 45 years since; 1s 1d *per ft.* ordinary blocks, 1s 10d to 2s for blocks from 12 to 14 feet at quarry; *c.* by land to Union canal 2 miles 1s per ton, thence to Edinburgh by canal 1s, thence by sea to London 18s, in all 20s per ton, or 2s 9d to 3s 8d *per ft.* in London; plain work 1·0.

CAT CRAIG.—Carridon, Linlithgowshire; *sandstone;* fine quartz grains with siliceous cement; *whitish grey;* 141 lbs. 11 oz.; depth 21 feet freestone; freestone 3 feet thick, blare 2 feet, freestone in several beds 9 feet, blare 2 feet, freestone in several beds, bottom not ascertained, the beds lie regularly; blocks of large size; in sea dykes; quarry cover of earth and blare 13 feet thick—quarry opened recently and worked to a trifling extent; *c.* by water the quarry being upon the beach, 10s per ton; plain work 1·15.

CRAWBANK.—Borrowstoness, Linlithgowshire; *sandstone;* fine quartzose grains with an argillo-siliceous cement, somewhat ferruginous, disseminated mica; *light ferruginous brown;* 129 lbs. 2 oz.; depth 50 to 60 feet; the thickest bed about 18 feet of straw-coloured stone; largest blocks 4 to 5 feet thick, 5 to 6 feet broad, 8 to 10 feet long—Roman Bridge, A. D. 140, old Church of Kinneil, twelfth century; quarry joints from 9 to 10 feet apart. In the neighbourhood, about half a mile distant, are other quarries, belonging to the Duke of Hamilton; one called Mains quarry, containing an economical stone for foundations, another called Craigenbeck quarry, from whence stone is shipped extensively to St. Petersburgh for furnaces, ovens, and other similar purposes, it is also used for bridges, harbours, &c. Borrowstoness Harbour is free of dues; 1s per cubic foot for blocks not exceeding 5 cubic feet at quarry; *c.* by railway to Borrowstoness harbour and shipped at 2d per foot, thence by sea to London at 1s per cubic foot, in all 1s 2d per cubic foot, or 2s 2d for blocks not exceeding 5 cubic feet in London; plain work 0·95.

HUMBIE.—Humbie, Linlithgowshire; *sandstone;* fine quartz grains with siliceous cement, slightly calcareous, mica chiefly in planes of beds; *pale grey and light brown;* (white) 140 lbs. 3 oz., (grey) 135 lbs. 13 oz.; depth 88 feet; irregular masses, part bedded—20 feet of the top a dark stone, 43 feet below it a white stone, and 25 feet at the bottom a grey stone; thickest bed 8 feet; blocks 90 cubic feet, and upwards if required—Newliston house Kirkliston, Dundas castle, additions to the Royal Institution, front of Surgeon's Hall, spire of Tron Church, and various other public buildings in Edinburgh, Royal Exchange and Bank, &c. at Glasgow, &c.; this stone will work more freely than Craigleith and is not liable to spalt. Plain rubbed work upon this stone 4*d.* per foot at Glasgow, or 7*d.* per foot over the entire face of a building. Quarry joints from 2 to 12 feet apart. Dip of beds 10° to 20°. Quarry cover

9 feet thick. Quarry opened about 11 or 12 years; from 5 to 40 feet 1s 10d, or from 8 to 16 feet 1s 2d white rock, and 1s grey rock, at quarry; *c.* by land to Queensferry, 2s 6d per ton, including loading, thence by sea to London, 13s or 14s per ton, or 3s 2d per foot for large scantling, 2s 6d for blocks under 16 feet, in London; plain work 1·0.

Perthshire.

LONGANNET.—Tulleallan Estate, Perthshire; *sandstone;* fine quartz grains with siliceous cement, containing oxide of iron, a few plates of mica; *light ferruginous brown;* 131 lb. 11 oz.; depth 30 feet quarried, and upwards of 156 feet below bottom of quarry; thickest beds, 5 feet; blocks 4 to 5 tons—Staadt-house Amsterdam, Exchange Edinburgh, Tulle Marr Castle Perthshire, and part of a street in Perth; a lease may be had for working this quarry upon moderate terms; 8d to 2s 6d *per ft.* at quarry; *c.* by railway to the shipping pier, and from thence to the Pool of London, probable cost 16s per ton, or 1s 8d to 3s 6d per foot in London; plain work 1·15.

MYLNEFIELD, or RINGOODIE.—Longforgan, Perthshire; *sandstone;* fine siliceous grains with a calcareo-argillo-siliceous cement, micaceous in planes of beds; *purplish grey;* 160 lbs.; depth 60 feet—Old steeple of Dundee, twelfth century, well preserved, docks of Dundee, royal asylum of Dundee, and all the principal buildings in Dundee, Bell Rock lighthouse, Royal asylum of Perth, Kinfauns castle, Castle Huntley, Pitfour castle, Rossie priory, and all principal buildings in vicinity; 9d *per ft.* blocks under 2 tons, 11d blocks 2 to 3 tons, 1s blocks 3 to 4 tons, 1s 2d blocks 4 to 5 tons, 1s 5d blocks 5 to 6 tons, at quarry; *c.* by water to Dundee, 5 miles, and thence by sea to the Pool of London, 17s 6d per ton; plain work 1·3.

Ross-shire.

MUNLOCHY.—Bennetsfield Shore, Ross-shire; *sandstone;* fine siliceous grains with an argillo-siliceous cement, micaceous; *red and variegated;* 160 lbs. 9 oz.; depth 60 or 80 feet; thickness of beds, from 2½ to 6 feet; blocks of large size—Cathedral church of Ross at Fortross, A. D. 1124, Inverness old bridge, Cromwell-court, and also for canals, locks, and basins; 5d to 5½d *per ft.* at quarry; plain work 1·15.

Stirlingshire.

DUNMORE-AVENUE.—Dunmore Park, Stirlingshire; *sandstone;* fine quartz grains, with an argillo-siliceous cement, containing oxide of iron, micaceous; *ferruginous light brown;* depth 25 feet; thickest bed 7 feet; blocks 20 feet; this stone has not been used for a considerable period, and has never been wrought for sale; *c.* by sea, at 11s per ton

DUNMORE-WOOD.—Dunmore Park, Stirlingshire; *sandstone;* fine quartz grains with an argillo-siliceous cement; *whitish grey;* depth 16 feet; beds varying from 6 to 16 inches; on the estate of Dunmore; this stone has never been worked for sale; *c.* by sea to London, 11s per ton.

DUNMORE CRAIGHEAD.—Dunmore Park, Stirlingshire; *sandstone;* fine quartz grains with an argillo-siliceous cement; *whitish grey;* depth 12 feet; thickest bed of liver rock 4 to 7 feet; blocks 20 feet long—A tower on the estate 600 years old of this stone in good condition; *c.* by sea to London, 11s per ton.

DUNMORE STABLE.—Dunmore Park, Stirlingshire; *sandstone;* fine quartz grains with an argillo-siliceous cement; *whitish grey;* 132 lbs. 2 oz.; depth 14 feet; in regular beds, thickest bed 7 feet; blocks 25 feet—Extensively on the estate, a set of offices built in 1826; *c.* by sea to London, 11s per ton; plain work 1·1.

TABLE (B.)

SANDSTONE BUILDINGS.

Bakewell, Derbyshire.—The houses generally are of sandstone, and in fair condition. A new bank now erecting of sandstone from Bakewell Edge.

Bakewell Church.—(14th century.) Of a sandstone of the vicinity, very much decomposed.

Barnard Castle, Durham.—(14th century.) Circular keep, apparently of Stenton stone, in excellent condition. In modern works, the joint stock bank and market-house, of Stenton stone, in good condition.

Belper New Church, Derbyshire.—Built 10 years since, of sandstone from Hungerhill, in an incipient state (in parts) of decomposition.

Blandford parish church, Dorsetshire.—(1769.) Of a green siliceous fine-grained sandstone, the dressings being of a stone similar to the Portland oolite; the former much decomposed; the latter in very good condition.

Town-hall, about 80 years old, of stone similar to the Portland oolite, in good condition.

Blancepeth castle, Durham.—Of ancient date, of sandstone of the vicinity; recently restored extensively; older parts in various states of decomposition.

Briavel's, St., castle, Gloucestershire.—In ruins (13th or 14th century). Entrance gateway (the chief remains of the castle), built of red sandstone; decomposed.

Bristol cathedral.—(Of the 13th and 14th centuries.) Built of red sandstone, and a yellow limestone (magnesian?), strangely intermixed; the red sandstone in all cases decomposed; the limestone more rarely decayed; the tracery, &c. of the windows, which are of the limestone, are in good condition, but the pinnacles and other dressings, which are of the same material, are much decomposed. The east end of the cathedral is a remarkable instance of the decay and preservation of the two stones employed. Norman gateway, west of the cathedral (the upper part of the 15th century); the Norman archway and its enrichments, which are of a very florid character, built of yellow limestone (magnesian?), in excellent condition.

Byland abbey.—(12th century.) In part of a siliceous grit (principally in the interior), and in part (chiefly on the exterior) of a compact oolite, from the Wass quarries in the vicinity. The west front, which is of the oolite, is in perfect condition, even in the dogs-teeth and other florid decorations of doorways, &c. This building is covered generally with lichens.

Carlisle.—Ancient buildings:—Cathedral (13th century), of red sandstone, in various states of decomposition. Modern buildings:—many of red sandstone, more or less in a state of decomposition.

Castle Howard, Yorkshire.—Generally built of a siliceous fine-grained sandstone, from the park; generally in good condition, but in some parts, such as the parapets, cupolas, and chimney shafts, much decomposed. The pilasters of the north front, from a quarry at Appleton; in good condition, except where subjected to alternations of wet and dry, as in the plinths, where there are signs of decomposition. The stables are of Appleton stone, and in good condition.

Chatsworth house, Derbyshire.—Original house, built of Ball Cross sandstone, from Bakewell Edge; not in very good condition, particularly in the lower parts of the building. In the recent additions the same stone is employed, together with that of Bailey Moor and Lindrop Hill.

Chepstow castle, Monmouthshire.—(11th and 12th centuries, with additions of the 14th century.) Of mountain limestone and old red sandstone; the former in good condition; the latter decomposed. Dressings of doors, windows, archways, and quoins are for the most part of magnesian limestone, in perfect condition; the remainder is of red sandstone, and is generally much decomposed. Chapel (of the 12th century); mouldings and carvings of windows, &c., which are of magnesian limestone, are in perfect condition.

Coxwold church, Yorkshire.—(15th century.) Generally of fine siliceous grit of the vicinity, and in part of a calcareous nature. Tower in good condition. Porch decomposed. Lichens abundant on the north side.

Derby.—St. Peter's church (13th century), of the variegated coarse sandstone of the vicinity, similar to that of Little Eaton. The whole in bad condition; but the red stones less so than the grey or white.—St. Alkmund's church (of the 14th century), of a coarse sandstone of the vicinity, in a very decomposed state, to the obliteration of the mouldings and other details; it has lately been scraped and painted, to preserve it from further destruction. —All Saint's church (tower of 15th century), of sandstone, similar to that of Duffield bank, partly in fair condition, and partly much decomposed, particularly the great western entrance. The body of the church, built 110 years since, of sandstone, in part decomposing. Modern buildings:—Town-hall, of sandstone of the vicinity, in fair condition.

The bank, of sandstone from Morley Moor, built a few years since, in very good condition.

Durham, cathedral.—(11th and 12th century.) Of a sandstone of the vicinity; selected indiscriminately, and in all states of decomposition; few stones are quite perfect. Castle—(of 11th century.) Of similar stone, and in a similar state.

Easby abbey, Yorkshire.—(13th and 14th centuries.) Of sandstone of the vicinity; mouldings and carvings decomposed, and in part obliterated. Walls built very rudely, and in various states of decomposition; some parts however maintain their original surface.

Eccleston abbey, Yorkshire.—(13th century.) Of stone similar to that of the Stenton quarry. The mouldings and other decorations, such even as the dog's-teeth enrichments, are in perfect condition.

Edinburgh.—Ancient buildings:—Holyrood chapel (12th century), of sandstone from the vicinity, in part much decomposed; in other parts, such as the west door, almost perfect.—The palace (built in the 16th and 17th centuries), of similar stone; generally in good condition, the older parts being slightly decomposed. The oldest part of the Tron church (1641), of sandstone, much decomposed. A house on the Castle-hill (1591), of sandstone, only slightly decomposed.

Modern buildings, wholly erected of sandstones from the Craigleith, Red Hall, Humbie, and Binnie quarries: for the most part from the first-mentioned quarry. None of them exhibit any appearance of decomposition, with the exception of ferruginous stains, which are produced upon some stones.

Among the oldest is the Registry-office, which is of Craigleith stone, and built above 60 years since; it is in a perfect state.

Fountain's abbey, Yorkshire.—(11th and 12th centuries, with additions of the 16th century.) Of coarse sandstone of the vicinity, generally in bad condition, particularly the west front, which is much decomposed. The nave and transept, which are the earliest portions of the building, are the best preserved.

Fountain's hall, Yorkshire.—(1677.) Of sandstone of the vicinity, and magnesian limestone in the dressing. The whole in fair condition.

Forest of Dean, Gloucestershire.—Park End new church (built 15 years since, of sandstone, similar to that of Colford. No appearance of decomposition.

Glasgow.—Ancient buildings:—High church (12th century), sandstone of the vicinity; generally very much decomposed, particularly on the south side. Old quadrangle of the college (temp. James 2.), of sandstone, decomposed.

Modern buildings:—Hunterian museum (1804); superstructure said to be of stone from the President quarry; slight traces of decomposition on the south-west front. The basement, of another sandstone, in a more advanced state of decomposition; other parts of the building are almost in a perfect state. The other buildings are generally erected of stone from the Giffneuch and other quarries in the immediate neighbourhood, except the New Exchange buildings, which are of stone from the Humbie quarry, 30 miles from Glasgow, recently erected, in which there are not any apparent symptoms of decomposition.

Gloucester, cathedral.—(Norman for the greater part, altered and cased in the 15th century.) Built of a fine-grained and ill-cemented oolite, a shelly oolite, and a red sandstone (north side) intermixed, of which the former constitutes the greater portion. The tower (15th century), of shelly oolite, in perfect condition. The early turrets of the south transept are also in good condition. The body of the building is much decomposed. The great cloister is built of the same materials as the cathedral. The moulded and decorated work is in good condition; the other parts are more or less decomposed. The small cloister is built of a fine oolite, with a compact cement, and is in good condition.

The new bridge. Of Whitchurch sandstone, parapets of Ruordean fine-grained sandstone; in good condition.

Haddon hall, Derbyshire.—(15th and 16th centuries.) Of a fine-grained sandstone, similar to that of Lindrop-hill. The dressings, parapets, chimney shafts, quoins, &c., are wrought and rubbed; the remainder of the walls is of rough walling. The whole in fair condition.

Harrowgate.—Cheltenham pump-room. Of sandstone from Woodhouse, near Leeds. Built recently; in good condition. Swan hotel, and other modern buildings, of a coarse sandstone of the vicinity; generally in good condition.

Hardwicke hall, Derbyshire.—(1597.) Of a fine-grained sandstone, chiefly from a quarry in the hill on which the house is built, intermixed with a calciferous grit, similar to that of Mansfield; generally in good condition. The ashlar is in parts decomposed, especially where it is set on edge.

Howden church, Yorkshire.—(15th century.) Partly of magnesian limestone, of a deep yellow colour, and partly of a coarse siliceous grit, of a ferruginous colour. Dressings and enrichments and the central tower are of the former stone; generally decomposed, particularly at the top of the tower. The other parts of the building, which are of the grit, are very much decomposed.

Kirkstall abbey, Yorkshire.—(11th century.) Of coarse sandstone of the vicinity, in various stages of decomposition, according to the aspect. The east side is in fair condition; some of the zig-zag enrichments and early capitals, and other enrichments of mouldings, are in perfect condition. The windows of the chancel and tower (inserted in the 16th century), of a yellow sandstone, are for the most part gone, and what remains is much decomposed.

Mansfield town-hall, Nottinghamshire.—Built 3 years since, of magnesio-calciferous sandstone from Mansfield. No appearance of decomposition.

Newcastle-upon-Tyne.—Ancient buildings:—St. Nicholas's church (14th century), of sandstone of the vicinity, similar to that of the Heddon quarry; very much decomposed. Parts restored within the last century with the same stone now decomposing. The upper part of the tower and spire restored within the last five years, and painted to preserve the stone from decay. Other ancient buildings of the same stone more or less in a state of decomposition, according to the date of their erection.

Modern buildings, built within the last 25 years, of sandstone from the Felling and Church quarries at Gateshead, and the Kenton quarry; parts already show symptoms of decomposition.

Pontefract castle, Yorkshire.—(14th century.) Built generally of a coarse grit, of a dark brown colour, occasionally mixed with an inferior magnesian limestone. The whole in a very decomposed state, more particularly the sandstone, in which all traces of the original surface are effaced. Fragments of magnesian limestone are embedded in several parts of the walls with mouldings of the 12th century, in perfect condition.

Raby castle, Durham.—(14th century.) Of sandstone of the vicinity. Parts in a perfect state; others slightly decomposed.

Richmond castle, Yorkshire.—(11th century.) The Keep of sandstone, similar to that of Gatherly Moor; generally in good condition. Mouldings and carvings in columns of window in a perfect state.

Ripon, Yorkshire.—An obelisk in the market place (1781), of coarse sandstone, much decomposed, in laminations parallel to the exposed faces.

Ripon cathedral.—Lower part, east end, S. E. angle, (Norman,) of coarse sandstone of the vicinity, in good condition. The west front, the transepts and tower, (of the 12th and 13th centuries,) of coarse sandstone of the vicinity, in fair condition. The mouldings, although generally decomposed, are not effaced. The dog's-teeth ornament in most parts nearly perfect. The aisles of the naves, the cleristory, and the choir, (of the 14th and 15th centuries,) of coarse sandstone and magnesian limestone intermixed; not in good condition; the latter stone, on the south side, often in fair condition. The lower parts of the building generally, but particularly the west fronts, which are of coarse sandstone, are very much decomposed.

Rivaulx abbey, Yorkshire.—(12th century.) Of a sandstone at Hollands, one mile from the ruins; generally in excellent condition. West front slightly decomposed; south front remarkably perfect, even to the preservation of the original tool marks.

Shaftesbury, Dorsetshire.—St. Peter's church. (15th century.) Of a green siliceous sandstone, from quarries half a mile south of the church. The whole building much decomposed. The tower is bound together by iron, and is unsafe, owing to the inferior quality of the stone.

Spofforth castle, Yorkshire.—(14th century.) Of coarse red sandstone, more or less, but generally much decomposed. The dressings of the windows and doors of a semi-crystalline magnesian limestone, are in a perfect state, the mouldings and enrichments being exquisitely sharp and beautiful.

Tintern abbey.—(13th century.) Considerable remains, of red and grey sandstones of the vicinity; in part laminated. In unequal condition, but for the most part in perfect condition; covered with grey and green lichens.

Tisbury church, Wiltshire.—(13th and 14th centuries; the lower part of the tower of the 12th century.) Of calciferous sandstone from Tisbury. The dressings are throughout in perfect condition. The ashlar variable; in part much decomposed; the undecomposed portions are covered with lichens. Tombstones in the churchyard generally in good condition, some being more than a century old. The houses of the village built generally of the Tisbury stone, and are in very good condition. The whole covered with lichens.

Wakefield parish church, Yorkshire.—(Tower and spire of the 16th century.) Of sandstone, much decomposed. The body of the church, of recent date, of sandstone, strongly laminated, and generally decomposed between the laminæ.

Whitby abbey.—(13th century.) Of stone similar to that of Arslaby Brow in the vicinity; generally in good condition, with the exception of the west front, which is very much decomposed. The stone used is of two colours, brown and white; the former in all cases more decomposed than the latter. The dog's-teeth and other enrichments in the east front are in good condition.

LIMESTONE BUILDINGS.

Bath.—Abbey church (1576), built in an oolite of the vicinity. The tower is in fair condition. The body of the church, in the upper part of the south and west sides, much decomposed. The lower parts, formerly in contact with buildings, are in a more perfect state; the reliefs in the west front of Jacob's ladder, are in parts nearly effaced.—Queen's-square, north side, and the obelisk in the centre, built above 100 years since, of an oolite with shells, in fair condition.—Circus (built about 1750), of an oolite in the vicinity, generally in fair condition, except those portions which have a west and southern aspect, where the most exposed parts are decomposed.—Crescent, built about 50 years since, of an oolite of the vicinity; generally in fair condition, except in a few places, where the stone appears to be of inferior quality.

Bristol, cathedral.—(Of the 13th and 14th centuries.) Built of red sandstone and apparently a yellow limestone (magnesian?) strangely intermixed. The red sandstone in all cases decomposed; the limestone more rarely decayed. The tracery, &c. of the windows, which are of the limestone, are in good condition; but the pinnacles and other dressings, which are of the same material, are much decomposed. The east end of the cathedral is a remarkable instance of the decay and preservation of the two stones employed. Norman gateway, west of the cathedral, (the upper part of the 15th century,) the Norman archway and its enrichments, which are of a very florid character, built of yellow limestone (magnesian?), in excellent condition.

St. Mary, Redcliffe.—(Tower of the 12th century; body of the church of the 15th century). Of oolitic limestone, from Dundry; very much decomposed.

Burleigh-house.—(15th century.) Of a shelly oolite (Barnack rag), in excellent condition throughout. The late additions are of Ketton stone.

Byland abbey, Yorkshire.—(12th century.) In part of the siliceous grit (principally in the interior), and in part (chiefly on the exterior) of a compact oolite, from the Wass quarries in the vicinity. The west front, which is of the oolite, is in perfect condition, even in the dog's-teeth and other florid decorations of the doorways, &c. This building is covered generally with lichens.

Colley Weston church, Northamptonshire.—(14th century.) Of a shelly oolite (Barnack rag), in perfect condition throughout.

Dorchester.—St. Peter's church. (15th century.) Of laminated oolite, somewhat similar to that of Portland, and of a shelly limestone, somewhat resembling that of Hamhill. The latter used in pinnacles, parapets, and dressings. The whole in a decomposed state.

Glastonbury.—*Abbey.*—Joseph of Arimathea's chapel:—Considerable ruins, Norman; of shelly limestone, similar to that of Doulting; generally in good condition; the zig-zag and other Norman enrichments perfect; the capitals of columns, corbels, &c., are of blue lias, much decomposed, and in some cases have disappeared. The church:—considerable remains of the choir, and a small portion of the nave (11th century); of shelly limestone, similar to that of Doulting, in good condition. *St. Benedict's, parish church* (14th century).—Of limestone similar to that of Doulting; in good condition. *St. John the Baptist's, parish church* (15th century).—Of stone similar to that of Doulting; generally in fair condition.

Gloucester.—Cathedral.—(Norman, for the greater part altered and cased in the 15th century.) Built of a fine-grained and ill-cemented oolite, a shelly oolite, and a red sandstone (north side) intermixed, the former constituting the greatest portion of the edifice. The tower (15th century) of shelly oolite in perfect condition. The early turrets of the south transept are also in good condition. The body of the building is much decomposed. The great cloister is built of the same materials as the cathedral. The moulded and decorated work is in good condition; the other parts are more or less decomposed. The small cloister is built of a fine oolite, with a compact cement, and is in good condition.

St. Nicholas's church.—(Body, Norman; tower and spire, 15th century.) Of a shelly and inferior kind of oolite intermixed, and in unequal condition.

St. Michael's church.—(15th century.) Built of the same stone as St. Nicholas's, and in the same condition.

Grantham church.—(13th century.) Lofty tower and spire at the west end. Built of an oolite similar to that of Ancaster; in good condition, more especially the tower, except as to some portions of the base mouldings.

Ketton church, Rutlandshire.—(West entrance door, Norman; tower of the 12th or 13th century; nave, aisles, and chancel of the 14th century.) Of a shelly oolite (Barnack rag), in good condition. Dog's-teeth, carved corbels, and other enrichments in a perfect state.

Kettering church.—(14th and 15th centuries.) Of a shelly oolite, fine-grained, the greater portion resembling Barnack rag. The tower and spire in perfect condition. The body of the church in parts slightly decomposed.

Kirkham priory, Yorkshire.—(13th century.) Inconsiderable remains. The western front and great entrance slightly decomposed throughout; the portions which remain of the body of the church very perfect; but many of the stones are much decomposed. The stone is very similar to that of the Hildenley quarry. The whole is much covered with lichens.

Lincoln.—Cathedral.—(The minster generally of the 12th and 13th centuries.) Of oolitic and calcareous stone of the vicinity; generally in fair condition, more especially the early portions of the west front. The ashlar and plain dressings of the south front are however much decomposed. The mouldings and carvings of the east front are in a perfect state. *Roman gate*, of a ferruginous oolite, in fair condition. *The castle gateway* (13th century), of an oolitic limestone; ashlar much decomposed; dressings perfect.

Malton (old) church, Yorkshire.—(12th century.) Light semi-compact limestone, similar to that of the Hildenley quarry; generally in good condition, particularly the great west door (of the 11th century), where the zig-zag and other enrichments are perfect; some stones are much decomposed.

Montacute, Somersetshire.—Parish church (15th century):—Of Hamhill stone, in perfect condition, covered with lichens. The abbey (15th century): supposed abbot's house and gateway, of Hamhill stone, in good condition. Montacute-house:—(17th century.) Of Hamhill stone, in excellent condition.

Martock church, Somersetshire.—(15th century.) Of a shelly ferruginous brown limestone from Hamhill, in good condition, except the plinth and base mouldings, which are much decomposed. Covered with lichens.

Newark.—Church.—(15th century; the tower in part of the 12th century.) Of an oolite similar to that of Ancaster; generally in fair condition, with the exception of parts of the base mouldings. The building is covered with a grey lichen.

The castle.—(Norman, with additions in the 15th century):—chiefly of sandstone of the vicinity; in unequal condition. A large portion of the dressings of the windows, &c., are of an oolite, probably from Ancaster.

Town-hall (50 or 60 years old):—built of the Ancaster oolite; in good condition; in some blocks however there is an appearance of lamination, where decomposition has to a slight extent taken place.

Oxford.—Cathedral:—Norman. (12th century.) Chiefly of a shelly oolite, similar to that of Taynton; Norman work in good condition; the latter work much decomposed. *Merton college chapel* (13th century):—of a shelly oolite resembling Taynton stone; in good condition generally. *New college cloisters* (14th century):—of a shelly oolite (Taynton); in good condition. The whole of the colleges, churches, and other public buildings of Oxford, erected within the last three centuries, are of an oolitic limestone from Heddington, about one mile and a half from the University, and are all more or less in a deplorable state of decomposition. The plinths, string courses, and such portions of the buildings as are much exposed to the action of the atmosphere, are mostly of a shelly oolite from Taynton, fifteen miles from the University. and are universally in good condition.

Paul's, St., cathedral, London.—(Finished about 1700.) Built of Portland oolite, from the Grove quarries on the East Cliff. The building generally in good condition, especially the north and east fronts. The carvings of flowers, fruit, and other ornaments are throughout nearly as perfect as when first executed, although much blackened; on the south and west fronts, larger portions of the stone may be observed of their natural colour than on the north and east fronts, occasioned by a very slight decomp[illegible] of the surface. The stone in the drum of the dome and in the cupola above it appears not to have been so well selected as the rest, nevertheless scarcely any appreciable decay has taken place in those parts.

Pickering church, Yorkshire.—(13th and 14th centuries.) Oolitic rock of the neighbourhood; very much decomposed; the windows, mullions, and buttress angles, obliterated.

Pickering castle.—(14th century.) The walls of the oolite of the neighbourhood, and the quoins of a siliceous grit. The whole in fair condition.

Portland, Dorsetshire.—New church (built 1766):—Portland oolite; fine roach. In a perfect state, still exhibiting the original tool marks. Wakeham village, Tudor house, of Portland oolite, in excellent condition. *Old church*, in ruins, near Bow and Arrow castle, (15th century), of Portland oolite, resembling top bed; in very good condition; original chisel marks still appear on the north front. *Bow and Arrow castle*:—considerable remains of the keep, many centuries old, of Portland oolite; the ashlar resembles the top bed, and is in perfect condition; the quoins and corbels of the machicolated parapet appear to be of the cap bed of Portland oolite, and are in good condition.

Salisbury cathedral.—(13th century.) Of siliciferous limestone from Chilmark quarry. The entire building is in excellent condition, except the west front, which in parts is slightly decomposed. The building generally covered with lichens.

Sandysfoot castle, near Weymouth.—(Temp. Henry VIII.) Considerable remains of keep; chiefly of Portland oolite, partly of the top bed and partly of the fine roach; generally in excellent condition, with the exception of a few and apparently inferior stones. The inside ashlar of the walls is of large-grained oolite, apparently from the immediate vicinity of the castle, much decomposed.

Somerton church, Somersetshire.—(14th century.) Built chiefly of blue lias; the quoins, buttresses, parapets, and other dressings of a coarse ferruginous shelly limestone; in various stages of decay. The parapet of the clerestory of a lighter coloured stone, in good condition.

Stamford.—St. Mary's church (13th century):—of a shelly oolite (Barnack rag), in fair condition. *St. John's church* (14th century):—of similar stone, ill selected, and consequently decomposed in parts, and in laminations, according to the direction of the beds or shells. *St. Martin's church* (14th century):—of similar stone, in good condition. *All Saints*:—(lower part of the body of the church 13th century; the remainder of the 15th century.) Tower and spire in fine condition. Body of church decomposed. *Standwell's hotel*:—built 24 years since, of an oolite, similar to that of Ketton; in perfect condition. *St. Michael's new church*:—built four years since. No appearance of decomposition.

Wells.—The Cathedral:—west front (13th century), upper part of tower (14th century); of shelly limestone, similar to that of Doulting, generally decomposed, but not to any great extent. North flank (porch and transept, 13th century; the remainder of the 14th century), of similar stone, in good condition, except lower part of flank and west tower. The central tower (of the 14th century) in very good condition. South side of the cathedral generally in good condition. Chapter-house (13th century, with additions of the 15th century):—the whole in good condition, excepting the west front of the gateway, which is decomposed. Close gates (15th century) much decomposed, but especially on the south and south-west. The cloisters (15th century) generally decomposed, particularly the mullions and tracery.

Westminster abbey.—(13th century.) Built of several varieties of stone, similar to Gatton or Ryegate, which is much decomposed, and also of Caen stone, which is generally in bad condition; a considerable portion of the exterior, especially on the north side, has been restored at various periods; nevertheless abundant symptoms of decay are apparent. The cloisters, built of several kinds of stone, are in a very mouldering condition, except where they have been recently restored with Bath and Portland stones. The west towers, erected in the beginning of the 18th century, with a shelly variety of Portland oolite, exhibit scarcely any appearance of decay. Henry the 7th's chapel, restored about 20 years since with Combe Down Bath stone, is already in a state of decomposition.

Windrush church.—(15th century.) Of an oolite from the immediate vicinity; in excellent condition. A Norman door on the north side, enriched with the birds-beak and other characteristic ornaments, is in perfect condition. Tombstones in the churchyard very highly enriched, and bearing the dates of 1681 and 1690, apparently of Windrush stone, are in perfect condition.

Wyke-church, Dorsetshire.—(15th century.) Of oolite similar to Portland; the whole in good condition, except the mullions, tracery, and dressings of doors and windows, which are constructed of a soft material, and are all decomposed. On the south side, the ashlar is in part covered with rough cast. The entire building is thickly covered with lichens.

MAGNESIAN LIMESTONE BUILDINGS.

Beverley, Yorkshire.—The *Minster* (12th, 13th, and 14th centuries), of magnesian limestone from Bramham Moor, and an oolite from Newbold; the former, which is used in the west tower, central tower, and more ancient parts the minster, generally in good condition, but in other parts of the building the same material is decomposed. The Newbold stone, chiefly employed on the east side, is altogether in a bad condition. Some of the pinnacles are of Oulton sandstone, and are in bad condition. The building is partly covered with lichens. St. Mary's church (14th century), now in course of restoration, of magnesian limestone and oolite, supposed to be from Bramham Moor and Newbold respectively. The ancient parts are in a very crumbling state, even to the obliteration of many of the mouldings and enrichments.

Bolsover castle, Derbyshire.—(Temp. 1629.) Mostly in ruins; of magnesian limestone of several varieties, and of a calcareous fine-grained sandstone. The dressings, which are generally of sandstone, are much decomposed; in some instances to the entire obliteration of the mouldings and other decorations, and to the destruction of the form of the columns, rustications, &c. Most of the string courses, a portion of the window dressings, and the ashlar, which are of magnesian limestone, are generally in excellent condition.

Bolsover church, Derbyshire.—(15th century.) Of a magnesio-calciferous sandstone, more or less in a decomposed state throughout.

Chepstow castle, Monmouthshire.—(11th and 12th centuries, with additions of the 14th century.) Of mountain limestone and old red sandstone. The former in good condition; the latter decomposed. Dressings of door, window, archway, and quoins are for the most part of magnesian limestone, and in perfect condition. The remainder is of red sandstone, and is generally much decomposed. Chapel (of the 12th century):—mouldings and carvings of windows, &c., which are of magnesian limestone, in perfect condition.

Doncaster (old) church.—(15th century.) Of an inferior magnesian limestone, generally much decomposed, more especially in the tower and on the south and west sides; now under general and extensive repair.

Hemingborough church, Yorkshire.—(15th century.) Of a white crystalline magnesian limestone. The entire building is in a perfect state, even the spire, where no traces of decay are apparent.

Howden church, Yorkshire.—(15th century.) Partly of magnesian limestone, of a deep yellow colour, and partly of a coarse siliceous grit, of a ferruginous colour. Dressings and enrichments, and the central tower, are of the former stone, generally decomposed; particularly at the top of the tower. The other parts of the edifice built of the grit are very much decomposed.

Huddlestone-hall, Yorkshire.—(15th century.)—Of semi-crystalline magnesian limestone from the neighbouring quarry. In excellent condition, even to the entire preservation of the mouldings of the chapel window in the south-west front. The outer gate piers in the fence wall, also of magnesian limestone, very much decomposed.

Knaresborough castle, Yorkshire.—(12th century.) Magnesian limestone, carious in part; generally in very good condition, except on the south and south-west portions of the circular turrets, where the surface is much decomposed. The mouldings generally are in a perfect state. The joints of the masonry, which is executed with the greatest care, are remarkably close. The stone of the keep, which is of a deep brown colour, and much resembles sandstone, is in good condition, especially on the south-west side.

Koningsborough castle, Yorkshire.—(Norman.) Coarse-grained and semi-crystalline magnesian limestone from the hill eastward of the castle; in perfect condition. The masonry is executed with great care, the joints very close, but the mortar within them has disappeared.

Ripon.—Cathedral.—Lower part, east end, S. E. angle, (Norman), of coarse sandstone from the vicinity; in good condition. The west front, the transepts, and tower, (of the 12th and 13th centuries,) of coarse sandstone of the vicinity, in fair condition. The mouldings, although generally decomposed, are not effaced. The dogs-teeth ornament in most parts nearly perfect. The aisles of the nave, the clerestory, and the choir, (of the 14th and 15th centuries,) of coarse sandstone and magnesian limestone intermixed, not in good condition. The latter stone on the south side often in fair condition. The lower parts of the building generally, particularly the west fronts, which are of coarse sandstone, are much decomposed. *An obelisk in the market-place* (1781), of coarse sandstone, is much decomposed, and in laminations parallel to the exposed faces.

Robin Hood's well, Yorkshire.—(1740.) A rusticated building, of magnesian limestone, in perfect condition.

Roche abbey, Yorkshire.—(12th century.) Inconsiderable remains; of semi-crystalline magnesian limestone from the neighbouring quarry, generally in fair condition; the mouldings and decorated portions are perfect. Gate house (of 12th century), generally decomposed, with the exception of the dressings and mouldings, which are perfect.

Selby church, Yorkshire.—(Nave and lower part of the tower of the 11th century; the west front and aisles of the 12th century; and the choir, with its aisles, of the 14th century.) The Norman portion of the building, which is of grey magnesian limestone, is in excellent condition, particularly the lower part. The early English portions of the building are also of magnesian limestone, and in a partially decomposed state. The later portions of the building, which are too of magnesian limestone, are much decomposed and blackened.

Southwell church, Nottinghamshire.—(Of the 10th century.) Of magnesian limestone similar to that of Bolsover Moor, in perfect condition. The mouldings and enrichments of the doorway appear as perfect as if just completed. The choir, which is of the 12th century, and built of a stone similar to that of Mansfield, is generally in good condition.

Spofforth castle, Yorkshire.—(14th century.) Of coarse red sandstone, generally much decomposed. The dressings of the windows and doors, of a semi-crystalline magnesian limestone, are in a perfect state, the mouldings and enrichments being exquisitely sharp and beautiful.

Studley park, Yorkshire.—Banqueting house, about 100 years old, of yellowish magnesian limestone, in perfect condition.

Thorpe Arch Village.—The houses generally of this village are built of magnesian limestone from the vicinity; they are in excellent condition, and of a very pleasing colour.

Thorpe Salvin, near Worksop.—Manor-house (15th century), in ruins; of a siliciferous magnesian limestone and a sandstone; in unequal condition; the quoins and dressings are generally in a perfect state. Parish church)15th century), also of siliciferous variety of magnesian limestone and a sandstone; in unequal but generally fair condition. A Norman doorway under the porch is well preserved.

Tickhall church, Yorkshire.—(15th century.) Of magnesian limestone, in excellent condition. The lower part of the tower (of the 12th century) also in fair condition.

York.—Ancient buildings.—*Cathedral* (transepts 13th century; tower, nave, &c., 14th century):—of magnesian limestone from Jackdaw Craig. West end and towers restored 30 years since; they are in fair condition generally, but some of the enriched gables and other decorations are obliterated. The transepts are in many places much decomposed, especially in the mouldings and enrichments. The central tower is generally in good condition, but several of the enriched parts are decomposed. *St. Mary's abbey* (12th century):—of magnesian limestone. West front of the church generally much decomposed; the north flank in better condition, but in parts much decomposed. The gateway, which is of Norman origin, is in fair condition. *Roman Multangular tower*:—built of small stones; such as are of magnesian limestone are in good condition. *St. Denis's church*:—Norman doorway, of magnesian limestone; south aspect highly enriched with zig-zag and other ornaments; the columns are gone; the parts which remain are in good condition. *St. Margaret's church* (15th century):—of magnesian limestone; east front much exposed, and in good condition. The porch is of Norman date, and has been reconstructed; four bands of enrichment in the head in tolerably fair condition, but many stones, particularly those of a deep yellow brown colour, are much decomposed. *The other churches of York* (which are of the 14th and 15th centuries) are built of magnesian limestone, and are generally in an extremely decomposed state, in many instances all architectural detail is obliterated.

Modern buildings.—*The museum*:—of Hackness sandstone, built nine years since, much decomposed wherever it is subject to the alternation of wet and dry, as at the bottom of the columns of the portico, plinth, &c. *The castle* (recently erected):—the plinth of the boundary wall (which is of Bramley Fall sandstone) already exhibits traces of decomposition. *York Savings Bank*:—Huddersfield stone (?), in good condition.

Worksop church.—(Principally of the 13th century.) Of a siliciferous variety of magnesian limestone, and of a sandstone; in very unequal condition; some parts are very much decomposed while others are in a perfect state.

(Signed) Charles Barry.
H. T. De la Beche.
William Smith.
Charles H. Smith.

Description of the Galvanic Telegraph at the Great Western Railway.—The space occupied by the case containing the machinery (which simply stands upon a table, and can be removed at pleasure to any part of the room), is little more than that required for a gentleman's hat-box. The telegraph is worked by merely pressing small brass keys (similar to those on a keyed bugle), which, acting, by means of galvanic power, upon various hands placed upon a dial-plate at the other end of the telegraphic line, as far as now opened, point not only to each letter of the alphabet, as each key may be struck or pressed, but the numericals are indicated by the same means, as well as the various points, from a comma to a colon, with notes of admiration and interjection. There is likewise a cross (X) upon the dial, which indicates that when this key is struck, a mistake has been made in some part of the sentence telegraphed, and that an "erasure" is intended. A question—such, for instance, as the following, "How many passengers started from Drayton by the 10 o'clock train?"—and the answer, could be transmitted from the terminus to Drayton and back in less than two minutes. This was proved on Saturday. This mode of communication is only completed as far as the West Drayton station, which is about 13½ miles from Paddington. There are wires (as may be imagined) communicating with each end, thus far completed, passing through a hollow iron tube, not more than an inch and a half in diameter, which is fixed about six inches above the ground, running parallel with the railway, and about two or three feet distant from it. It is the intention of the Great Western Railway Company to carry the tube along the line as fast as completion of the rails takes place, and ultimately throughout the whole distance to Bristol. The machinery and the mode of working it are so exceedingly simple that a child who could read would, after an hour or two's instruction, be enabled efficiently to transmit and receive information.—*Observer.*

THE RIVER CLYDE.

Extracts from a General Report on a part of the River Clyde, between Jamaica-street Bridge and the Glasgow Water-works. By WILLIAM BALD, F.R.S.E., M.R.I.A., &c. Civil Engineer.

* * The first great step to improve and extend the trade of Glasgow, is to increase the width and depth of the river Clyde, and to render it safe in every part of its navigation; secondly, to give sufficient room and full protection to all ships frequenting the harbour or port of the city. But, to attain the first of these important objects, it is necessary to observe, that to preserve depth in river channels by artificial means, is attended with a constant and a considerable expense; but, if natural means can be called into action to secure depth, and also width, or even partly to assist in doing so, it would be extremely desirable, and is the first thing which should occupy the attention of the engineer in the improvement of a tidal river channel. If increased width be contemplated for any river, beyond the limits which nature has assigned to it, for the discharge of its land-flood waters, it will decrease in depth what has been given to it in width; and, on the other hand, if the natural breadth of a river be narrowed, it will acquire in depth, what has been taken from it in width; taking into account the nature of the soil at the bottom, and on the sides of the river, and the velocity of the water current.

Reflecting on these fundamental principles, and looking at the river Clyde, and the great necessity there exists of giving it increased breadth for the purposes of navigation, the first consideration should be, to preserve the depth where increased width is proposed to be given to it, by the immediate removal of every kind of obstacle which in any manner interferes with the free tidal flow of the sea-water upwards, by deepening and widening the channel of entrance, clearing away all banks, shoals, and obstructions, so that the sea-tide flood may ascend freely upwards, to the greatest extent that it can possibly reach.

It is manifest, that any plan that shall increase the volume of water into the upper reaches of the Clyde above the city of Glasgow, will be attended with the most beneficial results. The tide water in the Harbour will be increased; the time of high water will be more early, thereby enabling ships outward and inward bound to reach the port sooner, and depart from it earlier. The velocity of the tide of flood and ebb would be increased, not only through the Harbour, but also through the whole navigable channel of the Clyde; and even for some distance this scouring power would be felt above Hutcheson's Bridge, by which the whole impurities of the sewerage of the city would be washed away downwards by the ebbing tidal current, and which would render Glasgow more healthy, and the water in the Harbour more pure.

By the removal of the weir at the New Bridge, the Clyde could be deepened upwards in such a manner as to allow a volume of water each tide to ascend the Clyde towards Dalmarnock Ford, of about 13,200,000 cubic feet, equal to 367,242 tons.

$$(6{,}232 \times 13{,}200{,}000 = 82{,}262{,}400 \text{ gallons, or } \frac{13{,}200{,}000 \times 62.5}{2{,}240} = 368{,}303 \text{ tons.})$$

The removal of the weir would give a volume of water each tide, into the upper reaches of the Clyde, to the end of the tidal flow above the Glasgow works, of 20,400,000 cubic feet of water, equal to 567,557 tons.

$$(6{,}232 \times 20{,}400{,}000 = 127{,}132{,}800 \text{ gallons, or } \frac{20{,}400{,}000 \times 62{\cdot}5}{2{,}240} = 569{,}196 \text{ tons.})$$

This is nearly equal to a river line of four miles long, four feet deep, and two hundred and forty-two feet wide. This immense volume of water ascending and descending each tide, would eminently tend to carry away all impurities which are discharged into the Clyde at Glasgow; indeed, the effects of this scouring power would be felt towards the lower extremities of the river Clyde, as far as the banks opposite Port-Glasgow and Greenock.

The removal of the weir would at once open an extent of river, between the New Bridge and Hutcheson's Bridge, of nearly twenty-three acres, equal in extent to the whole of the lower Harbour; and a deepening of three or four feet would enable all the smaller craft in the lower Harbour to ascend into the very centre of the city, which would be a great relief to the lower Port, where the large ships lie. But this upper Harbour of twenty-three acres is quite capable of being so improved, that ships of the largest class might lie in it, and Glasgow would then indeed have the aspect of a great maritime port. To those who have visited some of the continental harbours and cities—such, for example, as Amsterdam and Rotterdam—nothing can appear more natural, and simple than to convert the whole of the Clyde, between the New Bridge and Hutcheson's Bridge, into a large floating harbour. Its position in the very middle of the city, would confer many advantages on the merchant and trader.

In the first instance, the weir might be lowered about three feet; the bed of the river between the New and the Old Bridge deepened three feet, and between that bridge and the City Wharf deepened only two feet. I am of opinion, that this extent of deepening will not endanger the Old Bridge at Stockwell-street, if proper precaution be taken; and this first step would afford immediate relief to the lower Harbour, by affording ample room to all the smaller craft to berth themselves between the bridges.

I am quite aware that none of the Acts of Parliament permit the river trustees to deepen any part of the Clyde above Stockwell-street Bridge; yet, notwithstanding, if the river were deepened even so far up as that bridge, it would be a most important advantage. The space between the New Bridge and the Old is about fifteen hundred feet long, by nearly four hundred feet wide, being an area of more than thirteen acres; it would therefore afford immense accommodation to the smaller vessels frequenting the Port of Glasgow.

It is really to be regretted that so magnificent a harbour improvement should be sealed up, and prevented from being carried into execution, on account of the existence of the weir at the New Bridge. I am aware that it has been, and continues to be, a source of very deep regret to that active and commercial intelligence, which so pre-eminently distinguishes the inhabitants of this great city, to have seen, for so long a period, a space so large lying wholly unoccupied, and which might be so easily and so cheaply converted into a most useful harbour; while, on the other hand, the lower Port is so crowded with vessels, that hardly a berth can be procured, nor even the necessary repairs made to parts of the quay walls without seriously inconveniencing the shipping: and all this has arisen about the lowering of the weir, which the Glasgow Water Company object to, as being injurious to their interest. On this important point I shall now proceed to offer a few observations.

The principal objection offered to the removal of the weir at the Glasgow New Bridge, has been made by the Glasgow Water Company. They state that it would lower the level of their present supply. Now, looking at the Glasgow Water-works, and the numerous public interests connected with them, both industrial and manufacturing, looking at the immense steam-power employed in the Water-works, amounting to no less, when completed, than 682 horse power; and again, at the vast capital which has been invested in those works, it really, on public grounds, becomes a question of the greatest importance, in deepening the river Clyde, and improving and enlarging the port of the city of Glasgow, to preserve these Water-works from sustaining any injury, either in lowering the existing level of the water in the Clyde, or deteriorating the quality of the water which affords the supply. On this most important subject, we fortunately have on record the evidence of the late Mr. Thomas Telford, and we have also the very clear and very able evidence of Mr. James Jardine, engineer to the Edinburgh Water-works; both of these gentlemen mention distinctly, that if the bottom of the ford at Dalmarnock Bridge be secured, so that its present level remain undisturbed, the weir may then be taken away at the Glasgow Bridge, and the Clyde deepened between Dalmarnock Ford and that bridge for about six feet, without, in their opinion, doing any injury to the Glasgow Water-works. But be it understood, that the work which they recommended, was not to rise above the level of the present bed of the Clyde at Dalmarnock Ford; for Mr. Telford says in his evidence, that when the bed of the river would be secured, "a stranger would be unconscious of any such operation having been performed there," because no weir would be seen traversing the Clyde. Numerous interests would, I fear, offer many serious objections to the erection of a weir rising even a few inches above the bed of the Clyde at Dalmarnock Ford.

Attentively reflecting on the evidence of Mr. Telford and Mr. Jardine, regarding the Glasgow Water-works, and considering that the Ford of Dalmarnock is at present nearly eighteen inches above the level of the Clyde, where the present supply is taken for the Cranstonhill Water-works, I think it possible to obtain a supply of water from the level of the river at Dalmarnock, without raising its level by the construction of any weirs rising above the present bed of the Clyde at that point, by simply securing the existing level of the river waters at the Ford. For I frankly avow, that I am decidedly opposed to the erection of any weirs across the bed of the Clyde. It would perhaps even be much better to carry a sufficient quantity of water from a still higher level of the Clyde, to supply the Water-works, than in any manner to interfere with the river channel, by the erection of engineering works which would obstruct the free passage of the land and tide waters, and prevent the navigation from being improved hereafter in the higher reaches; and also to enlarge and extend those natural tidal flows or scouring powers, which would act so beneficially, not only in cleansing all deposition caused by the city sewers, but would also be of great benefit to the Harbour in keeping it clear, as well as the whole channel bed of the river downwards. I am unable to find language to express all my thoughts on the great value which I attach to this upper scouring power, and on the necessity which exists that no part of the bed of the river shall ever be encumbered either with weirs, dykes, or locks, where it may be possible for the tidal rise to reach, or to which it at present extends.

Looking at the triumphant success with which the open tidal estuaries of rivers have been navigated since the application of steam power to maritime purposes, looking at the improvements which are being made in so many rivers, not only in Great Britain and Ireland, but also on the New and the Old Continents, to facilitate and extend the progress of this power into the most remote corners where the tide flows, and the extension of this power, which so peculiarly characterises and adorns the Clyde—the cradle of steam navigation—its further extension into the highest tidal reaches of the Clyde, at once claims and demands the deepest attention of those intrusted with the direction and improvement of the river and the port of this great city. Reflecting on the events of the last twenty-five years, in the improvement of the lower Clyde, who can tell to what an extent the improvement of the upper reaches of the river may not be carried?

In offering these few and limited observations on a small part of the upper Clyde, I regret exceedingly that it has not been in my power at present to bring under review the improvement of the lower water-basin of the Clyde, from the Jamaica-street Bridge to Port-Glasgow; the nature of the wide expanse of the tidal estuary, as well as the narrow parts; the cause of the formation of the sandbanks and shoals opposite Port-Glasgow and Greenock; the basin of the Leven, the Cart, and the Kelvin, and their infinence on the ship channel. And as regards the upper Clyde, I more particularly regret not being able to give the soundings, levels, nature of the bottom of the river, and the form of its bed, according to the various strata; the limit of the high floods, and those of low water, during summer and winter; the mode of securing the sides of the river when deepened; the area of the dry basin of the Clyde; the quantity of water falling within it in a year; the average daily quantity passing through it at the city of Glasgow; the quantity of alluvium held in suspension by its waters; the limit to which the sea-water reaches, and ceases to be sensible to the taste; the mean hydraulic depth at numerous places. These are subjects highly instructive to the engineer in devising plans for the improvement of estuaries, rivers, and harbours situated within them. I hope I shall be able, at no distant period, to submit to the trustees a detailed report upon the dry and water basins of the Clyde. Those basins will be found the most interesting in Scotland, whether as regards their physical structure, the immense and almost inexhaustible mineral wealth which they contain, or their capability of improvement in the tidal navigation, combined with the probable connecting ramifications of railways. All those matters are intimately connected and blended with the rising commercial prosperity of the city of Glasgow, its port, and its river.

I am obliged to bring under your consideration, the great and pressing necessity which exists of affording immediate accommodation to a large class of steamers, built or now building, and which may require to be furnished with engines. My feeling on this subject is so great, that I cannot refrain from hoping, that this branch of mechanical industry will receive at the hands of the river trustees, all that protection to which it is so justly entitled, forming, as it does, a branch of national industry, not only highly creditable to Scotland and to the genius of her people, but which employs thousands of her mechanics—diffusing wealth among numerous classes, and calling into full activity that peculiar mechanical and inventive power, which has extended the fame of this land and its inhabitants through the most remote and distant regions of the earth.

This accommodation for steamers of the largest class ought, as soon as possible, to be afforded, although it should only consist of a simple excavation on the side of the earthen bank of the Clyde, bordered with a small cheap wharf, constructed of home-grown timber; and this might be done below the present quay walls, without interfering with the present shipping accommodation, situated at the lower reaches at the entrance to the Harbour.

WILLIAM BALD.

Glasgow, 30th July, 1839.

ON RAILWAY CONSTANTS.

By Dr. Lardner, L.L.D.

Abstract of a Paper "On Railway Constants, and Resistance of Air to Railway Trains," read at the last Sessions of the British Association held at Birmingham, for which we are indebted to the able reports of the "Athenæum."

At the Liverpool meeting of the Association, in the autumn of 1837, an inquiry was undertaken by Dr. Lardner, in connexion with some other members of the Association, with a view to determine the mean numerical value of what were called *Railway Constants* by analogy to similar numerical quantities in other branches of science and art. *Constants* is a technical name given to certain quantities, more especially in astronomical and physical science, which enter largely into general calculations. As an example of these, may be mentioned, the height through which a body falls in a second of time; the length of a seconds pendulum; the ratio of the circumference of a circle to its diameter, and so on. A project of a magnificent kind was formerly suggested by Mr. Babbage, for the determination of the mean numerical values of the "Constants of Nature and Art." Among these quantities which enter railway calculations, that which is of the greatest practical importance is, the number by which is expressed the proportion which the tractive power, necessary to move loads on a railway, bears to the weight of the loads it moves. The great importance of this will be readily perceived, if it be considered that such is in fact in a great degree the ratio of the cost to the work done. Accordingly, the first point to which this inquiry was directed was, the solution of that problem.

The resistance opposed by a railway train, to the power which draws it, arises from several causes; 1st, the friction or attrition of the axles of the wheels in their bearings; 2nd, the rolling friction of the tires of the wheels upon the rails; 3rd, the resistance of the air to the train moving through it. These are all the causes which produce resistance in the train moved. But independently of these, there are resistances peculiar to the engine, arising from the friction, or attrition of the various parts of the machinery which are in motion, and which suffer a pressure or strain, depending on the resistance of the load drawn; also the re-action of the steam, escaping from the blast pipe on the other side of the piston, and other similar causes. But to simplify the inquiry in the first instance, the resistance of the engine was put aside, and the investigation was directed exclusively to the resistance of the train. Various methods presented themselves for testing this. The most direct method was the application of an instrument called a dynamometer in front of the train, by which the train could be drawn, and which would afford a direct measure of the force with which it was so drawn. This method, however, was subject to several objections. It was found that the surface of rails, commonly regarded as level, were really subject to variations of inclination through small distances, which produced upon the dynamometer sudden jerks, which caused its index to play between such extreme limits as to render it impossible to arrive at any useful mean of its indications. Besides this, if such an instrument were used to estimate the resistance of a train, moving with any considerable speed, it must necessarily be placed between the engine and the train, and would therefore show only a modified effect of the atmospheric resistance; inasmuch as the engine would have already encountered and removed a portion of that resistance before the instrument could be affected by it. Numerous experiments were nevertheless made with such instruments, and it was not abandoned until its failure was rendered practically manifest. Another method occurred to Dr. Lardner for determining that portion of the resistance which is due to friction, by attaching to an engine such a load as the engine is capable of moving, at a slow uniform velocity, up a given inclined plane, and then taking the same load to a more steep inclined plane, and detaching from it as many waggons as would enable it to move up the steeper inclined plane at the same slow speed as that at which it moved up the less steep inclined plane. Under these circumstances it might be safely assumed, that the absolute resistance to the engine would be in both cases the same, and the difference of the gravity of the two inclined planes would, in such a case, by the aid of mathematical principles, and by formulæ, which Dr. Lardner constructed, give the resistance due to the waggons detached in passing from the less to the more steep inclined plane. This method would be attended with the advantage of giving a result, in a great degree, free from the atmospheric resistance, and therefore would furnish a near approximation to the value of the friction, properly so called. As the motion would be slow, and a part of the train would be in front of the waggons detached, the atmospheric resistance would necessarily have but a very slight effect. As no opportunity, however, presented itself of executing experiments upon this principle, he did not occupy the time of the Section in enlarging upon it.

After much consideration, he arrived at the conclusion, that the method of investigation which was calculated to give the most satisfactory results as to the resistance of railway trains was, by observing their motion down steep inclined planes. This method had been already practised, and its principles will be easily rendered intelligible. If a body be placed on a steep inclined plane and allowed to descend it by the force of its gravity, its motion down the inclined plane would be accelerated. If the causes of resistance affecting the body were uniform in their effect, and independent of the velocity, then the motion of the body down the inclined plane would be uniformly accelerated, just as a body falling freely and perpendicularly by gravity would, apart from the atmospheric resistance. By being uniformly accelerated, is meant this, that the increase of velocity which takes place every second of time is the same. Thus, whatever velocity is acquired by the body at the end of the 1st second, having descended from a state of rest, twice that velocity will be acquired at the end of the 2nd second, and thrice that velocity at the end of the 3rd second, and so on. It is evident, therefore, that a body, subject to such acceleration, would go on increasing its speed without any limitation. As the intensity of the force of gravity is exactly known, and as the effect produced in diminishing that intensity by a plane of given inclination is a matter of easy and exact calculation, nothing can be more certain than the computation of the motion which a body would have down an inclined plane if that body were subject to no resistance. Now, if it be subject to resistance, the comparison of its actual and observed motion, with the motion which it would have, being subject to no resistance, computed, as just explained, ought to supply means of determining the amount of the resistance; but to do so it is necessary to know, to a certain extent, the law of the resistance which is in operation.

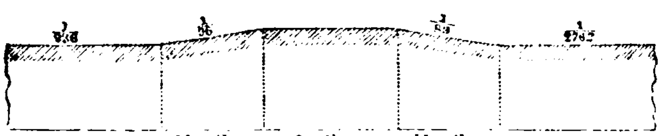
The resistance arising from attrition or friction, whether it be of surfaces rubbing one on another in the manner of a sledge, or rolling one on another as the tire of a wheel rolls upon a rail, or subject to the kind of attrition which takes place between the axle of a wheel and its bearings, have been all submitted to most elaborate and careful experimental inquiry; and the laws of tho resistances, arising from these, have been fully and clearly developed. The question of friction was formerly investigated by Coulomb, Ximenes, Vince, and others; but recently a more extensive and valuable series of experiments on the subject, than was ever before executed, has been made, under the order of the French government, by M. Morin, and their details made public. The results of these fully corroborate the laws which had already resulted from the inquiries of the philosophers who before examined the subject, which laws are as follows:—1st, the resistance arising from friction, whether of rubbing or rolling, or that between the axle of a wheel and its bearings, are, when other things are the same, independent of the velocity; 2nd, other things being the same, these resistances are directly proportional to the amount of pressure on the rubbing surfaces, and independent of the magnitude of these surfaces. To these laws, taken within practical limits, there can scarcely be said to be an exception. The extreme cases which become exceptional, having no application whatever to the present inquiry, it will not be necessary to regard them.

The immediate consequence, from the friction being the same at all velocities, is, that it is a uniformly retarding force, that is to say, that it destroys in the moving body on which it acts equal velocities in equal times. This, if it destroy a certain amount of speed at the end of one second, it will destroy twice that at the end of two seconds, three times at the end of three seconds, and so on. Now if a railway train, moving down a steep inclined plane, were subject to no other resistances than those arising from friction, it is evident that it would move down the plane with a uniformly accelerated motion, although that motion would be less accelerated than if it were subject to no resistance. In other words, the *kind* of motion affecting it would be the same as if there was no resistance, the *degree* of motion alone being altered. It has been stated that, subject to no resistance, certain speeds wonld be gained by the train in one, two, three seconds. These speeds would be those due to the gravity of the plane. These speeds would, however, now be diminished by the amount of velocity destroyed by the friction; and as this latter would be increased in the same proportion as the speed imparted by gravity, the descending body would be accelerated by a uniform force, equal to the difference between the acceleration of gravity and the retardation of friction. In a word, both of these being uniform and independent of the velocity, their difference, that is, the effective accelerating force, down the plane will be uniform and independent of the velocity.

Such was the reasoning on which was based all former investigations of the resistance of railway trains, by observing their motions down inclined planes. The acceleration due to gravity was calculated; the actual acceleration moving down the plane was observed, and the difference was supposed to give the retarding force due to the resistance. It is evident that by such a mode of proceeding, the effect of the atmosphere, or of any other cause which produced a retardation increasing with the speed, was either neglected, or was considered to be of such trifling amount, compared with the resistance due to friction, that it might be regarded as involved in the estimate of resistance thus obtained with sufficient accuracy for practical purposes. Such, indeed, was the impression on Dr. Lardner's own mind when he commenced this investigation, and he accordingly proceeded on the same principles as those adopted by other inquirers, except that in the formulæ he included the effect of the gyration of the wheels, which was neglected in the calculations of M. de Pambour, and which omission entailed an error upon his results.

With a view to determine the actual acceleration of a train down an inclined plane, the Whiston and Sutton inclined plains on the Liverpool and Manchester Railway, and a series of inclines on the Grand Junction Railway, extending from Madeley for several miles towards Crewe, were selected. This figure represents the inclined planes on the Liverpool and Manchester Rail-

Level.



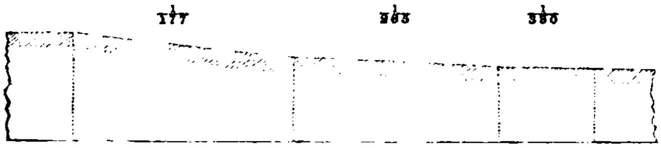
1½ miles. 2 miles. 1½ miles.

way. The summit level which lies between them is about two miles in length; the Whiston inclined plane descends towards Liverpool, falling at the rate of 1 in 96 for about a mile and a half, and is succeeded by an inclination which rises at the rate of 1 in 936 for a considerable distance.

The Sutton inclined plane falls, towards Manchester at the rate of 1 in 89 for about a mile and a half, and is succeeded by a portion of the line nearly level, for a considerable distance towards Manchester.

The first plane on the Grand Junction line descended from the Madeley summit towards Crewe, falling at the rate of 1 in 177 for a distance of three miles and a quarter; this is succeeded by another which falls at the rate of 1 in 265 for a distance of rather more than three miles, which is succeeded by another falling 1 in 330 for a distance of nearly a mile and a half. This last is succeeded by a level, which continues for several miles. These planes are represented in the following diagram.

Level.



3m. 20chns. 90 links. 3m. 3chns. 72 links. 1m. 31c. 31l.

The Whiston and Sutton inclined planes on the Liverpool and Manchester line, are straight throughout nearly their whole length. The Madeley inclines, represented in the diagram, are, in some places, curved with a radius of a mile, turning alternately to the right and to the left; but considerable portions of them are straight. A stake, marked 0, was placed at the summit of each inclined plane, and the length of the plane descending was divided out by stakes marked successively, 1, 2, 3, &c., into spaces of one hundred yards. Watches, by which a second could be without difficulty bisected, were provided, and the moment of passing the successive stakes was observed to within, at the most, half a second of the truth. Every care was taken to confer the last degree of accuracy upon these observations; one person was employed to call out the moment of passing each stake; another, supplied with a watch, declared the time, and the third took it down; and in many cases these were checked by having two sets of observers.

A few experiments conducted in this manner soon made it manifest that the motion down an inclined plane was not, as has been hitherto supposed, uniformly accelerated. It was found, for example, that the increase of speed in each successive interval of time was not the same, but was continually less as the motion increased. In other words, the degree of acceleration *was gradually diminished.* Now this was an effect evidently indicating an increase of the resistance with the increase of speed, and naturally suggested the idea that the atmosphere must have had a more considerable effect than had been supposed. The mathematical formulæ, commonly used for the determination of resistance, are founded, as has been already stated, on the supposition that the resistance is independent of the speed. These formulæ were now applied to the motion of the train down the inclined planes for short distances, measured from the points at which the trains were respectively started, so that within the range of their application the train might acquire but very little speed, and therefore that the result might be only slightly affected by the atmosphere. The results of such calculations, applied to the motion of the train for 100, 200, or 300 yards, were found to give a resistance, amounting to from the 400th to the 450th of the load. This was not half the amount of the common estimate of the resistance to railway trains, which was about the 250th part of the load, that resistance having been assumed to be the same at all speeds. It occurred to Dr. Lardner now to attempt an approximation at the resistance by another process, as follows:—trains were brought to a level and straight line of railway, and, being driven by an engine until they attained a speed of 30 to 35 miles an hour, they were dismissed, and allowed to run until, being gradually retarded they were brought to rest. The line being staked out as before the moments of passing, the successive stakes were observed, and the rate at which the train was retarded by the resisting forces was observed, for each 100 yards over which it moved; a calculation was made of the amount of resistance by the usual formulæ, founded on the supposition that the resistance is independent of the speed; but these calculations being confined to the first 100, 200, or 300 yards, might be considered as giving a fair approximation, since the change of velocity throughout that distance was not very considerable. The result of such observations indicated a resistance amounting to from a ninetieth to a hundredth of the load. It will be observed that in these last cases the velocity of the train, at which the resistance was computed, was very considerable, while, in the former cases, taking the initial motion down an inclined plane, it was very small. The inference, of course, which followed, supposing such calculations to give correct results, was, that the actual resistance at high speeds was many times more than when the motion is slow. Since, however, these methods of calculation could be regarded as only approximative, and were, in fact, based on principles which were only true on the supposition that the resistance was independent of the velocity, which supposition was contradicted by the results of the calculations themselves, it was considered necessary to resort to some other and more correct method of determining the resistance.

If it be admitted that the atmosphere produces any considerable resistance, since that resistance must increase in a very high ratio with the speed, it would follow, that if an inclined plane of sufficient length could be obtained, the motion of a train would continue to be accelerated until it would obtain a velocity which would produce *a resistance from the air, such as combined with friction, would be equal to the gravitation down the plane.* When such a velocity should be attained, the moving force down the plane, being equal to the resisting force, no further acceleration would take place. As it was thought, however, that the inclined planes, which were accessible, might not be of sufficient length to produce this effect with such trains as it was possible at that time to obtain for experiments, it occurred to Dr. Lardner that the end would be equally attained by starting the train from the top of the inclined plane at a considerable speed; that thus, the acceleration it would receive while descending being added to its initial speed, might be expected to give that velocity, at some point of the descent which would be attended by a resistance equal to the gravitation of the train down the plane; at which point, therefore, acceleration might be expected to cease, and a uniform motion to be maintained to the bottom of the plane.

The first experiments tried with this view were completely successful, and the result obtained was in exact accordance with what had been anticipated. On the summit level of the Liverpool and Manchester Railway, marked in the diagram No. 1, a train of four carriages was placed, and was drawn by an engine to the top of the Whiston plane ($\frac{1}{96}$), from whence it was started at a considerable speed. Its motion was accelerated for a short distance, but soon became perfectly uniform; and it descended through the greater part of the plane at the uniform velocity of 31.2 miles an hour. This experiment was again repeated with the same coaches, increasing the load. As was expected from the gravitation of the increased load, a greater velocity was now obtained; but still a uniform velocity resulted, and the train descended the plane with the most perfectly uniform motion, at 33.72 miles an hour. These experiments were tried repeatedly on the same day with the same results. A moderate wind blew down the plane, so that the inference was, that this train, in a calm atmosphere, would have suffered a resistance greater than a ninety-sixth part of its weight, at the velocities above mentioned. This experiment, with a train of four coaches, was repeated on the Sutton plane, and on the inclines near Madeley, represented in the diagram; and in every case a uniform velocity was obtained,—this velocity diminishing with the steepness of the place.

When these first experiments became known, one of the objections brought against them was., that a train of four coaches was so light, that a moderate atmospheric resistance would retard it; and that as, in the practical working of railways, such trains were never used, the results obtained had no practical utility; and that with heavy trains, such as those actually used on railways, no such results would ensue. This objection, among others, was advanced in a Report published by Mr. Brunel, the engineer of the Great Western Railway. In order to meet this objection, trains of greater magnitude were subsequently tried, and the same results ensued—a uniform velocity being attained in every case in which the train could be started from the top of the plane with a sufficiently high speed. In the following Table I, is exhibited the mean results of a vast number of experiments tried with trains of four, six, and eight coaches. In the third column, the letter expresses generally the state of the wind—F fair, A adverse, C moderately calm, and CC a dead calm; the fourth column gives the gradient down which the motion took place; and in the last column is expressed, in miles per hour, the uniform velocities which the train attained, and which it preserved through a length of the plane sufficiently considerable to show that it would not have received any further increase.

Table I.

Number of Coaches.	Weight.	Wind.	Gradient.	Uniform velocity attained.
	Tons.		One in	miles per hour.
4	15.6	F	96	31.2
4	18.	F	96	33.72
4	18.	F	177	21.25
4	20.5	F	177	22.9
4	20.5	F	89	38.25
4	20.2	F	265	19.13
6	27.5	A	89	32.3
6	27.5	F	89	37.5
6	27.5	F	96	34.6
6	27.5	A	96	27.8
6	34.5	C	89	35.3
8	36.5	F	89	> 36.5
8	40.75	F	177	26.15
8	40.75	S	177	<17.7
8	40.75	CC	89	31.4

The last experiment with a train of eight coaches, weighing nearly forty tons, shows that, in a dead calm, the resistance of *that train at 31¼ miles an hour amounted to the eighty-ninth part of its weight; whereas the common estimate of the resistance of such a train at that speed has been hitherto about the 250th part of its weight!* This fact alone, were it unconnected with any others, would sufficiently illustrate the enormous extent of error which has prevailed hitherto in such estimations in railway practice. The third experiment with eight carriages was made with a side wind, the effect of which is abundantly manifested by the speed expressed in the last column. While the same train, moving with a fair wind down the Madeley plane, had a resistance equal to the 177th of its weight, at 26 miles an hour, its resistance with a side wind was of greater amount at 17.7 miles an hour. The relative effects of a fair and adverse wind, are likewise exhibited in the third and fourth experiments with six coaches, down the Whiston plane. The velocity, which gives a resistance equal to the 96th part of the load, was 34½ miles an hour with a fair wind, and only 27¾ with an adverse wind.

When the first experiments indicating these results became public, various objections were urged against them by Mr. Brunel; and although it was not considered by Dr. Lardner, or by any of the other persons engaged in this inquiry, that such objections were entitled to any serious attention, yet it was thought advisable to make experiments which would show whether or not they had any foundation in truth. One of these objections was the following: that the circumstances under which such experiments were performed, were not really, though they were apparently, similar to those of an ordinary train in motion; that the carriages were here sent with the square end foremost, to meet and receive the full resistance due to their surface, which is totally different from the case in which the engine precedes them. The engine in front, it was stated, would act as a sort of cut-air or bow, and thus destroy or diminish the resistance produced by the flat front of the carriages moving foremost. In order to ascertain the full value of this objection, Dr. Lardner took an engine, 'The Fury,' with her tender, and obtained two coaches, weighted so as to be nearly equal in weight to the engine and tender. The connecting rods and working-gear of the engine were detached from the driving wheels, so that the engine should be subject to no other friction save that which a coach is subject to. The Fury and its tender, and these two coaches, thus prepared, were placed successively at the summit of the Sutton plane, falling $\frac{1}{89}$ towards Manchester, and the Liverpool and Manchester Railway: and they were allowed to descend by gravity. The circumstances of their descent were found to be, in all respects, alike, passing corresponding stakes at very nearly the same time, and very nearly the same speed. The full particulars of this, and other experiments, will be published: but, in the meanwhile, the principal results of this experiment are exhibited in Table II:—

Table II.

	Weight.	Total distance run.	Time of running total distance.		Greatest speed.	Time of descending the Sutton plane 1-89.	
	Tons.	Yards.	m.	s.	m. per h.	m.	s.
Fury and Tender ..	11·39	4,710	11	37	29·	4	29
Two Coaches	11·33	4,577	11	40	28·12	4	24
Difference......	·06	133	0	3		0	5

It appears, therefore, that the difference in the whole distance run by the coaches, and by the engine and tender, amounted to only 133 yards, in a distance little short of three miles; and that there was only three seconds difference in the time. The maximum speed attained was nearly the same; and the time of descending the inclined plane only differed by five seconds. This difference, such as it was, was in favour of the coaches with their flat front. In fact, the differences of the numbers in the successive columns of the above table, are only such as would take place in the same experiment tried twice successively with the same coaches.

As a second test, the engine and tender was now placed in front of four coaches, so as to form a regular train, and it was allowed to descend the plane in the same manner. The engine and tender was then removed, and replaced by two coaches of equal weight, and the train of six coaches was then allowed to descend the plane in the same way. The result of the experiment is exhibited in Table III.

Table III.

	Weight.	Total distance.	Time of running total distance.		Greatest velocity.	Time of descending Sutton plane 1-89.	
	Tons.	Yards.	m.	s.	m. per h.	m.	s.
Fury, Tender and four coaches	27·45	5,068	12	9	30·5	4	33
Six coaches	27·45	4,850	10	48	31·	4	28
Difference......		218	1	21		0	5

It is needless to enlarge upon these results. The plain and inevitable inference is, and that inference would be further corroborated by what he had still to explain,—that the form of the front, whether flat or sharp, has no observable effect on the resistance; and that whether the engine and tender be in front, or two carriages of the same weight as the engine and tender, the motion of the train, and the resistance to its motion, will be exactly the same.

The form of a boat, or beak, having been given to some of the engines on the Great Western Railway, apparently with a view to diminish the effect of the atmospheric resistance, Dr. Lardner determined to ascertain how far such a form would produce any practical effect. He accordingly constructed a head or beak, to place before the first carriage of a train. Two boards were constructed equal in height to the body of the carriage, and being attached to each corner, were united in front at an angle, the vertex of the angle being five feet six inches before the flat front of the carriage, and the base of the angle being six feet six inches, corresponding with the width of the carriage. This apparatus would have the effect of a cut-air. It was first tried with a single coach, which, having it attached in front, was moved as before down the Sutton plane, and the circumstances of the motion having been observed and recorded, the beak was removed, and the coach again moved down with the flat end exposed to the air. The result was as follows:—

Table IV.

	Weight.	Total distance run.	Time of running total distance.		Greatest velocity.	Time of descending Sutton plane 1-89.	
	Tons.	Yards.	m.	s.	m. per h.	m.	s.
Coach with pointed front......	5·35	3,975	11	0	24·3	5	35
Coach with flat front	5·35	3,905	11	0	23·7	4	45
Difference......		70				0	50

It is evident that no effect whatever was produced by the beak, and, consequentiy, the flat end of the coach produced none of that resistance which Mr. Brunel ascribed to it. The same experiment was now repeated with a train of eight coaches, down the series of inclined planes at Madeley. The beak being placed upon the first coach, the train was started from the summit of the Madeley plane, falling $\frac{1}{177}$, and it was dismissed down the series of planes already described, the circumstances of its motion being carefully observed. It was then brought back to the top of the Madeley plane, and the beak removed, and was once more dismissed, the circumstances being again observed. The particulars of this experiment is exhibited in Table VI.

It appears, therefore, that the distance run without the sharp end differed only eighty yards in a distance of about eight miles; and the other differences exhibited in the table, are evidently such only as would take place with the same experiment twice repeated with the same carriages.

With a view to ascertain how far mere magnitude of froutage, independent of the general magnitude of the train, is productive of resistance, the front of a coach was enlarged by side boards, extending on either side about 20 inches, adding about 24 square feet to the front surface, forming a sort of wings in front of the carriage, but no corresponding width being given to any other part of the carriage. The coach, thus prepared, was placed at the summit of the Suttou plane, and allowed to descend from a state of rest. It was then brought once more to the summit, and the sides removed, and it was allowed to descend with its proper front. The result of these two experiments is exhibited in Table V.

Table V.

	Weight.	Total distance run.	Time of running that distance.		Greatest speed.	Time of moving down Sutton plane 1-89.	
	Tons.	Yards.	m.	s.	m. per h.	m.	s.
Coach with enlarged front ..	5·35	3,139	9	10	19·15	5	31
Coach with ordinary front	5·35	3,289	9	2	21·45	4	15
Difference		150	0	8	2 30	1	16

From which it was inferred, that mere width of frontage, apart from the general increase of magnitude, was not productive of any considerable practical effect in increasing the resistance.

A strong impression existed in the minds of some engineers and scientific men, to whom Dr. Lardner communicated the results of these experiments while they were in progress, that the shape of the hinder part of the train might have an effect upon the resistance. It was supposed that in very rapid motion a tendency to a vacuum would be produced behind the train, and that a corresponding atmospheric resistance, due to this partial vacuum, would be produced in front; that, consequently, if the square shape was removed from the hinder part, less resistance would be found. Although Dr. Lardner did not attach any weight to this objection, he was willing, nevertheless, to submit it to trial, and with that view he prepared a train of three carriages, which he first placed at the summit of the Sutton plane, falling $\frac{1}{89}$, and allowed them to descend by gravity in their ordinary state. He next allowed them to descend, having the pointed end behind; they next descended with the pointed end before,; and, lastly, they were once more allowed to descend without the pointed end. The result of these four experiments is given in Table VII.

In the third column is expressed the entire distance run, in yards; in the fourth column is the time of going that distance; in the fifth column is the speed acquired in descending the Sutton plane; in the sixth columu the time of descending that plane; in the seventh column the time of moving a distance of 2¼ miles from the time of starting; and, in the last column, the time of moving from the twelfth to the twenty-eighth stake, throughout which, the motion being tolerably rapid, the effect of the air might be expected to be greatest. It will be evident, from this table, that the pointed end, whether before or behind, was not attended with any appreciable effect, the discrepancies being only such as would occur iu the same experiment twice repeated.

It had been suggested that the resistance opposed by the air might be more or less produced by the spaces between the successive carriages of the train, the end of each successive carriage being more or less exposed to pressure against the air. In order to ascertain what weight this suggestion was entitled to, a train of eight carriages was prepared, having tenter hooks attached round the corners of their ends. Canvass was prepared, which. being hooked on these, might be stretched from carriage to carriage, so as entirely to enclose the space between the successive carriages, and to convert the whole train into one unbroken prism. The train being thus prepared with the canvass, was brought to the summit of the Madeley plane, and allowed to descend towards Crewe, the circumstances of the motion being observed as in the former experiments. It was then again removed to the summit, and, the canvass being taken off, the train was allowed to descend in its ordinary state, the spaces between the carriages being left open. The result of these two experiments is exhibited in table VIII; and it will be seen that the differences are nothing more than what would arise from casual causes affecting the same experiment twice repeated.

Being impressed with the idea that the amount of resistance might be more or less dependent on the general volume of air displaced by the train as it moves, rather than by the mere magnitude of frontage, an experiment was made which was attended with a result sufficiently remarkable. A train of five waggons was prepared, weighing exactly 30 tons, and loaded with iron rails: sides and ends were constructed, which, being put up, these waggons received the form of coaches, but which, being moveable, could be put up or laid flat upon the waggons at pleasure, This train of waggons was brought to the summit of the Madeley plane, and allowed to descend, by gravity, towards Crewe, the circumstances of its motion being observed, as before. It was then brought back to the summit of the same plane, and the sides were taken down and laid flat upon the waggons, and it was then moved down the plane. The particulars of these two experiments are exhibited in Table IX.

The effect of the form of the waggons upon the resistance is here sufficiently manifest, and the concurrent circumstances upon the several gradients plainly show the increased resistance produced by the increased magnitude of the train. From this and the former experiments, it may therefore be inferred that the mere form, whether of the front or hinder part, or the mere magnitude of frontage, produces no practical effects upon resistance; but that, by increasing not the frontage only, but the *whole volume* of the train, a material effect is produced.

It had been found, contrary to what was at first expected, that by increasing the number of carriages in the train, that portion of the resistance which must be ascribed to the atmosphere was increased. It appeared, at first view, that the chief, if not the only source of atmospheric resistance was to be found in the frontage or maximum transverse section. The experiments, however, are entirely incompatible with any such supposition. Had such been the case, the trains of six and eight carriages ought to have acquired a considerably greater velocity in descending the inclined planes, than the trains of four carriages, which was not the case. This is in some degree accounted for by the result of the last experiment indicating the connexion between the volume of air displaced and the resistance, and not between the mere frontage and the resistance. But, in addition to this, there is another circumstance, which was pointed out by Dr. Lardner long since. The wheels of the several carriages produce a vortex of air around them, and play in some measure the part of fanners or blowers. A considerable force must be absorbed by so great a number of these wheels moving at such a velocity. In a train of eight carriages we have thirty-two three-feet wheels, playing these parts of blowers, and revolving from four to five times in a second. How much force must be expended in maintaining such a motion, it is needless to say. But, besides this, another circumstance was observed. In these experiments, as well as in general railway practice, it is found that an extensive current of air moves beside a train, the current diminishing in velocity as the distance from the train increases. Immediately contiguous to the side of the coaches, the air moves with little less velocity than the coaches themselves. Outside that is another current, moving at a less rate, and beyond that another at a further diminished rate. There is, thus, a succession of currents, one outside another, extending to a considerable distance at each side of the train. All the resistance produced by the motion of this mass of air through the atmosphere, forms part of the resistance opposed to the moving power.

In all the experiments which were made on the series of planes between Madeley and Crewe, it was found that in moving over those parts of the line which were curved, the uniform velocity was precisely the same as on those parts which were straight. There was no discoverable difference in the rate of motion, from whence it follows that curves like these, having a radius of a mile, produce no observable effect upon the resistance. The experiments were so numerous, and performed under such a variety of circumstances, that, unexpected as these results were, there can be no doubt of their truth.

It has been stated confidently in print and at public meetings, by men reputed to possess information in practical science, that the atmospheric resistance has been long known, not perhaps with perfect accuracy, but that tables, giving a near approximation, have been published by different eminent men, and are to be found in most elementary works; that calculations founded on these tables, of the resistance of the atmosphere may be made, and that such calculations would give more correct results than such experiments as have now been described. As such statements are calculated to mislead, Dr. Lardner had no hesitation in declaring that they are utterly unfounded. No details exist, nor have any experiments ever been made by which the resistance of the air to a train of railway carriages could be obtained by any calculation whatever; nor was the amount of such resistance ever suspected, even by the persons who have ventured to utter such statements, as have been here proved to exist.

Having been satisfied of the large amount of the resistance of railway trains at the usual speed of passenger trains, the next inquiry was one of a still more difficult kind, namely, to obtain, by reducing the results of the experiments to mathematical analysis, an estimate of the quantity of this resistance which was due to friction and to the atmosphere respectively Part of the details of this investigation may be seen by reference to the volume of the Transactions of the British Association, lately published, and the remainder will appear in Dr. Lardner's second Report. In the

TABLE V.

	Weight.	Total distance run.	Time of running total distance.	Initial speed.	Uniform speed on 1-177.	Speed at foot of 1-265.	Speed at foot of 1-330.	Time of moving down 1-177.	Time of moving down 1-265.	Time of moving down 1-330.
	Tons.	Yards.	m. s.	m. per h.	m. per h.	m. per h.	m. per h.	m. s.	m. s.	m. s.
Eight coaches, with pointed end foremost	40·75	14,411	26 48	23·70	24·	19·25	14·87	8 41	8 50	4 50
Same train, with flat end ..	40·75	14,331	25 39	23·37	26·18	19·25	14·35	7 53	9 32	4 57
Difference		80	1 9	·33	2·18		·52	0 48	0 42	0 7

TABLE VII.

	Weight.	Total distance run.	Time of running total distance.	Greatest speed.	Time of moving down Sutton plane 1-89.	Time of moving 2¼ miles.	Time from stake 12 to stake 28.
	Tons.	Yards.	m. s.	m. per h.	m. s.	m. s.	m. s.
Four coaches, with flat front and end	14·8	5,209	13 50	32·14	4 28	7 54	2 9
Same, with pointed end	14·8	5,350	13 45	31·03	4 25	7 50	2 9
Same, with pointed front....	14·8	5,376	13 1	32·14	4 23	7 30	2 5
Same, with flat front and end	14·8	5,518	13 25	32·14	4 22	7 32	2 6

TABLE VIII.

	Weight.	Total distance run.	Time of running total distance.	Initial speed.	Uniform speed on 1-177.	Speed at foot of 1-265.	Speed at foot of 1-330.	Time of moving down 1-177.	Time of moving down 1-265.	Time of moving down 1-330.
	Tons.	Yards.	m. s.	m. per h.	m. per h.	m. per h.	m. per h.	m. s.	m. s.	m. s.
Eight coaches, with canvas..	40·75	14,367	25 39	26·39	25·57	18·	12·4	8 2	8 47	5 31
Same without canvas	40·75	14,731	25 39	23·37	26·18	19.25	14·35	7 53	8 32	4 57
Difference		364		3·2		1·25	2·31	0 9	0 15	0 34

TABLE IX.

	Weight.	Frontage.	Total distance run.	Time of running total distance.	Uniform velocity on 1-177.	Velocity at foot of 1-265.	Time of moving down 1-177.	Time of moving down 1-265.
	Tons.	Square feet.	Yards.	m. s.			m. s.	m. s.
Five wagons, with high sides	30	24·	14,058	34 55	22·75	19·50	18 51	6 55
Same, without high sides ..	30	47·8	10,019	32 4	17·	8·50	15 44	9 47
Difference		23·8	4,039	2 51	5·75	11.	3 7	2 52

meanwhile we may state the results, from which it would appear, that as considerable an error has been committed in overrating the amount of resistance dne to friction, as in underrating the whole resistance. The formulæ, established by Dr. Lardner, have been applied to a limited number of experiments performed under different circumstances, and the results agree in giving the friction a value amounting to from five to six pounds a ton of the gross weight. How widely this differs from the common estimate may be perceived when it is stated, that that estimate is from nine to eleven pounds per ton. Mr. Woods. the engineer of the Liverpool and Manchester railway, has applied a method of calculation to one of M. de Pambour's experiments, by which the resistance from friction is obtained very nearly free from the effect of atmospheric resistance, but it is not the method used by Dr. Lardner. The result obtained by Mr. Woods is the same as that obtained by Dr. Lardner.

Dr. Lardner read at the meeting a communication from M. de Pambour, stating, that that gentleman had been engaged in similar inquiries, as to the amount of the friction and the atmospheric resistance, with a view to correct, in the forthcoming edition of his work on Locomotive Engines, any errors which might have existed in the former edition, and the results which M. de Pambour stated, that he obtained for the friction, were the same as those obtained by Dr. Lardner and Mr. Woods.

Dr. Lardner proceeded to say, that the results of this extensive course of experiments corroborated and fully established a doctrine which he had ventured to advance before a committee of the House of Lords in the year 1835, but which was then and subsequently pronounced to be paradoxical, absurd, and one which could have no practical truth. That doctrine was, that a railway laid down with gradients, from sixteen to twenty feet a mile, would be for all practical purposes nearly, if not altogether, as good as a railway laid down, from terminus to terminus, upon a dead level. The grounds on which he advanced this doctrine were, that a compensating effect would be produced in descending and ascending the gradients, and that a variation of speed in the train would be the whole amount of inconvenience which would ensue; that the time of performing the journey, and the expenditure of power required for it, the expense of maintaining the line of way, and supplying locomotive power, would be the same in both cases; that, therefore, he thought that no considerable capital ought to be expended in obtaining gradients lower than those just mentioned. He stated that he was assailed with the most unsparing ridicule when he advanced this doctrine, and that up to the present hour, so far as he knew, it had never been adopted or assented to by any practical man in the country. He saw, however. its complete verification and establishment in the results of these experiments, and determined on making an *experimentum crucis*, which should put its truth beyond all question. The variety of gradients on the railway extending between Liverpool and Birmingham, offered a favourable theatre for such an experiment, and accordingly a train of twelve coaches was prepared, each coach being loaded to the gross weight of five tons. An engine, called the *Hecla*, was provided, weighing twelve tons, with her tender weighing ten tons, making a gross load of eighty-two tons. It was determined to run this train from Liverpool to Birmingham and back, observing with the utmost precision, the moment of passing each quarter-mile post, and obtaining thereby the actual speed with which every gradient, from one end to the other of the line, was ascended and descended, and the velocity on the levels. By taking a mean of the speed in ascending and descending the gradients, it would be necessary, if the doctrine held by him had any truth in it, that this mean should be exactly, or very nearly, equal to the speed on a level. The journey was accordingly performed, and the results of it will be published in detail in Dr. Lardner's second report. But, in the meanwhile, the speed, in ascending and descending the several gradients and the mean between them, is exhibited in Table X.

Table X.

Gradient.	Speed. Ascending.	Speed. Descending.	Mean.
One in	miles per h.	miles per h.	
177	22·25	41·32	31·78
265	24·87	39·13	32·00
330	25·26	37·07	31·16
400	26·87	36·75	31·81
532	27·35	34·30	30·82
590	27·27	33·16	30·21
650	29·03	32·58	30·80
Level			30·93

He said, that on this table it is scarcely needful to make a single observation. It is quite evident, that the gradients do possess the compensating power which he ascribed to them. The discrepancy existing among the mean values of the speed, is nothing more than what may be ascribed to casual variations in the moving power. This experiment also was made under very favourable circumstances, the day heing quite calm. Without going into the details of the principle on which these remarkable results depend, it may be stated generally, that since the chief part of the resistance of a railway train depends on the atmosphere, and is proportional to the square of the velocity, a very small diminution in the velocity itself produces a considerable diminution in its square. A train, in ascending a gradient, may therefore relieve itself from as much atmospheric resistance as is equal to the gravitation of the plane by slackening of its speed. If its speed be slackened so as to render the resistance equal to that which it would have upon a level, then the engine would have to work with a less evaporating power than on a level, inasmuch as the motion would be slower. In practice, therefore, it can never be needful to slacken the speed so much as to equalize the resistance with that upon the level. Supposing the evaporating power to remain the same, the speed need only be slackened, so that with the same evaporation an increased resistance can be overcome at a speed less than the level, but not so much less as would render the resistance equal to the level. This, in fact, is what takes place in practice, as is apparent from the results above given.

Dr. Lardner concluded by stating in detail a number of conclusions which he considered to be warranted by the experiments; but he reserved to himself the power, when the experiments should be all reduced, of modifying these conclusions, if it should appear necessary to do so. He stated, that many of the experiments had been only recently made, and had consequently not been submitted to mathematical analysis. Meanwhile he had taken care to lay nothing before the Section, except what had been fully borne out by the experiments themselves. He regarded the following conclusion as established by his experiments.

1. That the resistance to a railway train, other things being the same, depends on the speed.

2. That at the same speed, the resistance will be in the ratio of the load, if the carriages remain unaltered.

3. That if the number of carriages be increased, the resistance is increased, but not in so great a ratio as the load.

4. That, therefore, the resistance does not, as has been hitherto supposed, bear an invariable ratio to the load, and *ought not to be expressed at so much per ton.*

5. That the amount of the resistance of ordinary loads carried on railways at the ordinary speeds, more especially of passenger trains, is very much greater than engineers have hitherto supposed.

6. That a considerable, but not exactly ascertained proportion of this resistance is due to the air.

7. That the shape of the front or hind part of the train has no observable effect on the resistance.

8. That the spaces between the carriages of the train have no observable effect on the resistance.

9. That the train, with the same width of front, suffers increased resistance with the increased bulk or volume of the coaches.

10. That mathematical formulæ, deduced from the supposition that the resistance of railway trains consists of two parts, one proportioned to the load, but independent of the speed, and the other proportional to the square of the speed, have been applied to a limited number of experiments, and have given results in very near accordance, but that the experiment must be further multiplied and varied before safe, exact, and general conclusions can be drawn.

11. That the amount of resistance being so much greater than has been hitherto supposed, and the resistance produced by curves of a mile radius being inappreciable, railways laid down with gradients of from sixteen to twenty feet a mile have practically but little disadvantage compared with a dead level; and that curves may be safely made with radii less than a mile; but that further experiments must be made to determine a safe minor limit for the radii of such curves, this principle being understood to be limited in its application to railways intended chiefly for rapid traffic.

In the course of his address, Dr. Lardner took occasion to acknowledge the very valuable assistance which he had received from Mr. Edward Woods, the engineer of the Liverpool and Manchester Railway, who assisted Dr. Lardner in almost all the experiments, and conducted some of them himself in Dr. Lardner's absence. To the skill and intelligence of that gentleman, as well as to his general mathematical acquirements, he felt himself much indebted. Mr. H. Earle was also associated in these experiments, and took part in the direction of many of them.

FINE ARTS IN ITALY.

We give insertion to the following well authenticated anecdotes to show that many of our wealthy countrymen are most egregiously imposed upon in their quest of old pictures and ancient statues; this mania has become so general that many artists of talent are compelled to fabricate old pictures reputed to have been painted by the ancient masters; statues, busts, and fragments of sculpture are chiselled out of Greek or Parian marble, and to favour the deception they are defaced and stained by iron rust and tobacco-juice, to give the fragments the appearance of having been decomposed and stained by the hand of time. Coins and engraved gems are also commonly made and sold as antique. It is but justice to declare that we have seen works in sculpture in imitation of ancient art so well executed, and their style and character in such strict unison with the purity of Greek art, that they have baffled the most experienced eye to discover the fraud. The celebrated Giromætti of Rome, by command of the late Pius 8th, made a copy of a gem engraved by Discorides, both the original and copy of which were deposited in the museum. One however was stolen and sold by the purloiner to a nobleman for a large sum of money, but most fortunately the stolen cameo proved on examination not to be the original. A Mr. —— an Englishman of some considerable attainments and taste for the fine arts, was commissioned by the English Government to visit Rome for the purpose of purchasing works of art for the British Museum; on his arrival in this city, he found his way to the sanctum sanctorum of Vescovalle, in Piazza di Spagna, a dealer in antiquities, when that man of art expatiated with all the subtile eloquence of an Italian, on the merits of his wares. Our countryman felt flattered at the compliments so unsparingly paid to his taste and discernment in having selected some of the most soul-breathing creations of the chisel. Mr. —— elated with his good fortune, called on our distinguished fellow-countrymen Gibson, the eminent sculptor, to invite him to a high intellectual treat, and on the road to the shop Mr. M. spoke of Phidias and Praxitiles, and dwelt with the eloquence of a Philostratus on the beauties of the works which he had selected, giving quotations from Pliny, Winkleman, and Visconti, in proof of their authenticity. Our artist felt humbled in his own estimation after such Demosthenian eloquence, and filled with veneration as a lover of Greek art, they entered the studio where our man of letters pointed with conscious pride to the objects he had selected; our sculptor was thunderstruck, not at the beauties of the works, but at the statues, as they were indeed nondescripts, monstrosities, composed of odd fragments, the works of sculptors of the time of Constantine, consequently of the worst era of Roman art.

WILLIAM WILKINS, A.M., F.R.S., &c.

It is our painful duty to announce the demise of Mr. Wilkins, Professor of Architecture to the Royal Academy, who died at his residence at Cambridge, on Saturday, August 31 last, in the 61st year of his age: his remains were interred in the chapel of the College of Corpus Christi.

Mr. Wilkins entered the Cambridge University as a scholar of Caius and Gonville College, in 1796, and graduated in 1800, as sixth wrangler of his year. In 1801 he succeeded to the University Travelling Bachelorship, and passed four years in Greece and Italy in the prosecution of his studies, amongst the remains of ancient art, preparatory to commencing his profession of architect, and during which time he was elected a Fellow of his College.

Among Mr. Wilkins' earlier works are Donnington Castle and Osberton, (of both of which, elevations, &c., may be found in "The New Vitruvius Britannicus,) but neither have much architectural merit. At Cambridge he was employed on many buildings that afforded, more or less, opportunities for the display of talent, yet that which ought most to have distinguished him, it being entirely his own, namely Downing College, is by no means so creditable to his taste as the new screen at King's College. Besides these works he made some additions at Corpus Christi and Trinity Colleges, and executed, we believe, some repairs at St. Mary's Church, in that university. Another large public building erected by him is the East India College at Haileybury, which, however, does not say much for his invention, being not only in precisely the same style, but little more than a repetition or variation of his design for Downing, as was strikingly manifested by the two drawings at the Exhibition in 1838. (See our first volume, p. 224.) In the Nelson column at Great Yarmouth he showed infinitely more originality, and he also designed another memorial to the same hero, namely that in Sackville Street, Dublin. In London he built the University Club House, the London University, St. George's Hospital, and the National Gallery, all of which are delineated and described in the new edition of the "Public Buildings," by Mr. Leeds. Though unfinished, and now perhaps never likely to be completed according to the original design, the University is one of the happiest of his works, far more so than the National Gallery, which seems hardly to be the production of the same architect, the dome of the latter being as unsightly a feature in composition, as in the other it is graceful. Perhaps Mr. Wilkins would have earned much higher fame for himself, had not his study of, and unquestioning reverence for antiquity, and the classical works of the Greeks, in some degree fettered his ideas and lowered his ambition, preventing him from aspiring to higher merit than that of merely applying correct imitations of Grecian orders and porticoes to his own buildings, sometimes without even attempting any thing further, as in the house at Osberton and Downing College. His literary productions, too, were quite as much archæological as architectural: they consist of the following publications:—Antiquities of Magna Græcia, imp. fol. Cambridge, 1807; Remarks on the Topography and Buildings of Athens, roy. 8vo. 1816; The Civil Architecture of Vitruvius, 2 vols., imp. 4to. 1817; Prolusiones Architectonicæ, 4to. 1837.

In his private character, Mr. Wilkins was a most amiable and honourable man, warm in temper, but kind-hearted, affable, generous and liberal, without the slightest tinge of that ostentation which sometimes renders pecuniary liberality little better than pride and self-worship. Unlike his predecessor in office at the Academy, he was not given to make any parade of public donations, but his liberality was prompted by sincere benevolence, and placed beyond the suspicion of any unworthy motive. We have heard anecdotes of his kindness and generosity that reflect the highest honour upon his memory, and prove him to have been, what is infinitely superior to his highest title as a scholar or an artist, a truly noble-minded and worthy man.

Marine Railway Slip.—The *Courrier de Bordeaux* contains a description of the marine railway, an apparatus introduced into France from the United States, and by means of which vessels of any size can be hauled ashore in an upright position for the purposes of careening, &c. It will be remembered that by means of this railway a vessel was hauled up and lowered again the other day in presence of the Duke and Duchess of Orleans. It consists of a railway, which may be prolonged indefinitely under the water to suit the rise or fall of the tide, and also on shore, according to the size of the ship-yard. Upon this an immense kind of wooden carriage, proportioned to the size of the vessel, is made to traverse by means of strong capstans. This carriage is of such a nature that it can be got under the keel of the ship, or rather the ship may be made to float on to it, and, by means of a system of wedges and ropes, can thus be so adapted to the hull as to fit and embrace it tightly all around. The ship is kept in the perpendicular, either with or without her cargo and crew on board, and the capstans being set to work, the carriage and its burden are hauled up the railway at the rate of from two to three feet per minute. The advantages of this system over that of dry docks, or of laying a vessel on its side, are stated to be very great; and a great saving of time and money is also effected. It was brought into France by M. Plantevigne, of Bordeaux, who has taken out a patent for it.

⁂ Is not this marine railway, the same as Morton's patent slip, which has travelled from England to America, and thence to France?—[Editor C. E. & A. Journal.]

AN ARITHMETICAL BALANCE, OR NEW CALCULATING MACHINE.

By M. Leon Lalanne, *engineer, "des Ponts et Chaussées." Communicated to the "Académie des Science." at the sitting on the 2nd ultimo.*

In making an estimate for the construction of an ordinary road, a canal, or a railway, it is not sufficient to calculate the quantity of ground work to be removed: but it is important also to ascertain the mean distance to which the cuttings have to be removed. For this purpose it is requisite to employ a person will versed in calculation, and particular care is required to avoid errors.

The ordinary mode of proceeding is to divide the section into lengths, and then to ascertain the cubical quantity of earth in each division, and multiply it by the distance to which it has to be removed; the sum of all the products so found, divided by the total quantity of earth to be removed, gives for quotient the mean distance, or *lead*. This operation, the author observes, is always excessively tedious. For example, a road four kilomètres (4374 yards) in length, would be divided into about 100 spaces, of about 40 mètres each, and each division would require two multiplications of numbers of between 3 and 5 figures by numbers of 2 or 3 figures.

Now if we compare the algebraic formula which represents the method by which the average distance is determined with the relation which exists between a system of parallel forces acting in the same direction at different points of a lever, when they are in equilibrio, we shall observe a striking analogy; for, calling p, p′, p″—the distances from the fulcrum at which the forces P, P′, P″, are applied on one of the arms of the lever, and δ the distance from the fulcrum to the point where the force P+P′+P″+, equal to the sum of the former forces, acting on the other arm, should be concentrated, we shall have

$$\delta = \frac{Pp + P'p' + P''p'' + ..}{P + P' + P'' + ..}$$

Now this distance is precisely that which serves to determine the mean distance of transport δ of the volumes P, P′, P″..removed respectively to the distances p, p′, p″...

So that, to determine the mean distance of transport, *without calculation*, it suffices to suspend on one of the arms of a lever, which balances one its point of suspension, weights proportional to the volumes to be transported, at distances from the point of suspension proportional to the respective distances of transport; and to seek at what distance on the other arm of the lever a weight equal to the sum of the former should be suspended, that the whole system may be in equilibrio.

The machine presented to the Academy by the author is founded on this principle; it was constructed from his own designs, at the expense of the "administration des Ponts et Chaussées," by the celebrated optician, M. Ernst. It is in the form of an ordinary balance without scales, of which the beam has a breadth of several centimètres. The two arms of the beam are divided into equal parts on each side of the axis of suspension, and one of them is divided into equal intervals by small transverse ridges, between which are placed the weights, which are in the form of flat plates. This simple arrangement overcomes the difficulty which it seemed would be met with in practice, in consequence of having to fix a great number of different weights at variable distances and sometimes very near to each other. The total weight suspended on the other arm is contained in a small moveable scale. This instrument has 150 divisions on each side of the axis, in a length of about 30 centimètres (12 inches); each division corresponds to a distance of four mètres (4·4 yards), so that the instrument is capable of indicating distances of transport as far as 600 mètres (656 yards), which is never exceeded in the construction of an ordinary road. The scale of weights is at the rate of one demi-centigramme to a cubic mètre. As the quantity of cutting is on an average not more than 5, and never exceeds 20 cubic mètres per mètre run, each arm of the balance will not, for a road four kilomètres (4374 yards) in length, be charged on an average with more than 100, and in extreme cases with 400 grammes at most.

Since the apparatus gives the value of δ in the general formula,

$$\delta = \frac{Pp + P'p' + P''p'' + ..}{Q + Q' + Q'' + ..}$$

in which the quantities P, P′, P″..p, p′, p″..Q, Q′, Q″..may have any finite value whatever, positive or negative, it may be employed not only for the determination of means, and the solution of the rules of alloys, but also for all the operations comprised implicitly in the formula, as the rule of three, common multiplication and division, involution, &c. It is even applicable to the calculation of terraces, and may furnish the results very expeditiously. From trials which have been already made, it is calculated that the mean distance may be found by means of the machine in at most one-fourth of the time required by the ordinary method.

A very simple modification would render the *arithmetical balance* available for calculations of a much higher order. Thus, to obtain the value of x in the formula,

$$a^x = A^a\, B^b\, C^c ..$$

it is sufficient, besides the graduation in equal parts, to add logarithmic divisions analogous to those of Gunter's rules; for the preceding equation gives

$$x = \frac{a \log A + b \log B + c \log C + ..}{\log a},$$

which indicates the equilibrium of a lever charged on one of its arms with the weights a, b, c,..at the respective distance log A, log B, log C,..from the point of suspension.

Involution, evolution, compound rule of three, and many other calculations of that kind, are but very particular cases of the preceding formula.

REVIEWS.

An Essay on the Boilers of Steam Engines. By R. ARMSTRONG, Civil Engineer. London, John Weale, 1839.

A new edition of this excellent work has appeared with additions, making it more complete, and consequently more deserving the attention of the public, the various rules and practical data which abound in it, entitle it to be considered a text-book for boiler makers, as well as boiler users. Having largely quoted from its contents in our former notices, nothing of a very material character presents itself, which we can transfer into our pages, but perhaps the following may be interesting to some of our readers:—

General Rules for proportioning the length of Boilers.

Rule I. A plain boiler without any inside flue, to be hung upon what is called the "oven plan,"* ought not to exceed in length six times the square root of the horse power in feet, or in ordinary circumstances, six times the square root of the area of the fire-grate in feet.

Rule II. A boiler without any inside flue, to be set up in the common way with a wheel draught, ought not to exceed in length four times the square root of the horse power; or four times the square root of the area of the fire-grate in feet.

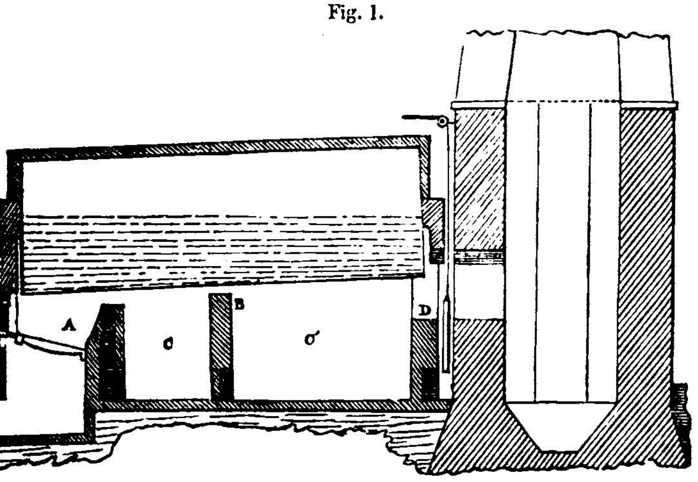
Rule III. If a flued boiler, or boiler containing one or more inside flues, (and the latter pass quite through,) is to be set up with a split draught, it ought not to exceed in length three and a half times the square root of the horse power, and if with a wheel draught, three and a quarter times the same, or three and a quarter times the square root of the area of the fire-grate in feet.

Rule IV. If a flued boiler with an inside uptake, like a Boulton and Watt boiler, (Art. 82,) is to be set up with a split draught, it need not exceed in length from three to three and a quarter times the square root of the horse power; or if it is to be set up with a wheel draught, then the length of the boiler ought not to exceed three times the square root of the horse power, or of the area of the fire-grate in feet.

The author, after detailing some experiments on the rate of combustion and evaporation, proceeds to describe the boiler by which those experiments were made:—

This boiler was purposely chosen of this simple and elementary form, and set up in the cheapest and simplest manner; that is, upon the "oven plan," so that all alterations or improvements that it might have been found expedient to make, either in the setting or the construction of the boiler itself, might be in the shape of additions merely, and therefore capable of being separately proved, both as to first cost and profit; and also that observations might be made upon it, for a sufficient length of time, without the liability to error arising from complication of construction, or interruption from the necessity of cleaning out flues or otherwise. It was thus made to answer the purpose of a trial boiler in order to guide the firm to which it belonged

Fig. 1.

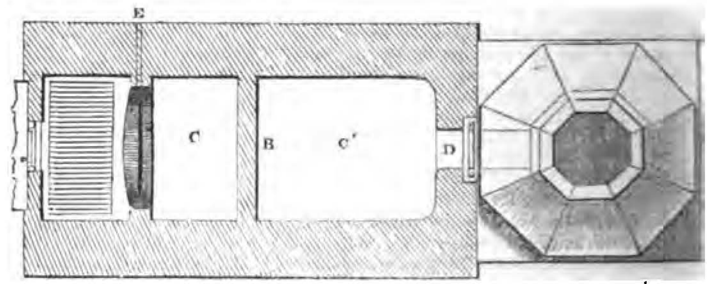


* That is, without any return flue, but with the flame and smoke to pass from the fire place directly under the bottom of the boiler to the vent or chimney. When the draught is arranged in this manner, it is by some called "a thorough draught."

in their choice of what kind of boiler to adopt in the erection of new works then contemplated by them.

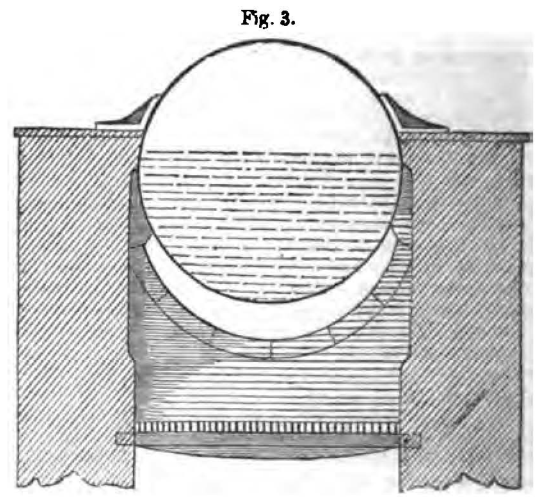
The following figure represents a longitudinal section through the centre of the boiler, furnace and chimney, in all respects proportional except as to length, which is to a scale of one-half of that for the depth and width, and fig. 2 represents a plan, or bird's-eye view, of the furnace, flame bed, chimney, &c., supposing the boiler to be removed: and the same letters refer to the same parts in both figures. The boiler is hung upon cast-iron brackets, rivetted to its sides a little above the centre, and with broad flanges resting upon the top of the side walls, as is shown in the cross sections, figures 3 and 4. It is fixed in an inclined position, or with a fall of about 8 inches to the front, so that by far the greatest proportion of the water is brought immediately over the furnace, as is shewn in fig. 1. A is the fire-grate with the ordinary furnace bridge at the end of it, only that the latter is provided with a longitudinal aperture, about 2 inches wide, communicating by a channel at its bottom, with the external air at E, and provided with a valve, so that the smoke could be consumed upon Parkes's principle, if necessary. But in addition to this, there is also another bridge B, at about half the length of the boiler, which divides the flame bed into two chambers C C. The damper plate D, is hung by side rods in the short passage leading to the chimney, which is the only part that can be properly called a flue. The damper is inverted, or made to open downwards, so that the current of smoke or hot air is made to pass over instead of under it. The octagonal chimney is 30 yards high and 3 feet wide inside at the

Fig. 2.



top, and intended to be large enough for two such boilers, which it evidently is. The following cut (fig. 3) is a cross section of the boiler taken

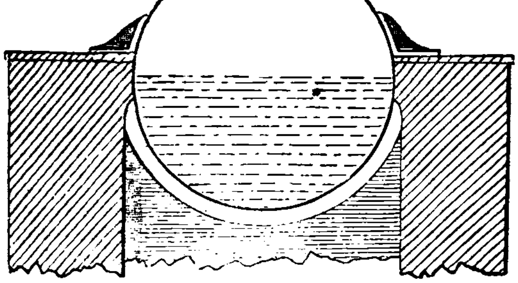
Fig. 3.



through the furnace at A, just in front of the fire bridge. This bridge is an inverted arch of the same radius as the boiler, and placed 8 or 9 inches below the bottom of the latter. The second or flame bridge B, is principally for the purpose of spreading the flame and heated air around the convex heating surface of the boiler in a stratum of comparatively equal thickness, and is considered an absolutely essential requisite when a boiler is set up upon the oven plan, and two or three such bridges are still more economical. They are usually called check bridges, from their tendency to check or impede the rapid current of hot air in its passage to the chimney, and consequently retain the heated gases longer under the boiler, which they certainly do, quite as effectually as causing the smoke to pass through long winding flues; but this is perhaps the least important purpose they subserve.

The flame bridge is shown in elevation in fig. 4, which is a cross section of the boiler and flame bed at the middle of the length of the boiler. This bridge is an inverted arch about five inches from the boiler, and equally distant all round. We may state here, that proper attention to the construction of these bridges is a matter of considerable importance; sometimes people have done away with them altogether, and then an enormous waste of fuel ensues, the flame being then apt to divide itself into two currents, one on each side of the boiler, and thus run off to the chimney without taking much effect upon the boiler bottom; others again have gone into the other extreme, and built a continued inverted arch from the fire bridge to the end of the boiler, which we need hardly observe, hurries the heated gases too rapidly off to the chimney.

Fig. 4.



Dimensions of Boiler:—

Length 33 feet 8¾ inches } outside. One-half of the convex surface
Diameter 5 — 5¼ —— }

was wholly exposed to the direct action of the flame and hot air, except about 4 inches in depth all round along each side and across the ends, amounting to about 1 square yard. The quantity of water worked with was 15 cubic yards, which was kept uniformly supplied by means of the ordinary feed pipe and float; the temperature of the feed water being the same as that of the atmosphere.

Dimensions of Fire Grate:—

Length 5 feet 6 inches } clear within the bearing bars, and within the
Breadth 5 — 6 —— }

side walls of the furnace. Fire bars in one length, 1¾ inch thick, $\frac{5}{16}$ inch between each, and set sloping, or declining towards the bridge, so as to be 2 feet 8 inches from the boiler bottom at the back and 1 foot 11 inches at the front end of the grate.

The boiler was made by Mr. Fairbairn, of Manchester, with the best Low Moor iron $\frac{5}{16}$ thick. It supplied steam to a 16-horse engine, loaded so as to require never less than 24 cubic feet of water evaporated per hour, also steam for heating drying cylinders, boiling water, and a variety of other purposes, amounting at times to nearly as much as the engine required itself.

The chapters upon the "Deposit of Sediment Incrustations," and "Causes of Explosions," deserve particular attention, more particular since the report of the commissioners appointed by parliament to investigate this subject. We fully concur in the opinion expressed in note 1, page 260, respecting Mr. Josiah Parkes's system of slow combustion, as applied any where, but particularly to a steam boat, where another objection besides that stated by the author, viz. increased immersion arising from the increased size and weight of boilers and water, would have a very heavy drawback to the passage of the vessel through the water, but as regards the application of the system of wiredrawing the steam, this method has been in use in America for years, the steamers on the North River and other places answer perfectly, and are of higher power than have been employed in any other part of the world.

In conclusion, we heartily recommend the book to all persons employing, or taking interest in steam engines.

Architectural Remains of the Reigns of Elizabeth and James I., from accurate drawings and measurements, taken from existing specimens. By C. J. Richardson, M.R.I.B.A. Folio, Lond. 1839.

Even those who regard the architecture of the Elizabethan period as an anomalous fashion of the art, rather than a distinct and well-matured style, must allow it to be interesting in an historical point of view, and so far to deserve attention. Neither can it be denied that although in the best examples of it there is always a very considerable mixture of alloy—much that is poor, mean, and fantastical mixed up with what is stately and picturesque, there is also generally something worth notice even in the worst. Yet while we freely admit this, by no means are we of opinion that it is to be recommended for imitation at the present day, because anything approaching to a direct copy of it, must retain all the defects of the originals, at the same time that it must fall short of them in many circumstances to which they are mainly indebted for the interest they excite as records of the period to which they belong, and its architectural taste;

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Doric or Ionic columns, have at length satiated the public, and led them to welcome any change from the chilling insipidity of that so-called classical style, as one decidedly for the better. And if change was to take place, to what could we revert with greater propriety than one which has a claim upon us as being strictly national and coeval with a brilliant period in our annals and our literature. Unfortunately though such reason sounds plausible enough, it is when fairly examined, but a very silly one. It would be just as wise to extinguish our gas lights and break up our rail-roads, as now after the lapse of two centuries or more, to fall back upon what is at best the exceedingly imperfect and half-wrought style of an age, which presents a sad declension in architectural taste, compared with its predecessors, and one moreover as much at variance with all our habits and feelings, as the farthingales and ruffs of those days are with our modern notions of elegance in dress.

Yet, although whim and the love of singularity, together with a confusion of ideas as to picturesqueness and beauty, (whereby they are supposed to be identical,) may lead some to adopt the style in question, just as they find it, without any attempt to purify or ennoble it, we have very little apprehension of its becoming at all general. In fact, it is by far too expensive for such purpose; if buildings in it are not upon such a scale, both as to magnitude and decoration as to be stately, they appear only heavy and uncouth, fantastically old-fashioned withal. Hardly does it admit of being simplified without requiring to be also greatly purified; since the mere omission of ornament tends only to take away all the character derived from it, and to render its intrinsic deformity all the more apparent and repulsive. Unless richness or even a prodigal magnificence can be indulged in, this style supplies nothing for interiors; since if it be divested of its carpet-patterned ceilings, its cumbrous fire-places, its elaborately carved wainscotting, nothing remains but rude and heavy forms, and proportions absolutely revolting to the eye of taste. In order to accommodate it, therefore, in any degree to general purposes, it would be necessary to do a very great deal more than merely compose from extant examples; nothing less, in fact, than to purify it of all its defects, and supply all its deficiencies, retaining only just so much of it as would furnish the leading ideas for something similar, yet greatly improved in character. We are of opinion that here would be a good field for any one to exercise his talent in, and assuredly a series of studies showing what is and what is not now available in Elizabethan, would be likely just at the present to find favour with the public.

It is time for us, however, to break off from our general remarks, and to speak more immediately of Mr. Richardson's work. After what we have already said, it would be quite idle in us to profess any particular admiration of the subjects it contains, further than as curious documents, not without their historical value as such, but in no wise tending to contradict what we have just been urging. Among them are one or two designs and plans by John Thorpe, copied from the originals in the Soanean Museum; and that which forms the frontispiece, strongly confirms what we have said as to buildings in this style when divested of the fantastic ornament peculiar to it, since scarcely anything can be more mean and quaint than that design intended to have been executed by Thorpe for his own residence. To be sure, it is not at all flattered, for being a fac-simile of the original drawing, which is a sort of bird's-eye view; it is shown as no building is ever seen, and is moreover delineated in the dryest and stiffest style. How greatly the designs are disfigured by that exceedingly preposterous mode of representation is rendered evident by the one forming No. 2, in plate 7, where it is quite distorted in Thorpe's bird's-eye perspective of it, for when put into proper perspective as has been done by Mr. Richardson in the following plate, it becomes so superior as hardly to appear to be the same thing. Yet, although as so shown, it is one of the best subjects in the book, by no means would it be difficult to render it a far better one, equally picturesque in composition, but more elegant, and more consistently rich throughout in its details.

The work is very handsomely got up, and the coloured elevation of one of the sides of the gilt room at Holland House, makes a splendid appearance, though gorgeous as it is, the effect is hardly equal to the expensiveness of such mode of decoration. Among the subjects to be given in the course of the work are Burleigh, Wollaton, and Blickling, which if suitably illustrated will be welcome enough.

A Practical Treatise on Bridge Buidling. By E. Cresy, Esq., Arch., C.E. F.S.A., &c. Part II. London: John Williams.

The appearance of the Second Part fully maintains the high character promised by the first. The work exhibits many valuable examples of bridge building; among which are 7 plates of the Strand Bridge constructed by George Rennie. Four plates of Skew bridges, on the Midland Counties Railway, which will be accompanied, when the work is completed, by a Treatise on Skew arches, by Mr. Woodhouse, the Engineer of the Railway. Three plates of bridges over the Ouse, near York, on the Great North of England Railway, Messrs. J. & B. Green, Engineers, besides several other well executed engravings.

A Practical Treatise on the Construction and Formation of Railways. By Jas. Day. London: John Weale, 1839.

This small volume contains a great deal of useful matter condensed in a narrow compass, and will be found very servicable to the student; throughout the work are distributed some serviceable tables, which will be of assistance to the engineer or contractor.

A Practical Treatise on the construction of Oblique Arches. By John Hart, Mason. Second Edition, with Additions. London: John Weale, 1839.

We gave our commendations to this work on its first appearance, and we now with pleasure direct the attention of the Profession, Masons, and Bricklayers, to the equally practical contents of the present Edition.

Theory, Practice, and Architecture of Bridges. Part III & IV. London: John Weale, 1839.

In our former notices of the two first parts of this excellent work, we spoke in most favourable terms of the manner in which it was got up, and of the utility of its contents; we also promised in our last review to notice the practical papers; but we regret that an overpress of matter precludes us at present from fulfilling our promise,—we will, however, endeavour to do so in the next Journal, by which time we hope to see another Part out. In the mean time, we recommend to *all*, to possess themselves of the work while the publisher is in the humour to sell it at the present low price.

Sir John Rennie is about to publish a work on Harbours.

Repton's Landscape Gardening and Landscape Architecture. A new Edition. By J. C. Loudon, F.L.S., &c. No. I. II. III. London, Longman & Co.

Repton's works are so well known to the Architect, and to every lover of landscape scenery, that it renders it quite unnecessary for us to give, at present, any lengthened notice of the appearance of a new edition, which is now being republished under the able auspices of Mr. Loudon, who stands very justly pre-eminent in his profession as a Landscape Architect. The high price of the former edition of Repton's works, prevented them being largely distributed,—but we hope, now that Mr. Loudon has undertaken to issue the work at about a sixteenth the price of the former edition, it will have a far more extended sale. We shall not allow many more numbers to be published, without giving an extended notice of their contents.

LETTER FROM MR. GODWIN JUN. ON NECESSITY OF INVESTIGATIONS IN ACOUSTICS.

Sir—The report recently made to the Commissioners of Her Majesty's Treasury by Messrs. Barry, De La Beche, W. Smith, and Charles Henry Smith, on the sandstones, limestones, and oolites of Britain, (and to which you drew attention in the last number of the Journal,) forms with the numerous tables and results of experiments by Messrs. Daniell and Wheatstone appended to it, one of the most valuable contributions to architectural science that has been made in modern times. One hundred and three quarries are described, ninety-six buildings in England referred to, many chemical analyses of the stones given, and a great number of experiments related, shewing among other points, the cohesive power of each stone, and the amount of disintegration apparent when subjected to Brard's process. It offers in consequence materials for deductions of great practical importance beyond those made or required to be made, in the body of the report, and will lead, I hope, to the publication of a comprehensive treatise on the subject by competent hands.

This being the case then, it must I think, seem desirable to all, that government should continue the good work they have so well begun, and that this report should be but the commencement of a valuable series; and I would venture to suggest touching the next step to be taken, the importance of appointing a committee to inquire into the most desirable forms of buildings and the best mode of construction, in a phonocamptic point of view, to investigate the science of sound and to deduce principles to be hereafter applied in the erection of buildings. On this subject, which is of the most vital importance to the excellence of the new houses of parliament, we are confessedly entirely ignorant, (and I speak not of architects *alone*,) we do not know so much as would enable one to say *with certainty* before a building be finished, whether or not it will be well adapted for oratorical purposes. Even in churches and other edifices where the voice is to issue invariably from one spot, many circumstances at present beyond our reach because not fully understood, may have the effect, and every day do have the effect of preventing persons in certain positions from hearing; but in an apartment where, as in the House of Commons, individuals will arise from all parts indifferently to address the meeting, the difficulties become much more numerous, the probability of failure in some one respect or another, is necessarily much greater. Sincerely therefore do I hope that a commission will be immediately appointed to collect information on the subject, and conduct a series of experiments on a large scale, without which, nothing effectual can be looked for. Independently too, of the immediate occasion for this inquiry, the mass of facts that would be collected and the truths obtained, would be a great boon to the profession at large, and could not fail to produce most advantageous results.

I ought perhaps to apologize for troubling you with this communication; but must offer in extenuation, that having bestowed some little attention myself upon the subject, and gained a knowledge of difficulties which at present meet the inquirer at every step, I am strongly desirous that some sufficient proceedings should be taken to procure more satisfactory data for reasoning than do now exist.

I am, sir, your obedient servant,

George Goodwin, Jun.

Brompton, Sept. 18, 1839.

BLOWING UP THE WRECK OF THE ROYAL GEORGE AT SPITHEAD.

Colonel Pasley commenced his submarine explosive operation against this immense wreck, on the 29th August, when he fired no fewer than five charges of gunpowder against her water-logged timbers—we believe with great effect. One of these charges consisted of 180 lb., the other four of 45lb. of powder each. The effect of these discharges at the bottom of the water, the depth being 14 fathoms, was very remarkable, resembling the smart shock of an earthquake. To those who stood on the deck of the lighters anchored near the point of explosion, the sensation was not unlike that of a galvanic shock, and these huge vessels were violently shaken. No column nor dome of water was, however, thrown up, as had been expected by those who had witnessed Colonel Pasley's experiments in the Thames and Medway. The water over the explosion remained quite tranquil for several seconds after the shock had been felt, and the sound heard, when it suddenly burst forth in a circle of bubbles and whirlpools, gradually extending on all sides, till it became about 40 or 50 feet in diameter. This circle of agitation was at first white with foam; but ended by becoming of a deep blue, or almost black colour, probably from the mud at the bottom being stirred up. Several fish were killed by the first explosion, but none by those which followed, and it is natural to suppose that the noise and shock would drive those fish to a distance which it did not kill outright.

On the 22nd ult. Colonel Pasley renewed his operations, and with the usual success which attends well-directed perseverance, at length succeeded in firing off one of the enormous sub-marine mines of gunpowder against the wreck. A cylinder, containing 2,320lb. of powder, was carefully lowered to the bottom, where it was placed alongside the most compact portion of the wreck which has yet been discovered by the divers. This operation was effected by means of hauling lines rove through blocks attached to the bottom of the ship by the divers. When everything was ready, the vessel in which the voltaic battery was placed was drawn off the distance of 500 feet, which is the length of the connecting wires, and instantaneously on the circuit being completed the explosion took place, and the effects were very remarkable. At first the surface of the sea, which had before been perfectly smooth and calm, was violently agitated by a sort of tremulous motion, which threw it into small irregular waves, a few inches only in height. This lasted for three or four seconds, when a huge dome of water made its appearance, of a conical or rather beehive shape. At first it appeared to rise slowly, but rapidly increased in height and size till it reached the altitude of 28 or 30 feet, in a tolerably compact mass. It then fell down and produced a series of rings, which spread in all directions. The first, or outer one of these, having the aspect of a wave several feet in height, curled and broke, as if it had been driven towards the shore. Neither the shock nor the sound was so great as had been expected by those who had witnessed the former explosions by Colonel Pasley, where the quantity of powder was only 45lb.; but the effect produced on the water at the surface, considering that the depth was 90 feet, was truly astonishing. What the effect has been upon the wreck will not be fully ascertained by the divers till the present spring tides are over, and the long periods of slack water at the neaps enable the divers to remain for upwards of half an hour under water. In the mean time, it is highly satisfactory to know that Colonel Pasley has completely established his command over the application of the voltaic battery to sub-marine purposes, and that he can now with certainty explode his charges at any depth of water. This will give him the power of placing his cylinders against the most refractory parts of the wreck, and by blowing these to pieces, and dislocating the knees, timbers, and beams, enable him to draw the whole up, bit by bit, to the surface. Any person who has seen the operation of breaking up a ship on land, knows that this is the only way of going to work with a mass so firmly bound together as a line-of-battle ship, that even the action of 57 years of decay under water goes but a small way to disintegrate the parts. The manly perseverance of Colonel Pasley, therefore, we are well convinced, will, in the end, effectually clear the noble anchorage of Spithead of this extremely troublesome obstruction.—*Times.*

LOCOMOTIVE POWER APPLIED TO CANAL TRANSIT.

On the 21st and 22nd of August an experiment was conducted on the Forth and Clyde Canal, of a novel and highly interesting nature, by John Macneil, C.E., and consulting engineer to the Canal Company. It is well known that the haulage of boats on this canal has hitherto been performed by horses, the rates of speed being for the heavy sloops, brigs, &c., in the London, Dundee, and other trades, about 1½ to 2 miles per hour, when drawn by two or five horses, according to the state of the weather, and for the swift or passenger boats between 8 and 9 miles per hour, on an average, when drawn by two horses. The object of the experiment was to ascertain the possibility of using locomotive steam power to draw the boats instead of horses: accordingly, a single line of rails, upon blocks, like an ordinary railway, was laid down for a considerable space along the canal banks, near lock 16; and a locomotive engine and tender, built by Mr. William Dodds, having been brought down the canal and set on the rails, on the morning of the 21st, Mr. Macneil, Mr. Johnston, the canal director, and several engineers and gentlemen, being present, the experiment commenced by attaching to the engine the towing-line of the first passenger boat that made its appearance, and which contained upwards of 90 passengers, with their luggage. There was a trifling delay in disengaging the horses and tying the line to the engine, but this was amply compensated when the "Victoria" briskly set off, and almost immediately gained a speed of 17½ miles per hour, which she kept up round two curves, and until the termination of the rails made it necessary to stop, amid the cheers of the delighted passengers. This experiment was repeated, during the course of the day, with each passenger boat as it came to the railed space, and with equal success each time. On one occasion a towing-rope, which was much decayed, got foul with a curb-stone and broke, but without causing the slightest inconvenience, except about one minute's delay. The engine employed being intended only for a slow trade, was not calculated to go at a greater speed than eighteen miles per hour; but it was the opinion of all present, that with proper passenger locomotives, a speed might be obtained equal to that upon the best railways, few of the latter possessing the advantage secured by the canal bank of a *perfect level* throughout.

The nature of the motion was highly gratifying to all the passengers, being more uniform, steady, and smooth than when the boats were drawn by horses.

Several of the heavy (masted) vessels were also taken in two during the two days of trial, at the rates of 3, 3½, 4, and 5 miles per hour; and, on one occasion, two loaded sloops, and a large waggon boat, were together attached to the engine, and hauled with ease at the rate of 2¾ miles per hour, whilst only *one-fourth* of the steam was allowed to pass the throttle-valve.

The foregoing statements render palpably apparent the immense advantages which might be gained by this new adaptation of steam power—a great economy in haulage expenses, as one engine might draw at least 6 sloops, which now would require from eighteen to twenty-four horses, and, if necessary, at double the present speed; and a proportional increase of the important traffic on the canal, which might be reasonably expected.

Passengers would increase in a great proportion, when attracted by economy and speed of transport. The Union Canal might be traversed in two hours, and the Forth and Clyde Canal in one and a half, instead of four hours and three and a half, as at present, and this by only assuming 16 miles per hour, though more might easily be performed, as the experiments have shown.—*Glagow Courier.*

THE EXPERIMENTAL PAVING OF OXFORD STREET.

The extended time allowed by the Marylebone vestry for testing the durability of the various specimens of experimental paving laid down in Oxford-street having expired on the the 3rd ult. a large body of the members of the Experimental Paving Committee proceeded to Oxford-street, for the purpose of entering into a minute examination of the specimens, prior to completing their final report and recommendation to the vestry as to the plan which it would be most advisable to adopt. The blocks of granite laid down, and the interstices of which are filled up with Claridge's Asphalte, was found to be in excellent condition, as was also the granite laid down by the parish and grouted together. The Bastenne Gaujac bitumen had stood the test of the wear occasioned by the number of vehicles passing through this extensive thoroughfare in a surprising manner, but at parts where the traffic is most severe here and there, slight ruts are perceptible. On arriving at the wooden blocks, the surface was found to be as smooth and even as when first laid down. Five of the blocks were taken up and minutely examined by the committee, and one of them split into pieces for the purpose of discovering if any symptoms of decay had made its appearance, but the wood was found to be perfectly sound, and the diminution of the length of the blocks (12 inches), notwithstanding the immense weight of the vehicles continually passing over them, was scarcely perceptible. Having completed their survey of the road, the committee adjourned to the Court-house for the purpose of deliberating as to the best mode to be adopted, when a long discussion ensued upon the subject. Mr. Kensett supported the adoption of the wood, and Mr. Harbutt and several others opposed it upon the ground that the material was of too slippery a nature for horses. After a variety of arguments, in the course of which three or four amendments were put and negatived, the following resolution was put and carried—viz. "That it appears to the committee that the wooden block paving has proved itself equal to the traffic and paving of the whole of Oxford-street, and it is, therefore, resolved to recommend to the vestry to adopt the wooden block paving for that thoroughfare, subject to certain conditions and regulations." The greatest interest is manifest on this subject in Marylebone.

Engraving on Marble.—A discovery of some importance to the statuary has recently been made by Mr. C. Page, of Pimlico, by means of which engraving on marble is greatly improved. In cutting letters in marble in the ordinary method, the edges chip off, and the defects are covered by painting them over; but Mr. Page obviates this difficulty by covering the surface of the polished marble with a coat of cement before the chisel is used. The cement effectually prevents the marble from chipping; and when the coating is removed, the letters remain as perfect as if cut in copper.

PROCEEDINGS OF PARLIAMENT.—SESSIONS 1839.

Hous of Commons.—List of Petitions and Private Bills, and progress therein.

	Petition presented.	Bill read first time.	Bill read second time.	Bill read third time.	Royal Assent.
Aberbrothwick Harbour	Feb. 6.	Feb. 27.	Mar. 12.	Apr. 15.	May 14.
Aberdeen Harbour	Feb. 8.	Mar. 15.	Apr. 15.	..	..
Ballochney Railway	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 1.
Barnsley Waterworks	Feb. 21.	..	..	..	..
Bath Cemetery	Feb. 22.	..	..	..	..
Belfast Waterworks	Feb. 22.	June 17.	June 27.	..	..
Birmingham Canal	Feb. 20.	Mar. 15.	Apr. 12.	June 13.	July 1.
Birmingham & Glos. Rlway.	Feb. 21.	Mar. 15.	Apr. 9.	..	..
Bp. Auckland & WeardaleRa.	Feb. 22.	Mar. 18.	Apr. 15.	..	..
Blackheath Cemetery	Feb. 22.	Mar. 18.	..	..	..
Bradford (York) Waterworks	Feb. 21.	..	..	..	..
Brighton Gas	Feb. 21.	Mar. 18.	Apr. 22.	May 31.	June 14.
Brighton Cemetery	Feb. 21.	Mar. 18.	May 28.	July 30.	Aug. 17.
Bristol & Gloucestershire Ra.	Feb. 21.	Mar. 7.	Mar. 19.	May 13.	July 1.
British Museum Buildings	Feb. 22.	Mar. 18.	Apr. 12.	May 2.	June 4.
Brompton New Road	Feb. 22.	Mar. 18.	May 30.	..	..
Cheltenham Waterworks	Feb. 22.	Mar. 12.	Mar. 22.	Apr. 30.	June 4.
Commercial (London and Blackwall) Railway	Feb. 14.	Mar. 8.	Mar. 21.	June 20.	Aug. 17.
Dean Forest Railway	Feb. 19.	..	..	..	..
Deptford Pier	Feb. 22.	Mar. 18.	May 28.	June 21.	July 19.
Deptford Pier Junction Rlwy.	Feb. 22.	Mar. 20.	May 28.	June 27.	July 19.
Deptford Steam Ship Docks	Feb. 22.	..	..	..	..
Edinburgh, Leith, and Newhaven Railway	Feb. 19.	Mar. 11.	Mar. 27.	May 30.	July 1.
Eyemouth Harbour	Feb. 12.	Mar. 14.	Apr. 8.	Ma 28.	June 14.
Fraserburgh Harbour	Feb. 20.	Mar. 15.	Apr. 8.	June 7.	July 1.
General Cemetery	Feb. 20.	Mar. 11.	Mar. 21.	Apr. 16.	May 14.
Gravesend Gas	Feb. 21.	Mar. 18.	..	..	..
Great North of England Ra.	Feb. 18.	Mar. 13.	Mar. 25.	May 3.	June 14.
Great Western Railway	Feb. 14.	Mar. 4.	Mar. 13.	May 1.	June 4.
Great Central Irish Railway	Mar. 3.	..	..	..	..
Herefordshire and Gloucestershire Canal	Feb. 20.	Mar. 13.	Apr. 22.	May 15.	June 4.
Herne Gas	Feb. 22.	..	..	..	..
Liverpool Docks	Feb. 21.	..	..	..	..
Liverpool Buildings	Feb. 21.	Mar. 18.	May 28.	June 27.	July 29.
Liverpool and Manchester Extension Railway	Feb. 14.	Feb. 28.	Mar. 12.	May 13.	June 14.
London and Birmingham Ra.	Feb. 8.	Feb. 22.	Mar. 6.	May 30.	June 14.
LondonBridgeApproaches,&c.	Feb. 19.	Apr. 11.	Apr. 26.	June 6.	Aug. 26.
London & Croydon Railway	Feb. 19.	Mar. 18.	Apr. 8.	May 3.	June 4.
London Cemetery	Feb. 19.	Mar. 18.	..	..	..
London & Greenwich Rlway	Feb. 21.	Mar. 18.	Apr. 8.	May 3.	June 4.
London and Southampton (Guildford Branch) Rlwy.	Feb. 22.	..	..	..	..
London and Southampton (Portsmouth Branch) Ra.	Feb. 6.	Feb. 25.	Mar. 7.	May 3.	June 4.
Manchester & BirminghamRa.	Feb. 18.	Mar. 18.	Apr. 23.	June 13.	July 4.
Manchester and Birmingham Extension(Stone&RugbyRa	Feb. 11.	May. 1.	May 14.	..	..
Manchester & Leeds Rlway.	Feb. 18.	Mar. 7.	Mar. 19.	May 30.	July 1.
MaryleboneGas & CokeComp.	Feb. 22.	Mar. 18.	..	..	..
Monkland & Kirkintilloch Ra.	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 4.
Necropolis (St.Panc.)Cemetry	Feb. 21.	Mar. 15.	..	..	..
Newark Gas	Feb. 14.	Feb. 28.	Mar. 11.	Apr. 18.	May 14.
Newcastle-upon-Tyne & N. Shields (Extension) Rlwy.	Feb. 18.	Mar. 15.	..	..	..
Northern & Eastern (1) Rlwy.	Feb. 22	Mar. 18.	Apr. 22.	June 4.	July 19.
Northern & Eastern (2) Rlwy.	Feb. 22.	Mar. 27.	Apr. 16.	June 4.	July 19.
North Midland Railway	Feb. 11.	Mar. 4.	Mar. 14.	May 1.	July 1.
North Union Railway	Feb. 22.	..	..	..	..
NottinghamInclosure & Canal	Feb. 18.	Apr. 11.	Apr. 23.	June 6.	July 1.
Over Darwen Gas	Feb. 21.	Mar. 18.	Apr. 12.	June 3.	July 19.
Perth Harbour & Navigation	Feb. 14.	Mar. 13.	Apr. 8.	May 2.	June 4.
Portishead Pier	Feb. 22.	..	..	..	..
Preston Gas	Feb. 6.	Feb. 20.	Mar. 6.	Mar. 19.	Apr. 19.
Preston and Wyre Railway	Feb. 6.	Feb. 20.	Mar. 4.	Mar. 15.	July 1.
Preston and Wyre Railway, Harbour, and Dock	Feb. 21.	Mar. 18.	Apr. 12.	June 13.	July 1.
Redcar (No. 1) Harbour	Feb. 19.	..	..	..	..
Redcar (No. 2) Harbour	Feb. 22.	Mar. 27.	..	..	..
Rishworth Reservoirs	Feb. 21.	Mar. 6.	Mar. 22.	May 30.	..
Rochdale Waterworks	Feb. 7.	Feb. 21.	Mar. 6.	May 6.	June 4.
Rochester Cemetery	Feb. 22.	Mar. 18.	..	..	..
Sawmill Ford Bridge & Road	Feb. 21.	Mar. 18.	Apr. 22.	June 10.	July 1.
Slamannan Railway	Feb. 12.	Mar. 18.	Mar. 27.	May 26.	July 1.
South Eastern Railway	Feb. 11.	Feb. 27.	Mar. 25.	May 15.	June 14.
S. Eastern (Deviation) Ra.	May 3.	May 6.	May 30.	June 19.	July 19.
Teignmouth Bridge	Feb. 14.	..	..	..	..
Tyne Dock	Feb. 22.	Mar. 15.	May 7.	June 13.	July 1.
Tyne Steam Ferry	Feb. 21.	..	..	..	..
Walsall Junction Canal	Feb. 22.	..	..	..	..
West Durham Railway	Feb. 21.	Mar. 18.	Apr. 8.	May 14.	July 4.
Westminster Improvement	Feb. 21.	..	..	..	..
Wishaw & Coltness Railway	Feb. 12.	Mar. 14.	Apr. 8.	May 3.	July 1.
Wyrley and Essington and Birmingham Canal	Feb. 18.	..	..	..	..

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF THE ARCHITECTS OF IRELAND.

THE first annual meeting of this excellent institution was held on Wednesday, Aug. 28, at No. 10, Gloucester-street, for the purposes of electing a council and other officers for the ensuing year, and of transacting other business of importance.

RICHARD MORRISON, ESQ., the Vice-President, in the Chair.

An animated conversation ensued between the respected Chairman and other gentlemen present, on the great advantages which the Institution must confer on the country. It was stated, that while the professional architects of Ireland were inferior to no other class of men in Europe, in the several branches of their profession, and were competent to raise the architectural taste of the country to the pre-eminence which we should hold in enlightened society, they were thwarted in all their efforts by a body of men who laid claim to the title of architects, though they were, in reality, merely mechanics, without any of the knowledge, taste, and learning, which are indispensable to the profession. The many tasteless and deformed buildings which everywhere meet the eye while going through the country, bear undeniable proof of the truth of this allegation, while the chaste designs which are occasionally met with afford evidence that real talent, if encouraged, is not wanting among us. The Institute is founded on the principles of the Royal Institute of British Architects, and it is intended to include among its members and associates all the qualified members of the profession in the country, as well as all the resident nobility, gentry, and other encouragers of the fine arts, and also, as honorary or corresponding members, the principal learned men of other countries. The objects of the society are the advancement of civil architecture, and of all the other arts and sciences connected with it; the formation of a library and museum; the carrying on of a correspondence with learned men in all parts of the world; and, in fact, the raising of the profession to its legitimate state in the country, and the improving of the national taste for architecture.

The Secretary read a very flattering letter from Lord Fitzgerald and Vesci, consenting to become the President of their society, and also from the Marquis of Normanby and other noblemen and gentlemen, stating their warm feelings of co-operation with the objects of the Institute.

The following are the officers appointed for the ensuing year:—

President, Lord Fitzgerald and Vesci; Vice-President, Richard Morrison, Esq.; Council, William Murray, Frederick Darley, William Dean Butler, William Farrell, James Sheil, George Papworth, and John T. Papworth, Esqrs.; Treasurer, William Murray, Esq.; Secretary, John T. Papworth, Esq.; Bankers, Messrs. Latouche and Co.

The Mining Journal.—We feel ourselves called upon to direct the attention of those of our readers engaged in mining pursuits, to the subscription now going on among the members of that interest, to express their sense of Mr. English's conduct, in the late action for libel brought against him by a Mr. William Millie Thomas. The jury expressed the sense of all well-thinking members of society by awarding a farthing damages, while the judge awarded a farthing only for the costs, and his friends have taken this opportunity to present him with a permanent testimony of his victory, and of their esteem.

STEAM NAVIGATION.

The Sesostris.—The launch of this beautiful vessel took place the beginning of last month, from the dockyard of Mr. Pitcher, at Northfleet. The Sesostris is one of a class built by order of the East India Company, for the express purpose of protecting their trade in the Indian seas. She is a magnificent vessel, of the highest order of naval architecture, and is altogether worthy of the important post assigned to her. She is now in the East India Docks receiving her engines.

The Boston and Liverpool Steam Ships.—Mr. Cunard, the enterprising proprietor of the line of steam ships to run between Boston and Liverpool, via Halifax, has arrived in town. He came passenger to New York in the British Queen.

He has determined, as we are informed, that the large boats of his line shall run, between Liverpool and Boston, merely stopping at Halifax some hours, to discharge freight and passengers. Of these boats he has four now building at Glasgow, each 1,260 tons, with engines of 460 horse power. They are upwards of 200 feet long, and 34 feet wide. He has two smaller boats building, for the purpose of keeping up a communication between Picton and Quebec.

What Mr. Cunard asks of the Bostonians is, that they should provide him with a wharf, without charge, at which his vessels may be safely moored while in this city. Such a wharf, it is supposed, will cost from 40,000 dollars to 50,000 dollars. The committee appointed some time since for that purpose, are taking measures, we believe, to collect the necessary amount. We cannot have a doubt of their speedy success. It is not to be supposed that our merchants will hesitate a moment about securing to themselves the great advantage of a semi-monthly steam-packet communication with England. It was the establishment of regular lines of packets between New York and Liverpool that first led to the great concentration of the foreign trade in that city. We ought to improve the present opportunity of regaining our fair share of that trade.

Mr. Cunard's line is to commence its trips on the 1st of May next. In point of steam ships we shall then stand on a par with New York. We shall have four, and for some time to come she is not likely to have a greater number.—*Boston Atlas.*

Stromboli.—This fine steamer was launched at Portsmouth on Tuesday, 27th of August, and immediately after warped under the sheers and masted. When that was done she was taken into dock, and is there at present to be coppered and fitted for engines, boilers, machinery, and paddles. The following are her dimensions:—Length, 180 feet 1 5-8 inch; ditto of keel for tonnage, 157 feet 2 3-8 inches; extreme breadth, 34 feet 4 inches; ditto for tonnage, 34 feet; depth of hold, 21 feet; tonnage, 966.

Prometheus, steam-vessel, built in Sheerness dock-yard, was launched the 23rd of September; her dimensions are:—Length between the perpendiculars, 164 feet; keel for tonnage, 141 feet 6 inches; extreme breadth, 32 feet 8 inches; breadth for tonnage, 32 feet 6 inches; moulded, 31 feet 10 inches; depth in hold, 18 feet 7 inches; burden in tons, 795; her engines are to be of 200 horse power. This vessel was built in the short space of 3 months.

Lengthening of a Steamer.—A curious operation lately took place in Chatham Dockyard, that of lengthening the Gleaner steam-vessel, which had been taken into dock for that purpose. She was sawn in two a little more than one-third of her length from her stern, and ways were laid from the fore part of her to tread on, the purchase falls were rove, and brought to two capstans, and the order being given by the master shipwright, the men hove away, and in five minutes the fore section was separated from the after part a distance of 18 feet. The space between will now be filled up by new timber. There is no record of any ship or vessel having been lengthened in this dock-yard before the Gleaner.

A splendid steam-ship, of eight hundred tons burthen, built for the Russian Government, was launched at Gravesend on Monday, the 9th ult.

The Vernon steamer sailed on Saturday, the 7th ult., from Blackwall, for the Cape of Good Hope, being the first attempt to send an ocean steamer round that point to India.

Canal Steam Navigation.—Messrs. Robins and Co. seem determined to introduce steam power on canals. On Saturday last we went, by invitation, to their warehouse in Camp-field, to witness the experimental trip of another boat. The vessel is the same as the one in which the propellers were used, about a year ago, and its name is *Novelty*. It is a rotatory engine of about ten horses' power, the invention of Mr. Rowley, surgeon, of this town. The boiler worked in Lord's mill, in Garrat-road, about six months ago, and is therefore too heavy for the purpose; but if the experiment succeeds, machinery will be made expressly for it. the action of the propellers was so violent as to shake the boat very much, and cause great leakage, thereby rendering it unfit for use. To avoid this, Mr. Rowley has adopted the rotatory form, and the motion is very pleasant. At a few minutes before two o'clock, the boat set off along the Bridgewater Canal, as far as a place called the Waters, distant about four miles and a half, performing the distance in 56 minutes, and the return thence in 45 minutes, being at the rate of nearly five miles an hour. The depth of water in the duke's canal is only four feet, and therefore the boat could not go at any speed. Subsequently, however, she was taken on the river Irwell, and proceeded up the river as far as the New Bailey Bridge, and she went there, from the junction locks, in ten minutes. She then went down as far as Throstle Nest weir, and performed the distance from the bridge to the locks in eight minutes, and to the weir in eleven minutes; thus going in less than twenty minutes; she then returned from Throstle Nest weir to the locks in twelve minutes. Several gentlemen were on board, and expressed their perfect satisfaction at her speed and motion. She started for London on Monday morning, tugging another boat with her, it being the object of Messrs. Robins, not so much to gain speed, as to economise the labour of horses, &c. The distance by canal to London is 264 miles, and were a direct line made instead of the round-about "junctions," it might be lessened 100 miles, and then canal passenger traffic would be a very profitable undertaking.

Her Majesty's new Steamer Medusa, intended for the morning line of packets between Liverpool and Dublin, proceeded on an experimental trip to Kingstown, under the command of Lieutenant Philipps, accompanied by Captain Bevis, her Majesty's agent in Liverpool. She accomplished her return passage in the unparalled short time of nine hours and thirty-eight minutes, from pier to pier, and this under many disadvantageous circumstances, having to contend with a very heavy beam sea, and her engines being new and stiff, and falling short by nearly a revolution per minute of their speed. We understand she was frequently going thirteen knots per log, and had she been favoured by a spring tide, her passage would scarcely have exceeded nine hours. She, and her sister ship, the Merlin, were modelled by Sir W. Symonds, and their machinery, which has proved to be of the very first order, was constructed at the celebrated foundry of our townsmen, Fawcett, Preston, and Co. They are of about 900 tons burden, and 320 horse power, and, owing to their great beam, have admirable accommodations. The size and the strength of these vessels, their power whether under canvass or steam, and the circumstance of their passing the perilous navigation at the entrance of our river by daylight, a matter of great consideration at all seasons, but particularly in the winter, have left the public nothing to desire.—*Liverpool Standard.*

Electro-Magnetic Navigation.—Mr. Faraday recently received a letter from M. H. Jacobi, dated St. Petersburgh, on the application of electro-magnetism to navigation, and Mr. Faraday has caused it to be inserted in the *London and Edinburgh Philosophical Magazine* for the current month. The following is a short extract from this very curious paper:—"In the application of electro-magne ism to the movement of machines, the most important obstacle always has been the embarrassment and difficult manipulation of the battery. This obstacle no longer exists. During the autumn of 1838, and at a season (in 1839) already too advanced. I made, as you will have learned by the *Gazettes*, the first experiments in navigation on the Neva, with a ten-oared shallop, furnished with paddle-wheels, which were put in motion by an electro-magnetic machine. Although we voyaged during entire days, and usually with 10 or 12 persons on board, I was not well satisfied with this first trial, for there were so many faults of construction and want of insulations in the machines and battery, which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. The experience of the past year, combined with the recent improvements of the battery, give as the result, that to produce the force of one horse (steam-engine estimation,) it will require a battery of 20 square feet of platina distributed in a convenient manner, but I hope that eight to ten square feet will produce the effect. If heaven preserve my health, which is a little affected by continual labour, I hope that by next Midsummer I shall have equipped an electro-magnetic vessel of from 40 to 50 horse power."

ENGINEERING WORKS.

Diving-bell at the Breakwater.—We understand that preparations have been for some time past in progress, under the direction of W. Stuart, Esq., the Superintendant of the Breakwater in Plymouth Sound, for the purpose of putting a diving-bell at work upon a part of this grand national undertaking. On Thursday last the bell was lowered down at the western end of the work, with the view of facilitating the formation of the foundation at that end, from 3 to 4 feet below the lowest ebb tide; and the extension of the slope lower down, round the head, with large blocks of granite dovetailed horizontally and vertically. This is the first occasion on which the bell has been used upon the breakwater, though it has been frequently used in carrying on other public works in this port.—*Plymouth Herald.*

Portishead Pier.—With a view to the port of Bristol becoming the packet station for Irish and foreign mails, a prospectus for a pier at Portishead has been published, in order to secure, at all times of the tide, a safe and commodious station for vessels.—*Bath and Cheltenham Gazette.*

Thomas Rhodes, Esq., Commissioner for the Improvement of the Shannon, is already on his tour of inspection.—*Waterford Mail.*

Pembroke Dockyard is to be considerably enlarged westward, and a new dock formed, agreeably to the instructions of Government.

The Boston Harbour Committee, acting on the suggestion of Mr. Valentine, have resolved to sink a vessel, to act as a breakwater, at the end of the new work in the haven, and for that purpose have purchased the old Witham steamer; this and some other precautionary measures are expected to preserve the remainder of the work, of which a very considerable portion was recently washed away.

Lincolnshire.—The plan for deepening and widening the Till between Haddow and Till-bridge, is not to be relinquished. The fall from Till-bridge to the Fossdyke being only 2 feet, it is proposed to cut a half secti n canal, thereby opening a water communication from Till-bridge to the Foss. Were this desirable object accomplished, the dyke would be rendered available for the purposes of navigation; and to the agricultural district ti would prove a valuable acquisition, as the corn, coals, manure, &c., now transmitted by land-carriage might be sent by vessels at a much cheaper rate.—*Lincoln Mercury.*

River Mersey.—A meeting was held at Liverpool, for the purpose of forming a company to undertake to make a tunnel under the Mersey, to connect Liverpool with the Cheshire side of the river. Mr. Stevenson, Mr. Vignoles, and other eminent engineers, declared the undertaking practicable.—*Chester Chronicle.*

The Newcastle Subscription Water Company's large reservoir, at the Westgate, has just been completed under the superintendence of W. D Anderson, Esq., the engineer of the corporation. It will hold more, we believe, than four times as much water as the old reservoir, and the town has been partially supplied from it since Tuesday last.—*Newcastle Chronicle.*

Galway Docks.—We stop the press to announce the effect of an extraordinary spring tide, accompanied with a south-west gale, to be compared only with the hurricane of the 7th of January last. The gale burst in a large cofferdam of our new docks, within about an hour of high water, and filled the basin, in an incredibly short period, to within 10 inches of the coping. The devastation wrought by the angry and raging element was majestically terrific. The immense pieces of balk, used as piles, were shattered to pieces, and nothing could withstand the force with which the tide rushed in. The gates fortunately escaped injury. The men employed by Mr. James Stephens were happily removed from the works before the tremendous (we may say) catastrophe. The works must be retarded for about a fortnight. Stones of a ton weight were rolled forth as pebbles by this destructive tide, and should the wind continue in the same point, the coping of the dock must be covered by the succeeding tides. No lives were lost.—*Galway Advertiser.*

Survey of the Coast between the Thames and Portsmouth.—We have recently observed notices in the local journals of inspections, by commissioners of known respectability, of harbours on this coast; and, on making the necessary inquiries, we are exceedingly glad to learn the very important nature of the investigation in which they are engaged. They have been appointed by the Board of Admiralty to inspect the harbours nd the coast between the Thames and Portsmouth, in order to enable them to frame a general report founded on satisfactory data as to the means of improving the communication between this country and France by steam packets, and of affording shelter to ships in distress during contrary winds or storms. There is not a single harbour along the coast in question which a vessel of any considerable size, or which steam packets can enter, near the period of low water. The commissioners are Admiral Gordon, Colonel Thompson (a military engineer), Messrs. James Walker and Cubitt (civil engineers), Captain Drewe (a member of the Trinity House), and Captain Vidall (a post captain in the navy).

Improvement of the Port and Harbour of Chester.—At a numerous and influential meeting of the inhabitants of Chester and its neighbourhood, held in the Exchange, for the purpose of hearing the report of the progress made by the River Dee Navigation Improvement Committee, to inspect Messrs. Stevenson's plans, and also to hear the remarks of Mr. Scott Russell on the subject, the Mayor, John Uniacke, Esq., who presided, explained the steps which had been taken by the committee appointed by the meeting held in December last, whose report, with that prepared by Messrs. Stevenson, civil engineers, of Edinburgh, would be submitted to the meeting. The citizens of Chester, he observed, entertained no hostile feeling to the River Dee Company, but he thought the latter were bound to fulfil the engagements they had entered into when they obtained their bill, a century ago, to keep sixteen feet of water in the river at moderate spring tides, or forfeit the tenure of their occupancy. If the citizens of Chester could not get the redress they sought, their only course would be to demand it at the hands of parliament.

The reports in question were then read, by which it appeared, after a careful survey, that the estimated expense of improving the navigation of the River Dee, from Chester to Flint, and of obtaining sixteen feet at high water, of ordinary spring tides up to Chester, was as follows:—

	£	s.	d.
For improving the turn at the Cheese House. . . .	350	0	0
For forming rubble facewalls at the first and second turns below the Cheese House	1,527	15	0
For extending the stone causeway from the Lower Barrel Perch to the Pentre Rock, including perches or beacons	11,304	15	0
For a steam dredge, with apparatus and punts, and for dredging the bed of the river, so as to obtain sixteen feet at high water of ordinary spring tides . .	9,458	18	0
Incidents on 22,641*l.* 8*s.*, at 10 per cent	2,264	2	9
Total	£24,905	10	9

Mr. J. S. Russell, of Glasgow, afterwards addressed the meeting, contending that a simple practical plan of improvement was now proposed to the inhabitants of Chester, which would repay them in a few years, by the increase of dues, for the money they had expended, when they might proceed still further with their improvements, and deepen the river from sixteen to twenty feet. On the motion of Dr. Thackeray, seconded by E. S. Walker, Esq., the report of the Messrs. Stevenson was adopted. W. H. Brown, Esq., said he had been authorized to state to the meeting, that the River Dee Company would give their fullest consideration and aid to any definite well-considered plan for the improvement of the river; they had consulted some of the most eminent engineers on the subject, many of whom considered the dredging scheme as quite problematical; but still the company were quite willing to aid the committee in making a trial of it, and for that purpose they had agreed to give 200*l.* towards furnishing a dredging machine and working it near the bends of the river. Mr. Stephenson and Mr. Russel remarked that no permanent good effect could be produced at the bends of the river by dredging, until the walls named in the report were made. W. Wardell, Esq., afterwards addressed the meeting, expressing a hope that the River Dee Company would go hand in hand with the meeting in carrying ont the improvements suggested.

PROGRESS OF RAILWAYS.

Lancaster and Preston Railway, and Wyre Railway.—The operations on both these lines of railway are now proceeding with all possible activity. On the Lancaster line, the viaducts, &c., required for carrying the line to a terminus, in this town, are in a state of considerable forwardness. The works on the Wyre line are also beginning to assume a business-like appearance at this end of the line, and a large skew bridge crossing Ashton-lane, promises to be a very elegant structure. We are informed by a gentleman much interested in the railway operations of this neighbourhood, that the lines will probably open simultaneously; but it is fully expected that the Lancaster line will be ready for opening in June next. At Fleetwood, the buildings are going on with great spirit. An hotel, on a very extensive and splendid scale, is on the eve of being erected. Greater enterprise has been lately exhibited in the progress of the Wyre railway, and other erections connected with it, than has been the case at any previous period.—*Preston Chronicle.*

Chester and Crewe and Birkenhead Railways.—We think our friends who have not lately visited the two railways in course of construction in the vicinity of this city, would be much gratified by an inspection of the works, which are progressing with great rapidity. We would especially recommend to their notice the railway at Upton, and the aqueduct under the canal at Christleton, through which the Chester and Crewe railway is to pass. The inverted arch, which is to bear the weight of one-half, is now finished. We understand the canal will be turned from its present temporary course, and flow over the acqueduct in two or three months. The foundation of the Tarvin Road bridge is being laid, and the double line of permanent rails between that place and Chester give a very finished appearance to that portion of the line.—*Chester Gazette.*

The Midland Counties Railway Company have very wisely instituted a *third*-class train of carriages, by which passengers are conveyed, morning and evening, between Derby and Nottingham, for a *shilling* each. We hear also that last week an arrangement commenced, by which passengers from Birmingham and Derby can reach Nottingham in time for the coaches to Lincoln and Hull.

Glasgow, Paisley, and Greenock Railway.—Last month the directors of this railway made their quarterly inspection of the works:—In Glasgow, on what is called the Joint Line, the piers of the arches are springing up in every direction; and although so lately commenced, the works are well forward. Most of the masonry between Glasgow and Paisley is completed, and the line is almost entire. Several miles of the permanent rails are now laying, and in a month or two the cutting at Arkleston will be the only part unfinished. The tunnel there is being bricked, and will be ready, we understand, in January. In Paisley, the masonry, which is of the most imposing kind, is likely to be finished this year. From Paisley to the river Gryfe the railway is in a very advanced state; and thence, over the entire Bishopton contract, the rapid advance made during the last three months appears wonderful when the nature of the material is taken into account. The tunnels especially are pushed forward with great energy and determination, and their position is in pleasing contrast with the popular predictions of six months back. The West Ferry cutting is finished, and presents a splendid vista of perpendicular rocks. About 45,000 yards of whin rock have been excavated here, at the expence of nearly 100,000 lbs. of gunpowder. —*Greenock Advertiser.*

York and North Midland Railway.—The laying of the second line of rails is proceeding with rapidity, and will be completed from this city (York) to the junction in about four months. The other works from Milford to Altofts are progressing very favourably, and no doubt exists that the contractors will have completed their respective contracts in March next.—*Yorkshire Gazette.*

Stockport Viaduct.—We mentioned a month ago that six arches of this stupendous undertaking had been turned and completed; since then another of the large arches (63ft. span) has been turned, and the piers for three others are nearly ready to receive the framing of the centres, so that seven arches, two of the small and five of the large, are so far completed as now to assume a feature from which the public may gather some idea of the extraordinary magnitude of the undertaking. The greatest praise is due to the contractors for the alacrity with which the work has proceeded; and judging from present appearances, we might venture to predict that all the ten arches on the Lancashire side of the river will be completed in the course of the present year. This is a most extraordinary instance of despatch even equal to railway speed, when it is told that they were commenced in March last, that eight of them are 63 ft. span, and five of them 73 ft. above the surface of the earth to the under side of the arch, and that each will consume 140,000 bricks and 3,500 feet of timber.

South Eastern Railway. (Godstone, Surrey).—The line of the South Eastern Railway is now being set out through this parish and neighbourhood, and active operations are expected to commence in a few weeks.—*Sussex Express, September 21st.*

Birmingham and Derby Junction Railway.—Engineer's report at the last half-yearly Meeting held on the 29th of August. Dear Sir.—Agreeably with your instructions, I have to submit to you the following brief remarks on the present state of the works.

The double line of the permanent way is laid and ballasted the whole distance, with the exception of about a mile near Derby, which, I expect, will be completed in the month of October. The recent unusually heavy rains, which delayed the opening of the line for several weeks, caused a general subsidence in the newly-formed embankments, and have required great exertions on the part of the contractors to maintain the permanent way in good order. No interruption to the traffic has, however, occurred from this source, and I anticipate, in consequence of the rapid consolidation of the embankments, some reduction in the repairs during the coming winter.

Excepting on the part of the line near Derby before mentioned, little remains to be done by the contractors in completing the line besides soiling the slopes and similar works, and the progress making, will, I expect, enable me to bring nearly the whole of their accounts to a close in the course of a few weeks. The necessary arrangements for commencing the conveyance of goods between Birmingham and Derby will be made by the end of September.

The stations at Burton and Hampton will be completed in the course of the ensuing month; and, in the mean time, the nature of the traffic at the intermediate temporary stations will best point out the extent of accommodation to be there permanently provided. Eight locomotive engines have now been received, and four are in the course of delivery.

A considerable number of coaches have been placed upon the line, and in a few weeks more, a stock of carriages will be ready sufficient for the requirements of every kind of traffic at present contemplated. From a careful revisal of the state of the works, with a view to a final settlement of the contractors' accounts, I have every reason to believe that the total expense, under that head, will not exceed the amount of my last estimate.

I am, dear sir,
Yours, respectfully,
John C. Birkinshaw,
Resident Engineer.

Henry Smith, Esq.

MANCHESTER AND BIRMINGHAM RAILWAY.

Engineer's Report to the Board of Directors read at the last Half-yearly Meeting, held on 5th of September.

Gentlemen.—I beg to present the following Report on the rate of progress of the works under contract during the last half-year:

No. 1, or Fairfield Street Contract.—The heaviest work on this contract is the cast iron oblique bridge (of 128 feet 9 inches span) over Fairfield Street. The masonry of one abutment is in a forward state, and the rate of progress is such as to insure both being ready for the erection of the arch by the middle of next month, when the castings are expected to be ready, and the founder has undertaken to have the iron work erected at the end of this year. The other part of this contract consists of arches of brickwork of 45 feet span, of which only five remain to be turned, and the piers and centres are ready. I entertain no doubt of this contract being completed within the specified time.

No. 2, or Chancery Lane Contract,—Does not comprehend any work demanding extraordinary exertions. All the piers and abutments are built, and the imposts ready for the arches. The arches are of 30 feet span, and sixteen only remain to be turned, which will be accomplished in six weeks, A portion of the parapet is built, and the rate of progress in each department is consistent with the contract being completed within the specified period.

No. 3, or High Road Contract,—Chiefly consists of fifty-two arches of 36 feet span, sixteen of which are turned. Of the remainder, four have the centres fixed ready for turning; twenty-four are ready for the imposts, which are in the ground; the piers for the remaining six are commenced, and are about half built. The number of centres in use, and of hands employed, enable the contractors to turn one arch daily; the whole, therefore, will require but six weeks, unless delayed by unfavourable weather. The south end of this contract is terminated by a cast iron oblique bridge over the Hyde Road. The piers and abutments of this bridge are in progress, and the whole of the iron work is cast, and now fitted together. The contractors had not possession of the land for this contract until April last, but have nevertheless undertaken to complete it simultaneously with their other contract, No. 2. The state of the works as now reported, and the arrangements made, are sufficient to justify a confident expectation of the completion of the work accordingly.

No. 4, *or Heaton Norris Contract*.—The excavation of Heaton Norris, and its corresponding embankment, are the only heavy work, and they are in a forward state. On the 13th of last month, the embankment from Heaton Norris to the Hyde Road required but 50,000 cubic yards to complete it. This work, therefore, has advanced consistently with its completion by the beginning of November next, as stated in my Report of last half-year. At the same date there remained in the Heaton Norris cutting 112,820 cubic yards. It will be observed that this quantity exceeds that which is required to finish the embankment; the surplus (being all sand) will be required for ballasting the permanent way. The embankment at the south end of this contract extends to the north abutment of the Stockport Viaduct, and requires only 12,700 yards to complete it. The bridges under the line are nearly all completed, except that which crosses the Stockport Road. This is an oblique cast iron bridge, each from the patterns made for the Hyde Road bridge. The iron work of both is in the same state of forwardness. The erection of the bridges over the line has just commenced, and will, I have no doubt, proceed with the energy necessary to bring the work to completion in the specified time. It may be proper to observe, that three bridges could not have been begun earlier, because the foundations are in sand full of water, which could not be effectually drained until the cutting was nearly finished. I have no reason to apprehend any disappointment in the completion of this Contract in the proper time.

No. 5, or Stockport Viaduct Contract.—The north abutment is built to the level of the cornice. Three arches are turned and backed; the fourth is nearly so; the centering for the fifth is being fixed; the sixth and seventh piers are built and the imposts are upon them ready for the centering; the base of the eighth pier is complete, and that of the ninth is just begun. The cofferdam for the north pier in the Mersey is finished, and that for the south is in progress. This Contract is proceeding satisfactorily, and I think consistently with the completion in proper time.

No. 6, or Congleton Viaduct Contract.—Eight millions of bricks have been made. The quantity will be sufficient to carry on the work until the return of the brick-making season. The contractor is erecting his machinery, and the first stone is expected to be laid in about a fortnight.

I am, Gentlemen, your most obedient Servant,

Manchester, Sept. 5th, 1839. GEO. W. BUCK.

NEW CHURCHES, &c.

Northumberland.—On the 9th ult. the foundation stone was laid of a new church to be erected at Tynemouth. The architects, Messrs. John and Benjamin Green, have selected for the style of architecture, the gothic of the 15th century, having the perpendicular character in the subdivision of the mullions of the windows, &c., which was prevalent in this country about the time of Henry the 7th, and other features which mark the style. The building will be highly ornamental to Tynemouth, being placed at the west end of the village, where the Preston and Shields roads divide. The plan of the church is in the form of a cross, with a transept at the north and south sides, and a chancel at the east end, beyond which is a robing room. There will be a tower or turret, and surmounted by a spire 95 feet high from the ground. The length of the church inside is 83 feet, including the chancel, and the breadth 41 feet, exclusive of the transepts, which project 9 feet on each side. The number of sittings provided for at present is 500 (on the ground floor), of which 250 are free; but the interior is arranged so that galleries may hereafter be erected, whenever it is found necessary to increase the accommodation. The site on which the church is built has been presented by his Grace the Duke of Northumberland, together with a donation of 200*l*. towards the erection.—*Newcastle Chronicle*.

Staffordshire.—The first stone of a new church in the parish of Walsall, was laid by the Right Hon. the Countess of Bradford, on Monday, 14th ult. The intended church will be a gothic structure, supported by buttresses, with embattled turrets and a tower, capable of accommodating 1,150 persons. About 500 sittings will be free.—Mr. Highway is the Architect.

Rye Church.—This ancient and spacious building is undergoing certain improvements, which, when completed, will add materially to its beauty and convenience. The gallery is to be considerably enlarged, chiefly for the accommodation of the school children, and for the reception of the organ; and a doorway underneath, which is said to have been closed for at least 100 years, has also just been opened. But the most material alteration will be made in the two immense gothic windows, at the east and west of the edifice. A large portion of the window at the chancel end, which is now bricked up, will be opened; and the plain glass will be replaced by either painted or stained glass. The same alteration is to be made in the western window, which will greatly enhance the beauty of the church. This is done at the suggestion of John Haddock Lardner, Esq., who has liberally offered to defray the whole of the expense.—*Brighton Gazette*.

Dorsetshire.—It has been decided to build a new church at Marshwood, and tenders have been advertised for, for carrying the work into execution.—*Dorset County Chronicle*.

Cheltenham.—The two new churches now building in our immediate vicinity are fast approaching completion. That on the border-line of Leckhampton parish, the works of which had for a long time been suspended from want of funds, is again in active progress, and the tower appears already rising considerably above the body of the church, the interior of which is also in a very forward state; masons and plasterers being alike busily employed therein. Christ Church, whose noble and cathedral-looking tower forms quite the crowning ornament of the town's architecture, has been for some time in the possession of the carpenters and painters, who are still actively engaged on the pews and general fittings. The pulpit and reading-desks, which are of white stone, sculptured and carved in harmony with the gothic style of the exterior style of the building, are nearly finished, and judging from the present appearances, the church seems likely to be quite ready for the performance of divine service in the course of a month, or six weeks at farthest. The second week in October has been named as the probable time of consecration, but we believe nothing has yet been positively fixed on the subject.—*Cheltenham Looker on*.

Church Building Commission.—The 19th annual report of the Commissioners for Building New Churches has been just issued. At the time of printing their last report the Commissioners state that 225 churches and chapels had been completed, in which accommodation had been provided for 297,912 persons, including 164,495 free seats appropriated to the use of the poor. Since that time they report that 18 churches have been completed, affording accommodation for 16,000 persons, including 9773 free seats for the poor; making in the whole 243 churches and chapels; affording accommodation for 314,412 persons, including 174,270 free seats for the poor. In addition to these, 18 other new churches are now building, and in a very forward state: the number to be accommodated in pews is 7207, and in free seats 9949; total 17,156. Plans for eight other churches have been approved of, and it is in contemplation to build eight others, at various places. Conditional grants of money have been made to 38 parishes, townships, or places, in aid of building churches and chapels; as also for providing sites for churches and chapels in 46 other different places, interspersedly throughout England. Applications for further church accommodation have been made by the inhabitants of 47 districts, situate respectively either in England or Wales.

Manchester.—The new Unitarian Chapel was opened for divine service at the beginning of the last month, it is situate nearly opposite Clifford-street, Upper Brook-street. The chapel (the corner stone of which was laid on the 8th Sept., 1837, the walls being at that time level with the floor) is a handsome stone edifice, from an original design by Mr. Charles Barry (who was present during the services), the architect of the new houses of parliament, of the free grammar school of King Edward IV. Birmingham, and of the Royal Institution and the Athenæum in this town. The style of architecture of this chapel, is what is designated the mixed or English. The west, or entrance end, has a cathedral-like appearance, chiefly the result of a bold arch, enclosing gothic folding-doors, and a double arched window above, between light elegant pillars. The corners, as well as both sides of the building, are flanked by massive stone buttresses, surmounted by crocketted pinnacles, and a high pointed roof, covered with green slates. The sides of the chapel are respectively divided, but eight buttresses, into seven beys, each containing a high arched window. The east or vestry end, has a circular window, below which is an attached, projected building, comprising a convenient vestry and a committee-room, each about fourteen feet square. The entrance to the chapel has two porches; stairs on each side of the outer arch communicate with the organ gallery and small galleries which form its wings, all being over the porches, and not projecting at all into the body of the chapel. The inner porch opens into lobbies, through which are entrances to the floor of the chapel. The position and form of the west-end galleries, placed as it were in arched recesses, and there being no other gallery, contribute to a pleasing and novel effect, which is produced in the interior by the lofty space terminating in an arched roof, approaching to the pointed of or lancet form. The dimensions of the chapel are 73 by 37 feet, inside measure. The chapel contains, on the floor, 88 pews, and four in the small galleries, and will furnish accommodation altogether for 450 persons. There are two side isles, as in the late Mosley-street chapel, dividing the pews into three tiers, all on the level; and the building can be warmed by means of hot water passing under the flooring, and the warm air from wh'ch ascends through gratings bordering the aisles. The cost of the land around (which is hereafter to be surrounded with an iron palisading, in harmony with the style that pervades the building,) and of the edifice itself, which was erected by Messrs. Bowden and Edwards, is between 8,000*l*. and 9,000*l*.—*Manchester Advertiser*.

PUBLIC BUILDINGS, &c.

Plymouth.—A meeting was held on the 18th ult. to take into consideration the erection of a Public Hall of very spacious dimensions in this town. Mr. Wightwick, the architect, submitted designs, and an estimate for the building, which met with the general approval of the meeting. The design for the building exhibits a grand Corinthian Portico towards Lockyer-street; and a neat front towards the east, harmonising with the architecture of Princess-square. To give an idea of the size of the great hall, it may be premised, that the ball-room of the Royal Hotel is about 77 feet by 40 feet, while the ceiling of the room proposed, measures 100 feet by 60. This will be surrounded with a gallery 10 feet wide, along the sides and one end, and 20 feet wide at the other end. In the eastern portion of the building are two handsome rooms, 50 by 25 each; and below these are the entrance from Princess-square, with rooms for a resident house-keeper. A great extent of basement is necessarily provided, to be apportioned off for store cellarage as required. The great hall would be lighted by two vast lantern ranges, extending from end to end, immediately under the cornice of the ceiling; and supported by opposite rows of lofty columns, or *antæ*, standing forwards the width of the galleries from the outer walls; so that the interior, (divided, as it were, into a spacious lofty nave, and lower side aisles, and having also galleries on smaller columns across both ends,) will exhibit an unusually rich and varied perspective. This design was, however, merely submitted by Mr. Wightwick, as a sketch, to be modified as occasion may require; and as made out chiefly with the view of obtaining definite information as to the cost of such a building.—*Plymouth Herald*.

Royal Exchange.—The joint committee of the Gresham trust, and the Mercers' company, have applied to Sir Robert Smirke, Mr. Hardwick, and Mr. Barry, to examine the designs sent in for the new Royal Exchange, and select six for the choice of the committee. It is said that the last-named gentleman has declined, and we suppose that the others must be placed in an awkward predicament, as their immediate relatives are understood to be competitors in the contest. It is to be hoped, at all events, that the design chosen may reflect credit on the city of London, and that no paltry considerations of mere rental, will lead to the selection of a project, whose only merit may be its producing "shent per shent" upon the outlay. If such should be the case, the ex-Chancellor of the Exchequer had better have kept his 150,000*l.* laid out in the purchase of valuable buildings for a site to receive such an excrescence, and the committee had better pause ere they pull down the wedgelike masses in front of the Bank, which may serve to conceal this evidence of the taste of our citizens. The eyes of all Europe may be said to be upon the choice of the committee, which is either to reflect credit or disgrace upon our national architecture.—*Times.*

MISCELLANEA.

Thorwaldsen, who has recently completed some mythological bas-reliefs, is at present occupied with a bust of Holberg, and, when that is finished, will undertake, for the Baroness Stampe, a statue of himself in marble. The sculptor is now residing at the beautiful estate of that lady, where she has built an *atelier* for his use. He has lately visited Hamburgh, and made many short excursions in the neighbourhood, which have resembled a continued triumph. Wherever he went he was received with processions, speeches, and all the usual manifestations of respect and pleasure: peasants, it is said, came many miles to see him, and landlords refused to accept payment for the refreshments furnished on these occasions—a proof how far his popularity has extended among the people, however imperfectly the grounds on which it rests may be understood.—*Athenæum.*

A RIVER SCYTHE.—A method has been resorted to for the purpose of cutting the weeds on the upper Witham of sewers, which has proved of great utility, and is deserving of being extensively adopted. It is this: several scythe blades are rivetted together in one length, so as to reach across the river, and also to curve down towards the bed of it. The elasticity of the scythes, and their united length, naturally cause the curvature to take the proper adaptation, and fit the bed; but there are also some weights added, to assist in keeping the implement at a proper depth: besides which it is requisite to let the edge be always horizontal: a broad piece of iron is therefore rivetted at each extremity, at right angles, and to these ends ropes are attached. Three men on each side of the river draw the apparatus upwards, thus meeting the weeds as they are bent downwards by the current: by proceeding thus the weeds are cut close to the roots. Four miles a day can be cut and cleared, but it is necessary to have four men on each side the river to haul and relieve each other, and eight men to follow with rakes.—*Stamford Mercury.*

Wrought Iron Wheels.—Bourne, Bartley & Co's. Patent Wrought Iron Wheels for locomotive engines, railway carriages, &c. The Wheel is made of wrought iron; the spokes of which are *flat*, and placed with their edges towards the running course of the wheel. The Patentees prefer making the naves of *wrought* iron, but they may be *cast* on, though the wheel would then be inferior to one with wrought iron naves.

Copying Oil Paintings.—The German papers state that M. Leipmann, of Berlin, has invented a machine for obtaining copies of oil-coloured paintings. It is further said, that the inventor produced with his machine, in one of the rooms of the Royal Museum, at Berlin, 110 copies of Rembrandt's portrait, painted by himself. M. Leipmann offers these copies for sale at a louis-d'or each.

T. H. Wyatt, Esq. has been appointed architect and surveyor to the Middlesex Hospital in lieu of Mr. Basevi, who resigned that appointment.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 5TH SEPTEMBER TO 26TH SEPTEMBER, 1839.

CHARLES GREENWAY, of Douglas, in the Isle of Man, for "*certain improvements in snuffers.*"—Sealed, September 5; six months.

BRYAN DONKIN, of Blue Anchor Road, Bermondsey, Engineer, for "*an improvement or improvements to be used in the process of making paper by hand or by machinery.*" Communicated by a foreigner residing abroad.—September 5; six months.

PAUL ROBIN, of St. Paul's Chain, London, Gent., for "*improvements in spinning.*" Communicated by a foreigner residing abroad.—September 5; six months.

JOHN RAPSON, of Emmett Street, Poplar, millright and engineer, for "*improvements in steering ships and vessels.*"—September 5; six months.

FREDERICK BROWN, of Luton, in the county of Bedford, ironmonger, for "*improvements in stoves or fire-places.*"—September 9; six months.

SAMUEL STOCKER, of High Holborn, pump maker, for "*improvements in beer, cyder, and spirit engines.*"—September 11; six months.

MOSES POOLE, of Lincoln's Inn, Gent., for "*improvements in apparatus applicable to steam-boilers in order to render them more safe.*" Communicated by a foreigner residing abroad.—September 11; six months.

STEPHEN ROGERS, of the city of Bristol, merchant, for "*certain improvements in building the walls of houses and other edifices.*"—September 16; six months.

ISAAC DODDS, of Masbro, and WILLIAM OWEN, of Rotherham, both in the county of York, civil engineers, for "*certain improvements applicable to railways, and in the construction and manufacture of wheels, engines, and machinery, to be used thereon, part or parts of which are applicable to other engines, and which wheels without a flange are also applicable for use on turnpike roads.*"—September 16; six months.

JOB TAYLOR, of Pendleton, near Manchester, joiner and builder, for "*certain improvements in machinery or apparatus for cutting or forming ornamental mouldings or devices in wood and other materials.*"—September 19; six months.

WILLIAM NEWTON, of Chancery Lane, for "*an improved machine or apparatus for weighing various kinds of articles and goods.*" Communicated by a foreigner residing abroad.—September 19; six months.

JOHN WERTHEIMER, of West Street, Finsbury Circus, printer, for "*improvements in producing ornamental raised surfaces on paper.*" Communicated by a foreigner residing abroad,—September 19; six months.

THOMAS TODD, of Kingston-upon-Hull, Gent., for "*improvements in propelling vessels*"—September 19; six months.

HENRY NEEDHAM SCROPE SHEAPNELL, of Gosport, Gent., for "*improvements in corkscrews.*"—September 26; six months.

SAMUEL WILKS, of Catherine Cross, Darleston, Stafford, iron founder, for "*improvements in boxes and pins, or screws for vices and presses.*"—September 26; six months.

WILLIAM HENRY HORNBY, and WILLIAM KENWORTHY, both of Blackburn, manufacturers, for "*certain improvements in the machinery or apparatus for sizeing, and otherwise preparing cotton, wool, flax, and other warps for weaving.*"—September 26; six months.

TO CORRESPONDENTS.

We have received several more communications on railway curves: we are afraid of tiring the patience of many of our readers by the continuance of the discussion, but knowing the great interest of the subject to the junior members of the profession, we have been induced to extend more space to it than we otherwise should have done. We shall select a few of the communications which remain on our table, and publish them next month, when we hope the discussion will terminate, unless there be any additional communication essentially different to what has already appeared.

Nelson Memorial. *We have to apologize to those parties who have forwarded us additional descriptions of designs, for not making room for their papers, we will try what we can do next month.*

Letters from Mr. Habershon and "A Catholic," relative to our review on half-timbered houses, are postponed until next month, when we shall conclude the review.

Thanks to Mr. Lewis Cubitt for his parcel.

In consequence of the very great length of some of the papers in the present Journal, which we considered best to publish in full, rather than divide them, we are obliged to postpone several communications, reviews of new books, and the principal wood engravings, intended for this month.

The report on the stone for the new Houses of Parliament will be concluded next month, we have only one more table to publish, which is on the chemical analyses of stone, by Professors Daniel and Wheatstone.

The Life of Watt, by Arago, will also be concluded next month, it will be seen that we have apparently *placed the paper out of its proper place, by inserting it after our usual notice to correspondents, which is generally the concluding article of the Journal, we have so placed it in order that the* "Eloge" *might appear unbroken when the volume is bound up; the continuance will form the first article next month.*

The third volume of the professional papers of the Royal Engineers was received as we were going to press; each additional volume, we are happy to say, increases in interest.

We shall be obliged, if correspondents who favour us with engravings and lithographs of designs of buildings, will favour us with a few particulars relative to their construction, cost, dimensions, &c.

The Editor will feel obliged to country subscribers if they will forward any account of works in progress, or any newspapers containing articles or paragraphs connected with the objects of the Journal; it will also be doing a great service if engineers and architects will cause all advertisements connected with contracts to be inserted in the Journal.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, please to direct it to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD. PRICE 17*s.*

THE LIFE OF JAMES WATT.

The interest attached to a life of Watt, and the additional attraction of its emanating from the pen of Arago, has naturally excited in the public, a desire to possess a work, apparently possessing such a valuable character. The controversies which have been raised by those who have read it in its original form, have excited a curiosity, which the well selected extracts in the Athenæum were calculated to provoke. Under such circumstances, this work necessarily demanded our attention, and we thought it therefore, better to give a complete translation accompanied by notes, rather than by referring to specific points, to appear in the position of treating M. Arago unfairly, or of availing ourselves of materials, which were not at the public's disposal.

In determining upon this task at that short notice, which the nature of a periodical work allows, it happened unfortunately that the illness of the gentleman, to whom it was originally confided, still further diminished the brief period, which was necessary for the discussion of a subject so extensive. It rarely happens that a translator can be placed in a position more embarrassing than that imposed by the work of M. Arago; coming, as it does, with all the weight of a great name, its pretensions are contradicted by a mannerism and poverty of style, which on the one hand, compels the translator to slur over these defects, or else to allow the points of detraction full play. Confused by this dilemma, we have generally felt it our duty at every sacrifice, to adhere strictly to the terms of the author. To render his text more clear, we have introduced engraved illustrations of which he was not able to avail himself, and we have still further elucidated it, by occasional notes of our own, and from the able columns of the Athenæum. To Tredgold and to Mr. Robert Stuart, it is needless to say, that no one engaged in the discussion of such a subject, could fail to be under obligations.

We have felt it our duty to express in our remarks, a difference from the views of M. Arago, at which the worshippers of names may feel astonished, but of which the lovers of truth will appreciate the necessity. With the most lavish promises, the work presents most insignificant performance, nothing true of what is new, and nothing new of what is true. It is needless to say, that England comes out from this chamber of torture, pure as she went into it, unaccused by her own confessions, and triumphant over the imputations of her adversaries.

HISTORICAL EULOGIUM ON JAMES WATT.

Read before the Academy of Sciences, at Paris, on the 8th of December, 1833, by M. Arago.

After running through a long list of battles, murders, plagues, famines, and catastrophes of all kinds with which the chronicles of some country were filled, of which I do not remember the name, a philosopher exclaimed "How happy is that nation, the history of which is barren" Why must we say, in a literary point of view, "Ill luck to whoever is obliged to relate the history of a happy people." If the exclamation of the philosopher loses nothing of its truth when applied to individuals, the converse, unfortunately, characterises with equal truth too many biographies.

Such were the reflections which struck me whilst I traced the life of Watt—whilst I collected together the kind communications of the relations, friends, and companions of that illustrious mechanic. His life, truly patriarchal, was devoted to labour, study, and meditation, and affords none of those striking events, the relation of which, used skilfully, serves to relieve the dryness of scientific subjects. I will relate it, however, were it only to shew in what an humble position were prepared those projects destined to raise the English nation to an unexampled degree of power. I shall particularly endeavour to point out minutely the numerous inventions which indissolubly connect the name of Watt with the history of the steam engine. I know the dangers of this plan, I feel the objections which may be raised against it, I know it may be said that we came to hear an historical sketch, and have been obliged to listen to a dry and barren lecture, a reproach, by the bye, which would be of little weight with me, could I but give a lecture on the subject. I will endeavour, therefore, not to trespass too far on your attention, but to recollect that clearness of expression is a matter of courtesy on the part of those who address a public audience

Childhood and Youth of Watt—His employment as Philosophical Instrument Maker to the University of Glasgow.

James Watt, one of the eight foreign members of the Academy of Sciences, was born at Greenock, in Scotland, on the 19th of January, 1736. Our neighbours on the other side of the Channel, are wise enough to think that the genealogy of an honest and industrious family is just as worthy of preservation, as the musty deeds of titled houses, often celebrated only for the enormity of their crimes, or the greatness of their vices. I may, therefore, state, that the great grandfather of James Watt, was a farmer in the county of Aberdeen, and that he was killed in one of the battles of Montrose. The victorious party, as was the custom in civil wars, and, I was going to add, is now, did not think his death a sufficient expiation for the opinions which he had embraced, but still farther punished him in the person of his son, by confiscating his little property This unfortunate child, Thomas Watt, was brought up by some distant relation; and in the isolated position to which he was reduced, gave himself up to serious and assiduous study. On the establishment of tranquility he removed to Greenock, where he taught mathematics and navigation; and afterwards lived at Crawford's Dyke, of which he was one of the magistrates. He died in 1734, aged 92 years.

This Thomas Watt, had two sons, the eldest of whom, John, followed the profession of his father, at Glasgow, and died in 1737, aged 50, leaving a chart of the River Clyde, which was published by his brother James. This latter, the father of the celebrated engineer, was for a long time treasurer, member of the council, and baillie of the burgh, and distinguished himself in those offices by his ardent zeal, and enlightened spirit of reform. He *pluralised*, do not be afraid, (these three syllables, which are now almost excommunicated in France, shall do no injury to the memory of Watt;) he *pluralised* three kinds of employment, he supplied shipping, he was a ship owner, and a merchant, although these, unfortunately, did not prevent him from losing in business, towards the end of his life, part of the fortune which he had so honorably gained. He died at the age of 84, in 1782.

James Watt, the subject of this Eulogium, was born with a very delicate constitution. His mother, whose maiden name was Muirhead, gave him his first lessons in reading. He learned writing and accounts from his father. He also attended the public school at Greenock. Thus the humble Scotch parochial schools* may be as justly proud of inscribing the name of this celebrated engineer among the pupils, whom they have formed, as the college of La Flèche, formerly boasted of Descartes, and as the University of Cambridge, still boast of Newton.

To be precise, I must relate that frequent illnesses prevented young Watt from constantly attending the public school of Greenock; that a great part of the year he was confined to his room, and that there he devoted himself to study, without any out-of-door assistance. As usually happens, the high intellectual faculties, destined to produce such precious fruits, began to be developed in retreat. Being too sickly to allow his parents to think of imposing upon him a laborious occupation; they even left him the free choice of his amusements, and we shall see whether he abused it. A friend of Mr. Watt one day perceived young James stretched upon the floor, and tracing with chalk all sorts of intricate lines. "Why," cried he, "do you allow this child to waste his time thus? send him to school." Mr. Watt replied: "Perhaps, sir, you may have pronounced a hasty judgment. Before condemning us, examine attentively what the boy is about." The reparation was not delayed; the child, only six years of age, was engaged in the solution of a geometrical problem.

Guided by an enlightened tenderness, the elder James Watt, placed a certain number of tools at the disposal of the young student, at an early age; the latter used them with the greatest skill; he took to pieces and put together again the childish toys which passed through his hands, and was always making new ones. At a later period he used them in the construction of a small electrical machine, the brilliant sparks of which became a great source of amusement and surprise to all the companions of the poor invalid.

Perhaps Watt, with an excellent memory, would not have figured among the little prodigies of the ordinary schools. He would certainly have refused to learn lessons like a parrot; he who perceived from his early years the necessity of carefully cultivating the intellectual elements which were presented to his mind. Nature, besides, had created him for meditation. James Watt, also augured very favourably of the rising faculties of his son; relations, however, more distant, and less clear-sighted, did not partake of the same hopes.

* Mr. Arago says grammar schools.—Note of translator.

"James," said Mrs. Muirhead to her nephew one day, "I never saw a more idle lad than yourself; take a book and employ yourself usefully. It is more than an hour since you have spoken a single word. Do you know what you have been doing all this while? You have been taking off and putting on the lid of the tea-pot; you have put the steam which goes from it, sometimes in a saucer and sometimes in a silver spoon; you have amused yourself with examining, uniting together, and laying hold of the drops, which the condensation of the steam formed on the surface of the porcelain or polished metal; is it not a shame to employ your time thus?"

In 1750, perhaps, each of us, like Mrs. Muirhead, would have used the same language; but the world has progressed, and our knowledge has increased. Thus, when, as I shall presently explain, the principal discovery of our colleague consisted of a particular means of converting steam into water, the object of the reproaches of Mrs. Muirhead will present himself before us under a different aspect, and little James before the tea-pot, will be the great engineer preluding the discoveries which were to immortalise him; whilst every one will, undoubtedly, remark that the words, *condensation of steam*, should so naturally be found in the history of the childhood of Watt. Besides, although I may be wrong as to the singularity of the anecdote, it may not be less worthy of preservation. When the occasion presents itself, let us prove to youth, that Newton was barely modest, when, to satisfy the curiosity of a great personage, who desired to know how attraction had been discovered, he replied—By thinking of it always! Let us shew to all, in the simple words of the immortal author of natural philosophy, the principal secret of men of genius.

The taste for anecdote, which our colleague, for more than half a century, diffused with so much grace among those by whom he was surrounded, shewed itself at an early age. The proof of it will be found in some lines which I extract as a translation, from an unpublished note, written in 1798, by Mrs. Marion Campbell, a cousin, and a companion from childhood, of the celebrated engineer.*

"In a journey to Glasgow, Mrs. Watt gave her young son, James, in charge to one of her friends. A few weeks after she came back to see him, but certainly without thinking of the singular reception which awaited her. Madam, said this friend to her as soon as she perceived her, you must send James back quickly to Greenock. I can no longer bear this state of excitement in which he puts me. I am harrassed for want of sleep. Every night, when the usual hour of bed time for my family is at hand, your son contrives, skilfully, to raise some discussion, in which he always finds means to introduce a tale which necessarily beget others. These tales, either pathetic or comic, are so charming and interesting, and my whole family listens to them so intently, that you might hear a fly buzz. Thus hour follows hour without our perceiving it, but on the morrow I am almost dying with fatigue; do, Madam, take back your child with you."

James Watt had a younger brother, John,† who, by determining to follow the career of his father, left him, after the Scotch custom, the choice of his avocation; but this avocation was difficult to find out, for the young student occupied himself in all with equal success. The banks of Loch Lomond, already so celebrated by its connexion with the historian Buchanan, and with the illustrious inventor of logarithms, developed his taste for botany. His rambles upon different Scotch mountains, caused him to perceive that the inert crust of the globe is not less worthy of attention, and he became a mineralogist. James, in his frequent encounters with the poor inhabitants of these picturesque countries, deciphered their local traditions, their popular ballads, and their wild prejudices. When his ill-health detained him at home, chemistry became the principal object of his experiments. The Elements of Natural Philosophy, by 's Gravesande, also initiated him into the thousand wonders of general physic. Indeed, like all sick persons, he devoured all the medical and surgical works he could procure. These latter sciences had so excited the curiosity of the scholar, that he was one day discovered carrying off to his chamber for dissection, the head of a child which had fallen the victim of some unknown malady.

But Watt did not design himself either for botany or mineralogy, for letters, poetry, or chemistry, neither for physics, medicine, or surgery, although he was so well versed in each of these classes of study. In 1755 he went to London, and placed himself under Mr. John Morgan, mathematical and marine instrument maker, in Finch-lane, Cornhill. The man who was to cover England with machines, by the side of which, as to their powers, the ancient and colossal machine of Marly would be but a pigmy, entered on his industrious career, by making, with his own hands, subtle, delicate, and frail instruments; those small, but admirable reflecting sextants, to which the nautica art is so much indebted for its progress.

Watt only remained a year with Mr. Morgan, and returned to Glasgow, where rather serious difficulties awaited him. Relying upon their ancient privileges, the incorporated trades looked upon the young artist from London as an intruder, and obstinately denied him the right of opening any kind of workshop. Every means of reconciliation having failed, the University of Glasgow interposed, granted to young Watt a small place within their own precincts, allowed him to establish a shop, and honoured him with the title of their mathematical instrument maker. Some small instruments, of this date, of exquisite workmanship, made entirely by the hand of Watt, are still existing. I will add, that his son recently shewed me the first sketches of the steam engine, which are truly remarkable for their fineness, their strength, and precision of stroke. It was not, therefore, without reason, whatever people may say, that Watt spoke with complacency of his manual skill. Perhaps you will think that I am over scrupulous in claiming a merit for our colleague, which can add so little to his glory. But, I will admit, that I never hear the pedantic enumeration of qualities of which superior men have been despoiled, without remembering that bad General of the age of Louis XVI., who always carried his right shoulder very high, because Prince Eugene, of Savoy, was a little hump-backed, and who did not think himself bound to endeavour to carry the likeness farther.

Watt had hardly attained his twenty-first year, when the University of Glasgow attached him to the University. He had for his patrons, Adam Smith, the author of the famous work on the Wealth of Nations; Black, whose discoveries concerning latent heat and carbonate of lime, gave him a distinguished rank among the first chemists of the eighteenth century; and Robert Simson, the celebrated restorer of the most important treatises of the ancient geometricians. These eminent persons at first, thought they had only saved from the trickeries of corporations, a skilful and zealous workman of mild disposition; but they were not slow in discovering the man of genius, nor in shewing him the strongest friendship. The students of the university considered it an honour to be admitted to the intimacy of Watt. Indeed, his shop! yes! a shop! became a sort of academy, where all the illustrious men of Glasgow attended, to discuss the most delicate questions of art, science, and literature. In truth, I should not dare to tell you what part the young workman, only 21 years of age, took in these learned meetings, if I could not rely upon an anonymous article of one of the most celebrated compilers of the Encyclopedia Britannica.

"Although still a student, said Professor Robison, "I had the vanity to think myself sufficiently advanced in my favourite studies of mechanics and physics, when I was presented to Watt. So that I was not a little mortified to see to what an extent the young workman was my superior. In the University, when any difficulty stopped us of whatever kind, we ran to our workman. Once excited, every subject became for him a matter of laborious study and new discoveries. He never gave up till he had quite solved the proposed question, whether he reduced it to nothing, or whether he drew from it some clear and substantial result. Once the solution seemed to require the reading of Leupold's work, the *Theatrum Machinarum*: Watt immediately learned German. Under other circumstances, and for a similar purpose, he acquired Italian. The artless simplicity of the young mechanic immediately gained the good will of all who addressed him, and, although I have lived some time in the world, I am obliged to declare, that I could not cite a second example of an attachment so sincere, and so general shown towards any person of incontestible superiority. It is true, that this superiority was veiled by the most amiable candour, and that it was united with a firm desire to acknowledge liberally the merit of every one. Watt, even delighted in endowing the inventive disposition of his friends with things which frequently were but his own ideas, presented under another form. I have," says Robison, "the greater right to insist upon this rare mental disposition, as I have personally experienced its effects."

You will have to decide, if it were not as honourable to pronounce these last words, as to have caused them to be pronounced.

Studies so serious, and so various, to which the young Glasgow artisan was continually compelled, by the circumstances of his singular position, did not hinder the routine of the shop. The latter he executed by day; while night was sacred to theoretical research. Watt, trusting in the resources of his imagination, seemed to delight in the most difficult undertakings, and in those for which it might have been supposed that he was least calculated. Will it be believed that he undertook to build an organ, he, who was so totally insensible to the charms of music, that he could never even contrive to distinguish one note from another; for example, ut from fa? Nevertheless he succeded in the attempt. It cannot either be denied that the new instrument exhibited some capital improvements in the mechanical part, in the regulators, in the manner of appreciating the strength of the wind; but you will be surprised when I inform you that its harmonical qualities were not less remarkable, and that they charmed even professed musicians. Watt solved an important part of the problem: he found out the medium assigned by an artist, in explanations of the phenomenon of pulsations; at that time little appreciated, and of which he could get no information but in the profound, but very obscure work, of Doctor Robert Smith, of Cambridge.

History of the Steam Engine.

I have now come to the most brilliant period of the life of Watt, and also, I fear, to the most difficult part of my task. The immense importance of the inventions I am about to describe to you does not admit of a doubt. Unfortunately, perhaps, I shall not be able to make them

* I am indebted for this curious document to my friend, Mr. James Watt, of Soho. Thanks to the profound veneration which he has preserved for the memory of his illustrious father; thanks to the inexhaustible complaisance with which he has received all my demands, I have been able to avoid several inaccuracies which glided into the most esteemed biographies, and from which even I, deceived by verbal communications, too lightly received, did not, at first, know how to guard myself.—*Note by M. Arago.*

† He died in 1762, on board one of his father's ships, on the passage from Greenock to America, at the age of 23 years.

thoroughly appreciated, without having recourse to tedious numerical comparisons. In order that these comparisons, if rendered indispensable, may be easily understood, I will allude as briefly as possible to the beautiful physical laws upon which it will be necessary to base them.

By means of simple changes of temperature, water may exist in three perfectly distinct states; in the solid state, the liquid state, and the ærial or gaseous state. Below zero, of the centigrade thermometer, (32° F) water becomes ice; at 100° (212° F) it is rapidly converted into gas; in all the intermediate degrees it is liquid.

A scrupulous observation of the points of transition from one of these states to another, leads to first-rate discoveries, which are the keys to the economical doctrines of the steam-engine.

Water is not necessarily hotter than any kind of ice, for it may be kept at the temperature of zero (32° F) without freezing; while ice may remain at zero (32° F) without melting; but it seems difficult to believe that water and ice, both of the same degree of temperature, both being at zero, only differ in their physical properties; that any element foreign to water, properly so called, cannot make a distinction between solid water and liquid water. A very simple experiment will, however, clear up the mystery.

Mix a pound of water at zero (32° F), with a pound of water at 75° centigrade, (167° F); the two pounds of the mixture will be at 37½° (99½° F), that is to say, at the medium temperature of the two component liquids. You thus perceive that the warm water has retained 37½° of its former temperature, whilst it has yielded the other 37½° to the cold water; all that is natural, and what might easily be forseen.

But let us now repeat the experiment with a single modification; instead of the pound of water at zero (32° F), let us take a pound of ice at the like temperature of zero, (32° F). From the mixture of this pound of ice with the pound of water at 75° (167° F), will result two pounds of liquid water, since the ice steeped in the warm water cannot fail to be melted, and it will keep its former weight. But do not hastily attribute to the mixture, as before, a temperature of 37½°, (99½° F.) for this will lead to an error: the temperature will be that of zero only. No trace will remain of the 75° (167° F.) of heat that the pound of water possessed. These 75° (167° F.) will have disunited the particles of ice, and have combined with them, but without warming them in any way,

I do not hesitate to pronounce this experiment of Black one of the most remarkable in modern natural philosophy. Look, indeed, at its consequences:

Water at zero, and ice at zero, (32° F.) differ in their intimate composition. The liquid comprises 75° (167° F.) of an imponderable substance, called heat, more than the solid. These 75° (167° F.) are so well concealed in the composition, I had almost said in the aqueous alliance, that the finest thermometer does not discover its existence. Heat, imperceptible to our senses, imperceptible to even the most delicate instruments; in short, latent heat, for that is the name given to it, is one of the principal constituents of bodies.

The comparison of boiling water, of water at 100° (212° F), with the steam which flies off, and also of a temperature of 100° (212° F.), leads to like results, but on a grander scale. At the time of being converted to a state of vapour at 100° (212° F), water becomes impregnated under a latent form, under a form not perceptible to the thermometer, with an enormous quantity of heat. When steam resumes the liquid state, this heat is disengaged, and goes to warm every thing, on its way, susceptible of absorbing it. If, for example, you cause a single pound of steam at 100° (212° F) to pass through 5·35 pounds of water at zero, the steam will become quite liquified. The 6·35 pounds resulting from the mixture are at a temperature of 100° (212° F). There enters then into the intimate composition of a pound of steam, a quantity of latent heat which would raise a pound of water, if prevented from evaporating, from 0 to 535° centigrade., (964° F.) This result will certainly appear enormous, but it admits of no doubt. Steam only exists on these conditions: wherever a pound of water at zero (32° F) is converted into steam, either naturally or artificially, it should take, to effect the change, and it does in fact take from the surrounding bodies, 535° (964° F) of heat. It cannot be too often repeated, that steam, in fact, restores these degrees upon whatever surfaces its ultimate liquifaction is affected. This is, indeed, the whole artifice from the fuel to the steam. They but badly comprehend this ingenious process, who imagine that aqueous gas only conveys to the pipes in which it circulates, perceptible or thermometrical heat; the principal effects are due to component heat, to hidden heat, to latent heat, which is disengaged at the moment, when the steam, by coming in contact with cold surfaces, is converted from a gaseous to a liquid state.

Henceforth, we must rank heat among the principal constituents of steam. We can only obtain heat by burning wood or coal. Steam, therefore, bears a market price higher than water, by the cost of the fuel employed in the act of vaporization. If the difference of the two values is very great, you must principally attribute it to latent heat, for thermometrical or sensible heat only bears a very small proportion to it.

Perhaps, at a later period, I shall have to dwell on some of the other properties of steam, so that if I do not mention them now, you must not imagine that I attribute to this assembly the disposition of certain students, who once said to their professor of geometry: "Why do you take "so much trouble to demonstrate these theorems? We have the fullest "confidence in you; give us your word of honor that they are true, and "that will be enough!" But I must not abuse your indulgence; I must bear in mind, that by referring to special treatises, you can easily fill the gaps which I have been obliged to leave.

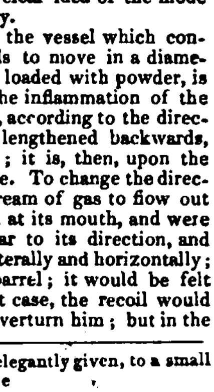
Let us now endeavour to determine the position of those nations which appear deserving of notice in the history of the steam-engine; let us trace the chronological series of improvements which this machine has undergone from its first glimmerings, now almost forgotten, down to the brilliant discoveries of Watt. I take up this subject with the fixed determination of being impartial; with a strong desire of rendering to every inventor that justice which is due to him; and with the certainty of remaining independent of every consideration which should or may originate in national prejudice, alike unworthy of the mission intrusted to me, alike unworthy of the majesty of science. I admit, on the other hand, that I shall pay but little attention to the numerous decisions passed under the dictation of similar prejudices; and, if possible, I shall heed still less, the severe criticisms which undoubtedly await me, for it is seldom in things of this nature that the future does not resemble the past.

A question well put is half resolved. If this sensible maxim had been borne in mind, certainly, the discussion on the invention of the steam-engine would not have assumed that acrimonious and violent character, with which until now it has been so strongly impressed. But, in endeavouring to single out one inventor, where, of necessity, several should have been distinguished, people rashly cast themselves into a defile, without an outlet; a watchmaker, well acquainted with the history of his art, would be obliged to hold his tongue before any one who asked him, in general terms, who invented watches; on the other hand, he would be but little embarrassed by the question, if it related separately to the motion, to different forms of the escapement, or to the balance—so thus it is with the steam-engine: it presents, at this day, the realization of several original, but very distinct ideas, which could not have emanated from the same source, but out of which, it is still our duty carefully to search the origin and date.

If, having made any use whatever of steam would give, as has been pretended, a right to figure in the history of this invention, we should be obliged to assign the first place to the Arabians, since, from time immemorial, their principal food, which they call *couscousson*, has been cooked by the action of steam on strainers, placed over rude kettles. A result like this is quite sufficient to throw back all the ridicule upon the source from which it was derived. Did Gerbert, our fellow countryman, who wore the triple crown under the name of Sylvester II., acquire a greater, when, towards the middle of the ninth century, he made the pipes of the organ of the cathedral of Rheims sound by the aid of steam? I do not think so: in the instrument, fashioned by the future pope, I can only discover a current of steam substituted for a current of ordinary air, the production of the musical phenomenon in the pipes of the organ, but in no wise a mechanical effect, properly so called. I find the first example of motion, engendered by steam, in a toy* still more ancient than the organ of Gerbert; in an eolipile of Hero of Alexandria, the date of which goes back to 120 years before our era. Perhaps it would be difficult, without the aid of a figure, to give a clear idea of the mode of action of this little instrument; but I shall try.

When the gas escapes, in a certain way, from the vessel which contains it, this vessel, by means of re-action, tends to move in a diametrically opposite direction. The recoil of a gun, loaded with powder, is on the same principle; the gas, engendered by the inflammation of the saltpetre, charcoal, and sulphur, flies off in the air, according to the direction of the barrel; the direction of the gun, lengthened backwards, abuts on the shoulder of the person who fired; it is, then, upon the shoulder that the butt end should re-act with force. To change the direction of the recoil, it is sufficient to cause the stream of gas to flow out in another direction. If the barrel were stopped at its mouth, and were only pierced with a lateral opening, perpendicular to its direction, and horizontal, the gas of the powder would escape laterally and horizontally; and the recoil would act perpendicularly to the barrel; it would be felt on the arm and not on the shoulder. In the first case, the recoil would push the person who fired, backwards, as if to overturn him; but in the

* *Hero's Steam Toy.*—A motion round an axis is elegantly given, to a small globe, by means of the re-action of steam upon the air. Two pipes, *a*, *c*, each having their upper extremity bent towards each other, rise from the cover of a vase, *o*; one of these, *c*, acts merely as a pivot, the other, *a*, conducts steam, raised in the boiler, into the ball or globe, *i*. This is suspended between them by having the steam-pipe, *a*, inserted into it, and is kept in its position by the pivot formed at the end of the opposite pipe, *c*. Two pipes, *m*, *n*, also bent at right angles at their extremities, are inserted into the circumference of the globe, and form a communication between the cauldron and the atmosphere.



Heat being applied to the cauldron, the steam, flowing from it through the vertical pipe *a*, into the little globe, *i*, thence finds its way through the pipes or arms, *m*, *n*, into the atmosphere; at this instant the re-action of the vapour on the air makes the globe revolve with a magical celerity, "as if it were animated from within by a living spirit."—*Stuart.*

second, it would tend to make him turn round on himself. If, then, you were invariably to attach the barrel in a horizontal position, to a moveable vertical axis, at the moment of the explosion it would change its direction, more or less, and would cause this axis to turn.

Preserving the same disposition, let us suppose, that the vertical rotary axis be hollow, but closed at its upper part; that it abut below, like a chimney upon a cauldron, in which steam is generated; that, moreover, there exist a free lateral communication between the interior of this axis and the interior of the gun barrel, so that, after having filled the axis, the steam penetrates into the barrel, and goes out through its side, by a horizontal opening. Except in intensity, this steam, in its escape, will act in the same manner as the gas disengaged from the powder would act in a gunbarrel, stopped at its mouth, and pierced laterally, but, here, we shall not have a simple shock, as happened in the case of the sharp and instantaneous explosion of the gun; on the contrary, the rotary motion will be uniform and constant, like the cause by which it is generated.

If we take, instead of a single gun, or rather a single horizontal tube, a vertical rotary tube, we shall have, with some slight differences, the ingenious work of Hero, of Alexandria. This is, without any fear of contradiction, a machine in which the steam of water engenders motion, and might produce mechanical effects of some importance—in fact, a genuine steam engine. Let us, however, not fail to remember that neither by form, nor by the mode of action of motive power, has it any resemblance to the machines of that kind now in use. If ever the reaction of a current of steam should be rendered useful in practice, we must incontestably award the originality of the suggestion to Hero; * but at the present day the rotatory eolipile can only be cited here in the same manner as engraving on wood is referred to in the history of printing. †

In the machines used in our factories, in steam packets, and on railways, motion is the immediate result of the elasticity of steam; it is, therefore, worth while to inquire how and where the idea of this power originated. The Greeks and Romans were certainly not unaware that the steam of water could acquire a prodigious mechanical power, and they explained, even at that time, by the sudden vaporization of a large mass of this liquid, the fearful earthquakes which, in a few seconds drove the Ocean from beyond its natural limits; scourges which, at one fell blow, sweep from their foundations the strongest monuments of human industry, which raise dangerous shoals in the soundless depths of the ocean, and raise up lofty mountains even in the middle of continents. Whatever may be said, this theory of earthquakes does not necessarily suppose that its authors had gone into investigations, experiments, and precise calculations. No one is now ignorant that at the time when heated metal is admitted into the earthen or plaster moulds of the founder, that a few drops of moisture, concealed in these moulds, are sufficient to cause a dangerous explosion. Notwithstanding the progress of science, our modern founders have not been always successful in preventing these accidents; how then could the ancients have provided against them? While they cast the moulds of statues, the splendid ornaments of their temples, public places and gardens, and of the private habitations of Athens, and of Rome, some accident must necessarily have happened; the men of art found out the immediate cause; the philosophers, on the other hand, carrying out the spirit of generalization, which was the characteristic trait of their schools, saw in these instances, genuine types of the eruptions of Etna.

All this may be very true, without having much relation to the subject with which we are engaged, and I have not, I own, dwelt so much as I might have done upon such slight lineaments of the ancient science relative to the power of steam, desirous, if I could, of remaining in peace with the Daciers of both sexes, with the Dutens of the age.‡

Natural or artificial powers before they become truly useful to man, have nearly always been pressed into the service of superstition, and steam forms no exception to the general rule. The chronicles inform us, that on the banks of the Weser, the god of the ancient Teutons sometimes expressed his displeasure, by a sort of thunderclap, which was immediately succeeded by a cloud, filling the whole edifice. The image of the god, Busterich, found it is said, in antiquarian researches, fully reveals the manner in which the pretended miracle was worked. The god was, metal, and the hollow head enclosed an amphora of water; wooden stoppers shut up the mouth and another hole situated above the forehead. Coals were adroitly introduced into a cavity of the skull and gradually heated the liquid; the steam engendered, soon drove out the stoppers, with a loud noise, and then rushed out, in two jets, forming a dense cloud between the god and his stupid worshippers. It seems, also, that during the middle ages the monks made the invention tell, and that the head of Busterich did not perform only before heathen assemblies.*

The next step, by which we reach any useful ideas on the properties of steam, after the first glimpses of the Greek philosophers, is by an interval of twenty centuries. It is true, however, that then experiments exact, conclusive, and irresistible succeed conjectures, unsupported by any tangible proof. In 1603, Flurence Rivault, gentleman of the chamber to Henry Ist., and tutor to Louis XIII., discovered, for instance, that a bomb of thick metal, and containing water, explodes sooner or later, on being placed on the fire, after *being stoppered*; that is to say, when the steam is prevented from freely expanding in the air, in proportion as it is formed. The power of steam is here characterised by a proof, clear, and susceptible to a certain point of numerical appreciation,† but it presents itself still farther to us as a terrible instrument of destruction.

Able minds did not stop at this miserable conclusion, they perceived that mechanical powers must become, like human passions, useful or injurious, precisely as they are well or ill directed. In the case of steam only, the commonest skill was really necessary to apply to productive labour, the terrible elastic power, which, according to all appearances, shakes the earth to its foundations, surrounds the art of the statuary with imminent dangers, and bursts into a thousand pieces the thick metal of the bomb. In what state is this projectile found before its explosion? The bottom contains very hot water, *but still liquid*; the rest of its interior is full of steam; this, for it is the characteristic mark of gaseous bodies, exercises its power equally on all sides, and presses with the same intensity on the water, and on the metal walls which retain it. Let us place a cock at the lowest part of the metal; when it is opened, the water, pressed by the steam, will spout out with extreme velocity. If the cock ends in the pipe, which, after having been bent outside around the bomb, is turned vertically from the bottom upwards, the water driven back will ascend it so much the more, as the steam has more elasticity; or rather, for it is the same thing in other words, the water will raise itself so much the more, as its temperature becomes higher; this ascending movement will only be limited by the resistance of the walls of the machine. For our bomb, let us substitute a thick metallic boiler, of large capacity, and nothing will prevent us from carrying great masses of the liquid to indefinite heights, by the simple action of steam; and we shall have created, in every meaning of the word, a steam-engine for draining.

You now know the invention which France and England have disputed, like formerly, seven cities of Greece contended, in turn, for the honor of giving birth to the immortal Homer. On the other side of the channel, the Marquis of Worcester, of the illustrious house of Somerset, is universally recognized; this side of the strait, however, we contend that it belongs to an humble mechanic, almost totally forgotten by biographers, Solomon de Caus, who was born at Dieppe, or in its neighbourhood. Let us examine impartially the claims of the two competitors,

* It is a remarkable fact, of which M. Arago appears not to be aware, that Hero's simple engine of emission is *at this moment* in use, both in this country and in America. We know of one steam-engine of Hero's of twenty-one horses' power, and its only fault is the consuming too much steam and fuel. It is, otherwise, a simple, cheap, and effective steam-engine.—Note of the Athenæum.

† These remarks also apply to a plan published at Rome, in 1629, by Branca, an Italian architect, in a work entitled, La Macchina, and which was to engender a rotatory movement, by directing the steam issuing from an eolipile, under the form of a bellows or a blast of wind, upon the floats of a wheel. If, contrary to probability, steam should one day be employed, usefully, as a direct blast, Branca, or the unknown author, from whom he might have borrowed this idea, will take a first-rate position in the history of this new kind of machine; but, with regard to the present machine, Branca's claims are absolutely null,—*Note of M. Arago.*

‡ For the same reason, I cannot refrain from relating here an anecdote, which, with a spice of romance and paradox comparison, as to what we now know of the action of steam, gives us a glimpse of the importance which the ancients attached to the power of this mechanical agent. It is related that Anthemius, the architect, employed by Justinian in the building of St. Sophia, had a house near that of Zeno, and that to annoy this orator, his open enemy, he placed on the ground floor of his own house, several cauldrons full of water. From holes cut in the lids of each of these cauldrons, he carried a flexible tube, which was applied to the party-wall under the beams which supported the flooring of Zeno's house; and that, as soon as the fire was lighted under the cauldrons, he made the floors dance as if they had been affected by an earthquake.—*Note by M. Arago.*

* Hero, of Alexandria, attributed the sounds, proceeding from the statue of Memnon, when the rays of the sun fell on it, and which excited so much controversy, to the passage by certain openings of a current of steam, which the solar heat produced, at the expense of the liquid, with which the Egyptian priests are said to have furnished the interior of the pedestal of the colossus. Solomon de Caus, Kircher, and others, have endeavoured to find out the particular means by which the theocratic fraud was thus made to operate upon credulous imaginations, but every thing induces us to believe that they have not hit upon the right cause, if on this subject any thing were to be guessed at all.—*Note by M. Arago.*

† If any learned personage should discover that I have not gone far enough back, by beginning with Flurence Rivault; if he should point out to me a quotation from Alberti, who wrote in 1411; and if, from this author, he affirmed that in the commencement of the fifteenth, century the lime-burners feared extremely for themselves and their ovens, the explosions of lime-stones, in which there might chance to be some cavity, I should reply, that Alberti was not himself aware of the true cause of these explosions, but attributed them to the transformation *into steam* of the air contained in the cavity, acted upon by the flames; and I should observe, that a bit of lime-stone, accidently hollow, would not have given any of those means of numerical appreciations which seem to be presented by Rivault's experiments.—*Note by M. Arago.*

In the first era, many of the experiments of steam were known and thoroughly understood. Steam was included, as it is by modern writers, under the head of the airs or gases, and was said to consist of water turned into air by heat. This has misled M. Arago, for, being apparently acquainted with the works of the Greek philosophers only through the medium of translations, he seems to imagine that when they speak of air producing a given effect, they mean only atmospheric air, whereas they fully explain themselves to mean water turned into air, using the word generically, not specifically, just as we should say water converted by heat into the gas or vapour, commonly called steam. Therefore, he infers, that they were ignorant of the principle of generating steam from water for their peculiar purposes, and asserts that the effects mentioned are attributable only to the gaseous matter of our atmosphere—whereas, Hero, of Alexandria, more than a century before the Christian era, understood the subject of the generation of steam from water by heat, and its application to true machinery, philosophical toys, or worse, engines devoted to the service of superstition and idolatry.—*Note of the Athenæum.*

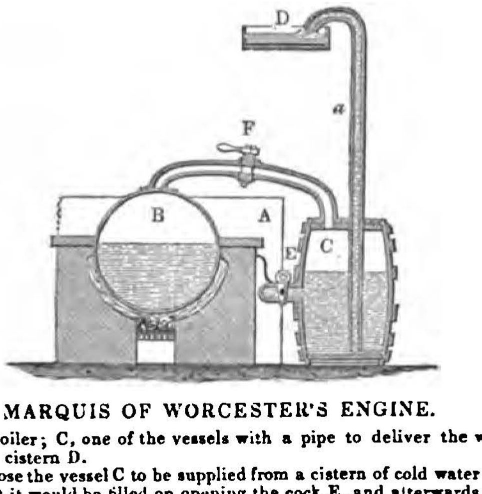
Worcester, seriously implicated in the latter years of the reign of the Stuarts, was confined in the Tower of London; one day, according to tradition, the lid of the pot in which his dinner was being cooked, suddenly flew off. "What is to be done in such a melancholy den, unless we have the liberty of thought?" The Marquis set himself to work, then, to think of the strange phenomenon which he had just witnessed. Then it occured to him, that the same power which raised the pot-lid would, under other circumstances, become a useful and convenient motive power. On recovering his liberty, he published, in 1663, in a book entitled *the Century of Inventions*, the means by which he proposed to carry out his idea.* This method, as to its essential character, seems, as far as it can be understood, to be the bomb half filled with the liquid and the ascending tube, which we have just described.

This bomb, this same tube, are described in the "Raison des forces mouvantes," † a work of Solomon de Caus. There the idea is presented clearly, simply, and without any exaggeration. Its origin has nothing romantic; it tells no story of civil war, nor of celebrated dungeons, not even of the lifting of the pot-lid of a prisoner's kettle. ‡ But, what is worth much more, in a question of priority, it is, by its publication, forty-eight years older than the *Century of Inventions*, and forty-one years antecedent to the imprisonment of Worcester

Thus brought back to a comparison of dates, the dispute would seem to be closed; for who could maintain that 1618 did not happen before 1663? But those whose principal object seems to have been to remove every French name from this important chapter in the history of the sciences, § suddenly shifted their ground, when *La Raison des forces Mouvantes* was brought out of the crowded libraries in which it had been buried. They broke, without hesitation, their ancient idol. The Marquis of Worcester was sacrificed to the desire of annulling the claims of Solomon de Caus; the bomb placed on the blazing furnace. and its ascending tube ceased, in fact, to be the true germs of the present steam-engine.*

As to myself, I cannot concede that he has done nothing useful, who, reflecting on the enormous expansion of steam greatly heated, first saw that it could be used to raise great masses of liquid to any imaginable height. I cannot admit that some remembrance is not due to the mechanic, who, the first also, described a machine fit for realising such results. We must not forget that we cannot judge properly of the merit of an invention, except by transporting one's self in thought to the period at which it was conceived, and divesting the mind for the moment of all the information which ages, subsequent to the period of this invention, have contributed. Let us imagine an ancient mechanic, Archimedes for instance, consulted on the means of raising to a great height, the water contained in a vast closed metallic recipient. He would certainly have spoken of great levers, pulleys, simple or combined, perhaps of his ingenious screw; but what would be his surprise if, to resolve the problem, some one proposed merely a bundle of sticks and a match? Will, I ask, would any one dare to refuse the title of an invention to a process with which the immortal author of the first and true principles of statistics and hydrostatics would have been astonished? † The apparatus of Solomon de Caus, this metallic envelope, within which was created an almost indefinite motive power, by means of a faggot and a match, will always figure nobly in the history of the steam-engine.

It is very doubtful whether Solomon de Caus and Worcester ever had their apparatus constructed: ‡ this honour belongs to an Englishman, Captain Savery. I assimilate the machine of this engineer to that of



* MARQUIS OF WORCESTER'S ENGINE.

B is the boiler; C, one of the vessels with a pipe to deliver the water to an elevated cistern D.

Now suppose the vessel C to be supplied from a cistern of cold water A by a pipe, so that it would be filled on opening the cock E, and afterwards closing it; if, when the steam in the boiler is of sufficient strength, the cock F be opened, the pressure of the steam on the water in C would cause it to ascend from C, through the pipe *a* into the cistern D. The vessel C being emptied, and the cock F being shut, it would refill with water on again opening the cock E. Another vessel C, and its cocks and pipes, are necessary to complete the species of water engine indicated by the description, and these may be on the other side of the boiler.—*Tredgold.*

† The Reason of moving Forces.

‡ M. Arago, with the same bad taste which influences the stile and matter of this memoir in too many places, here endeavours to throw unnecessary ridicule upon a legend, which, by its very simplicity, he is well aware gives a strong guarantee of its truth. The flimsy story of Solomon de Caus, wanted all the support of such wretched cavils; but we should have hoped that M. Arago, while endeavouring to maintain his character, as a man of impartiality and freedom from prejudice, by the choice of such a subject as Watt, would have found it useful to support in the details, what he will not otherwise gain credit for as a whole. This is too old a game of the enemy, however, to deceive the world; the French are too fond of realizing Swift's sarcasm of knocking down the other's mound instead of raising their own. It was thus that Voltaire, to acquire a reputation for his Henriade, attempted to reduce, in his *Essai sur la Poesie Epique*, Shakspeare and Milton to his own level. M. Arago, however, with all his talk about romance, has set afloat a more romantic French sentimental story, about the interview between the Marquis of Worcester and Solomon de Caus in a mad house. Why did not M. Arago, at the same time, laugh at the traditions of Archimedes and the bath, Galileo and the lamp, and Newton and the apple? why not conjure up for these a similar ribaldry of style, and an equal lowness of thought?—*Note of the translator.*

§ If M. Arago can tell what good French names have done in the history of the steam-engine, he is welcome to leave there as many as he likes, and to disinter as many volumes as he pleases from the *ponderous libraries*. He cannot deprive our race of a Savery, a Watt, and a Trevithick, of applying the steam-engine to draining, to mining, to every branch of manufactures, to the pathless ocean, and the iron road, the inventions of the high and low pressure principles, and their convertion in this continent and the other to many arts of peace and war. To all the rest the French are welcome—the *inane nomen* of cramming into such company the innumerable men who have talked, and who have done no more. France is too rich in great names, has too many realms of science exclusively her own, to humble herself to the indulgence of such petty jealousies, which do wrong to a noble country, and to a memory which every man of science must honour and respect. There are nobler places for M. Arago than the tribune, either of the academy, or of the senate house. This memoir is but one of the many instances of the mischevious system of which it is a part, invented by Louis XIV; this deplorable system has praised every traitor and villain down to the present time.—*Note of the translator.*

* It has been printed that J. B. Porta gave, in 1606, in his *Spiritali*, nine or ten years before the publication of the work of Solomon de Caus, the description of a machine intended to raise water by means of the elastic power of steam. I have shown elsewhere that the learned Neapolitan *spoke neither directly nor indirectly, of any machine* in the passage alluded to; but that his purpose, his only purpose, was to determine, experimentally, the relative volumes of water and steam; that in the little experimental apparatus employed for this purpose, steam could only raise the liquid, according to the very words of the author, a few inches; that in every description of this experiment, there is not a single word implying that Porta was acquainted with the power of this agent, and the possibility of applying it in the production of an effective machine.

Can it be supposed that I am obliged to quote Porta, if it be only on account of his researches on the transformation of water into steam? But I should then reply, that this phenomenon had already been studied with attention by Professor Besson, of Orleans, towards the middle of the sixteenth century, and that one of the treatises of this mechanic, dated 1569, especially contains an essay on the determination of the relative volumes of water and steam.—*Note of M. Arago.*

The candour of M. Arago seems to fail him more and more; but we leave this portion to the able castigation of the Athenæum, hereafter quoted.—*Note of the translator.*

† Putting out of the question the illogicality of this pseudo argument, we may simply observe that it is but a part of the false system by which M. Arago finds it necessary to bolster up their shallow claims. Here we have a reason for secluding the anecdote of Anthemius (p 402) in the obscurity of a note, and the reason for slurring it over as of suspicious authenticity; for admitting what M. Arago says concerning the properties of the apparatus of Solomon de Caus, was it not anticipated by the operation of Anthemius? He certainly knew that steam was a motive power, or why did he attempt such a powerful experiment in the house of Zeno? Anthemius certainly knew of the *bundle of sticks and a match.*—*Note of the translator.*

‡ There is no doubt as to the case of Solomon de Caus—he never constructed a machine; and there is none as to the Marquis of Worcester, for he certainly did. We have done sufficient to shew the groundlessness of M. Arago's pretensions, so that we cannot do better than sum up the question with the following able remarks of the *Athenæum.*

"When the revival of learning, towards the conclusion of the dark ages, exhumed once more the knowledge of the Greeks, Hero's work was one of the first productions of the press. It gave an excitement to the mechanical talent of the age—many ingenious men imitated and extended the contrivances of Hero, and produced ingenious mechanical toys; and Gerbert, Cardan, Mathesias, Baptista Porta, Solomon de Caus, Giovanni Branca, Cornelius Drebel, Kircher, and others, imitated the machines of Hero, and made some modifications of their structure, and extended their applications.

"Out of this group, M. Arago selects one of the least distinguished—Solomon de Caus—and endeavours to exalt him to the pedestal of fame, as the inventor of the steam-engine, because, forsooth, he took up the inventions of Hero, and slightly modified them. The following are the facts of the case:—1, It is not known of what country De Caus was a native; 2, It is well known that he was engineer and architect to Charles the First, and was employed in designing hydraulic ornaments for his Palace of Richmond; 3, That he dedicates the second part of his work to Charles's sister, the Electress Palestine; 4, That he resided, for a time, at Heidelberg; 5, That a French edition of his work was dedicated to the king of France, in whose service he appears, at one time, to have been engaged; 6, That, amongst other things in his book, he describes a machine for throwing up a jet of water, in a manner similar to Hero's steam jet; an invention which he does not even claim as his own, but describes amongst a number of others; "*dont il se peut faire diverses machines, j'en donnerai ici la demonstration d'une.*"

On this slender ground, M. Arago builds the following theory:—1, That De Caus was certainly a Frenchman! 2, That this machine, described by De Caus, to make a small jet of water play ornamentally in the air, was certainly his own invention, and was, literally, a steam-engine, suitable to the purpose of draining mines of water!! 3, That Solomon de Caus is the inventor of the steam-engine!!!

"To this we reply,—1, That De Caus may have been a German, a Frenchman, an Englishman, or a Jew; 2, That De Caus is, in all probability, only describing the invention of another, and that he puts forth no claim to originality; and 3, That the invention, if his own, is a mere machine for projecting an ornamental jet of water for a garden, inferior to many of Hero's toys.

"But we cannot but believe that M. Arago himself is aware of the weakness of his cause; for, in explaining the machine of De Caus—which he calls a *veritable machine de vapeur, propre à opérer des épuisemens*—he has not inserted De Caus's own drawing of the machine, which would have at once shown its nature as a trivial and useless toy; but he gives a figure and description of his own invention, so altered as to lead his two predecessors,* although he introduced some essential modifications; that, among others, of generating the steam in a separate vessel. † If it is of little difference as to principle, whether the motive steam be engendered at the expense of the water to be raised, and in the very heart of the boiler in which it is to act, or whether it originates in a separate vessel, to act at pleasure, by means of a communicating tube, having a cock above the liquid, which is to be raised, it is certainly not the same in a practical point of view. Another change still more important, well worthy of special attention, and equally originating with Savery, will be alluded to in the space we shall devote to the labours of Papin and Newcomen.

Savery had entitled his work, *The Miner's Friend*, but the miners showed themselves little obliged to him for his complaisance, for, with only one exception, none of them gave any orders for his engines. They were only employed in conveying water to different parts of palaces, country-houses, parks, and gardens; and were never used but in altering the level from 12 to 16 yards. We must acknowledge, moreover, that the danger of explosion would have been considerable, if there had been applied to the apparatus that immense power which their inventor asserted they could attain.

Although the practical success of Savery was rather imperfect, yet the name of this engineer merits a very distinguished place in the history of the steam-engine. Persons whose whole life has been devoted to speculative subjects, are unaware what a difficulty there is in bringing the most apparently well digested plan into execution. I do not, like a celebrated German savant, pretend that *nature always cries out no! no!* when we wish to raise a corner of the veil which covers her, but by following the same metaphor, we are at least allowed to affirm that the attempt becomes so much the more delicate and difficult, and the success so much the more doubtful, as it requires the combination of a greater degree of mechanical skill, and the employment of a large number of material elements; under every one of which considerations, and taking the period into calculation, no one was ever placed in a more unfavourable position than Savery.

I have spoken until now only of those steam-engines, the resemblance of which, to those now bearing that name, is, more or less, indisputable. Now I shall consider the *modern steam-engine*, that which is employed in our manufactories, upon vessels, and in the shafts of nearly all our mines. We shall see it arise, increase, and develope itself sometimes on the inspiration of some chosen individual, some on the spur of necessity, for necessity is the mother of genius.

The first name which we find in this new epoch, is Denis Papin. It is to Papin that France owes the honourable rank which she claims in the history of the steam-engine. However, the really legitimate pride with which we are inspired by his success, will not be without alloy. The claims of our fellow countryman are only to be found in foreign collections, his principal works were published beyond the Rhine; his liberty was threatened by the edict of Nantes, and it was in mournful exile that he enjoyed for a moment that of which men of research are the most desirous—tranquillity of mind. Let us quickly throw a veil over these unfortunate results of our civil discords; let us forget that fanaticism attacked the religious opinions of the philosopher of Blois, and get back to our machinery, with regard to which, however, the orthodoxy of Papin has never been contested.

In every machine there are two things to be considered—on the one hand, the movement, and on the other, the disposition, more or less complex, with fixed or moveable parts, by means of which the motive power communicates its action to resistance. In the height to which mechanical knowledge has now-a-day been carried, the success of a machine, intended to produce great effects, depends principally upon the nature of the motive power, and on the means of applying and conducting its power. And it was to the production of an economical moor, capable of communicating incessant oscillations, and with great power, to the piston of a large cylinder that Papin devoted his life. To borrow afterwards, from the oscillations of the piston, a sufficient power to turn the stones of a corn-mill, or the cylinders of a flatting-engine, the paddle wheels of a steam-boat, or the bobbins of a cotton spinning machine—to lift the clumsy hammer, which beats with frequent strokes the colossal lumps of glowing iron, fresh from the reverberating furnace, to cut, like a riband in a lady's hand, thick bars of metal with the sheering blade of gigantic scissars; these are, I assert, so many problems of a very secondary rank, and which would not trouble the most common-place mechanic. We can therefore employ ourselves in considering exclusively the means by which Papin proposed to engender his oscillatory motion.

Let us suppose a large vertical cylinder, open at top, and resting at the base, on a metal table, having a hole in it, closed or opened at pleasure by a cock. Into this cylinder let us introduce a piston, that is to say, a circular plate full and moveable, which will close it entirely; the portion of the atmosphere which occupies the lower part of the cylinder will then tend by its re-action to produce an inverse motion. This second force will be equal to the first, if the cock be open, since a gas presses equally on all sides. The piston will then be acted upon by two opposite forces, which will keep it in equilibrium; although it will descend, but only by its own gravity. A counterpoise in a small degree heavier than the piston, will on the contrary be sufficient to lift it to the top of the cylinder, and to keep it there. Let us suppose the piston arrived at this extreme position, and let us endeavour to point out the means of causing it to descend *with great force* and to bring it back again. Imagine, that after having closed the lower cock, we succeed in *suddenly* annihilating all the air contained in the cylinder, in a word to empty it. This vacuum having once been made, the piston only receiving its action from the external atmosphere which presses from above, *will rapidly* descend. This movement effected, the cock is opened, the air immediately returns from below, and counterbalances the action

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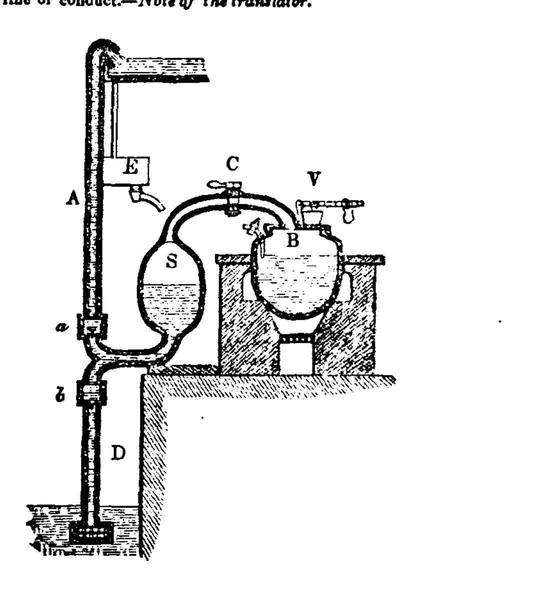
his reader to suppose an effect produced of a different and important character Herein we cannot but think that M. Arago's candour appears for a moment to have yielded to his desire to flatter the vanity of his countrymen, and render himself popular

"In the second era, the era of successful application of the power of steam to useful purposes, we find, first of all, the Marquis of Worcester. There is no doubt whatever urged by M. Arago, against the authenticity of the Marquis's written and published descriptions of the steam-engine, but he contents himself with asserting that the Marquis never made his machine! nor applied it to use, and that therefore *he* stands on no better ground than De Caus. It is to be regretted, that M. Arago did not make himself better acquainted with the published history of the steam-engine, for he would then have known that the Marquis of Worcester not only made a steam-engine, but that it was applied to the purpose of raising water for the use of the inhabitants of Vauxhall; that it was of more than two-horse power, and that it was seen in operation, amongst others, by Cosmo de' Medici, on the 28th day of May, 1653, who gives testimony thus—"it raises water more than forty geometrical feet, by the power of one man only; and in a very short space of time will draw up four vessels of water through a tube or channel not more than a span in width, on which account it is considered to be of greater service to the public, than the other machine near Somerset House;"—the machine at Somerset House being one driven by two horses.

"In brief, let M. Arago say what he may, Worcester, Savery. Newcomen, and Smeaton, are the great names of this era; and Dr. Papin, though he made many clever attempts at the contrivance of machines, on the principles suggested by his predecessor, the Marquis of Worcester, and his contemporaries, Savery and Newcomen, was never known to make a single successful attempt with steam, excepting applying it to the extraction of nutriment from bones, an invention which bears his name, and for which alone it is that futurity will ever mention it."—*Note of the translator.*

* Bonnani says, however, that after the death of Kircher, there was found in his museum *the model* of a machine which that enthusiastic author had described in 1656, and which differed from that of Solomon de Caus, by the mere fact, that the motive steam was engendered in a vessel totally distinct from that which contained the water to be raised.—*Note of M. Arago.*

It is thus that M. Arago gradually distributes in his notes the slain corses of Solomon de Caus' competitors; but we leave to our readers to make their comments on this extraordinary line of conduct.—*Note of the translator.*



† SAVERY'S ENGINE.

It consisted of a furnace and boiler B; from the latter two pipes, provided with cocks C, proceeded to two steam vessels S, which had branch pipes from a descending main D, and also to a rising main pipe A; each pair of branch pipes had valves *a*, *b*, to prevent the descent of the water raised by the condensation or by the force of steam. Only one vessel S, is shown, the other being immediately behind it. One of the steam vessels being filled with steam, condensation was produced by projecting cold water, from a small cistern E, against the vessel; and into the partial vacuum made by that means, the water, by the pressure of the atmosphere, was forced up the descending main D, from a depth of about twenty feet; and, on the steam being let into the vessels again, the valve *b* closed, and prevented the descent of the water, while the steam having acquired force in the boiler, its pressure caused the water to raise the valve *a*, and ascend to a height proportional to the excess of the elastic force of the steam above the pressure of the air.

Captain Savery afterwards simplified this engine considerably, by using only one steam vessel. To prevent the risk of bursting the boiler, he applied the steelyard safety valve V, invented by Papin for his digester. The cocks were managed by hand; and, to supply the boiler with water, he had a small boiler adjoining to heat water for the use of the large one, and thus prevent the loss of time which must have occurred on refilling it with cold water.—*Tredgold.*

of the atmosphere above; as in the beginning, the counterpoise brings up the piston to the top of the cylinder, and all parts of the apparatus are restored to their original condition. A second evacuation, or rather if you prefer it, a second annihilation of the interior air will again bring down the piston, and so on as before.*

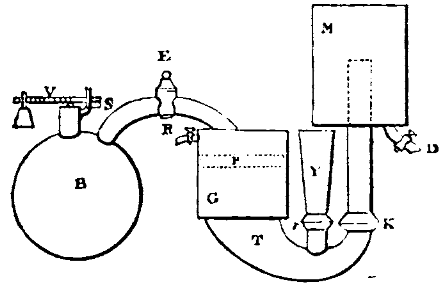
The true motor of the system would in this case be the weight of the atmosphere, and let us undeceive those who might imagine, that because they can walk and even run through the air with ease, that it possesses neither power, or weight. With a cylinder, two metres (78 inches) in diameter, the effort which the piston of the engine would make in descending, the weight which it could lift the whole height of the cylinder would be 31,000 kilogrammes (69,281 lbs.) This enormous power, frequently renewed, would be obtained by means of a very simple machine, if we discover a prompt and economical method of engendering and destroying at pleasure an atmospheric pressure in a metal cylinder.

This problem Papin solved—his fine, his great solution, consisted of the substitution of an atmosphere of steam, for an atmosphere of common air, if replacing this by a gas which at 100° centigrade (212°F) has precisely the same elastic power, but with an important advantage which the ordinary atmospheric does not possess, that of the power of the aqueous gas weakening itself very quickly when the temperature is lowered, so that in the end it disappears almost entirely, if the refrigeration be sufficient. I should characterize the discovery of Papin, as well, and in fewer words, if I should say, that he proposed to make use of steam to create a vacuum in large spaces, and that this method is prompt and economic. †

The machine in which our illustrious fellow countryman was the first to combine in this manner the elastic power of steam, with the property which steam possesses of being annihilated by refrigeration, he never executed on a large scale; his experiments were confined to mere models. The water intended to engender the steam, did not even occupy a separate boiler, but inclosed in the cylinder, it rested on a metallic plate, which closed it at bottom. It was this plate which Papin heated directly to convert the water into steam, and it was from this same plate that he removed the fire when he wished to effect the condensation. A similar process, hardly endurable in an experiment intended to verify the correctness of a principle, would evidently be inadmissible if it were requisite to make the piston move with rapidity. Papin, while he said "that this could be effected by different constructions easily to be imagined," did not point out any of these modes of operation He left to his successors both the merit of the application of this fruitful idea, and that of the inventions in detail, which alone can secure the success of a machine.

In the first part of our investigation on the employment of steam, we quoted the ancient philosophers of Greece and Rome; one of the most celebrated mechanics of the school of Alexandria; a pope; a gentleman of the court of Henry the Fourth; an hydraulist, born in Normandy, that fertile birth-place of great men, which has contributed to the national pleiad, Malherbe, Corneille, Poussin, Fontenelle, La Place, and Fresnel; a member of the House of Lords, an English mechanic; and lastly a French physician of the Royal Society of London, for we are obliged to confess, that Papin almost always exiled, was only a corresponding Member of our Academy. Now is the time for simple mechanics and workmen to enter on the scene, in which it will be found that all classes of society have united for the formation of a machine, of which the whole world is to enjoy the benefit.

In 1705, fifteen years after the publication of the first memoir of Papin, at Leipsic, Newcomen and Cawley, the first, a hardwareman; the other a glazier, at Dartmouth, in Devonshire, constructed, (recollect that I do not say projected, for the distinction is important)* a machine intended for draining, and in which there was a separate boiler in which the steam originated. This machine, as well as Papin's little model, consists of a vertical metal cylinder, closed at the bottom and open at top, and a piston, well fitted, intended to traverse it in its whole length in ascending and descending. In both, when the steam arrives freely at the bottom of the cylinder, fills it, and thus counterbalances the pressure of the external atmosphere, the ascending movement of the piston is effected by means of a counterpoise. † In the English machine, indeed, in imitation of that of Papin, as soon as the piston has arrived at the termination of its ascending course, the steam which had contributed to raise it, is refrigerated. A vacuum is thus made in the whole capacity

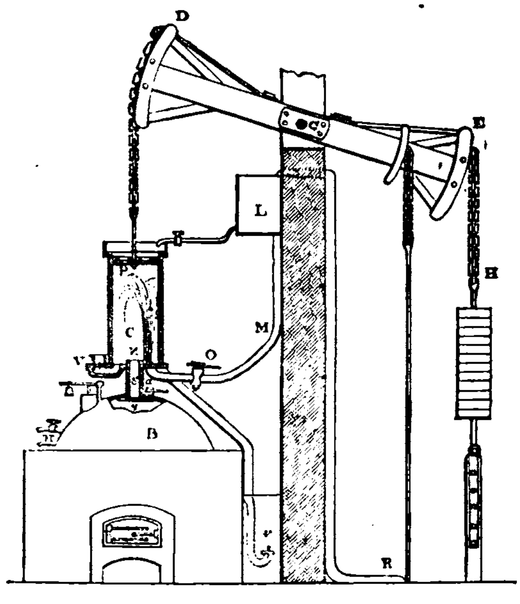


* PAPIN'S MACHINE.

Consisted of a boiler B, provided with a safety valve V; and a cylinder G H, connected to the boiler by a steam pipe S. The cylinder was closed at the top, and contained a floating piston P; and the base of the cylinder terminated in a curved tube T, which ascended into a cylinder M; the bent tube had a pipe Y, from a reservoir of water communicating with it, and it was provided with a valve at r. Now suppose the cylinder G H, to be filled with cold water by the pipe Y, from the reservoir, and the boiler to contain strong steam; by opening the cock E, the steam would be admitted, and, pressing on the floating piston P, cause the water to ascend into the cylinder M: its return is prevented by the valve K, and the steam cock E being shut, and the cock R opened, to let the condensed steam escape at the pipe R, the water from the reservoir refills the steam cylinder through the pipe Y, and it is ready for repeating the operation. The water raised to be directed to any useful object by the pipe D.—*Tredgold.*

† An English mechanist, doubtlessly deceived by an unfaithful translation, asserted some time ago, that the idea of employing steam in the same machine as an elastic power, and as a rapid means of engendering a vacuum, belonged to Hero. On my side I have proved incontestably that the mechanist of Alexandria never thought of steam; that in his apparatus the alternate movement was only to be produced by the dilatation and condensation of the air, arising from the intermitting action of the solar rays.—*Note of M. Arago.*

* M Arago, still acting upon the old system, again commences a system of trickery, which is fortunately too cobwebby for any audience but one, to the prejudices of which it was addressed. To any other it would have needed an explanation how his country glazier found means to benefit by Papin's *projection* at Leipsic.—*Note of the translator.*



† NEWCOMEN'S STEAM ENGINE.

The following is a description of the engine, as far as it was improved by Newcomen. B represents the boiler with its furnace for producing steam; and at a small height above the boiler is a steam cylinder, C, of metal, bored to a regular diameter, and closed at the bottom, the top remaining open. A communication is formed between the boiler and the bottom of the cylinder, by means of a short steam pipe, S. The lower aperture of this pipe is shut by the plate *p*, which is ground flat, so as to apply very accurately to the whole circumference of the orifice. This plate is called the regulator, or steam cock, and it turns horizontally on an axis *a*, which passes through the top of the boiler, and is fitted steam-tight; and has a handle to open and shut it.

A piston P is fitted to the cylinder, and rendered air-tight by a packing, round its edge, of soft rope, well filled with tallow to reduce the friction, and its upper surface is kept covered with water to render it steam-tight. The piston is connected to a rod, P A, which is suspended by a chain from the upper extremity D of the arched head of the lever, or working beam, which turns on the gudgeon G. This beam has a similar arched head E F, at its other end, for the pump rod H, which receives the water from the mine. The end of the beam to which the pump rod is attached, is made to exceed the weight and friction of the piston in the steam cylinder; and when the water is drawn from such a depth, that the steam piston is too heavy for this purpose, counterpoise weights must be added at I, till the piston will rise in the steam cylinder at the proper speed. At some height above the top of the cylinder is a cistern L, called the injection cistern, supplied with water from the forcing pump R. From this descends the injection pipe M, which enters the cylinder through its bottom, and terminates in one or more small holes at N. This pipe has at O a cock, called the injection cock, fitted with a handle. At the opposite side of the cylinder, a little above its bottom, there is a lateral pipe, turning upwards at the extremity, and provided with a valve at V, called the snifting valve, which has a little dish round it to hold water for keeping it air-tight.

which it traversed, and the external atmosphere forces it to descend. To effect the necessary refrigeration, Papin, as we know, was satisfied with removing the pan of fuel which heated the bottom of his metal cylinder. Newcomen and Cawley employed a process much better in every respect, they caused a considerable quantity of cold water to flow into the ring-like space contained between the external surface of the cylinder of their engine and a second cylinder, a little larger, in which it was enclosed. Cold thus was communicated gradually to the whole thickness of the metal, and ultimately reached the steam itself.*

Papin's machine, thus perfected† as to the manner of refrigerating the steam, or of condensing it, excited the greatest interest in the mine proprietors—it extended rapidly into several counties of England and rendered important service; the little energy of its movements, a necessary consequence of the slowness with which the steam was refrigerated and lost its elasticity, was however a deep source of regret. Chance luckily pointed out a very simple means of remedying this inconvenience.

In the commencement of the eighteenth century, the art of stuffing large metal cylinders and closing them hermetically by means of metal pistons was still in its infancy; therefore, in the first engines of Newcomen the piston was covered with a layer of water for the purpose of filling up the vacancies between the circular centre of this moveable piece, and the surface of the cylinder. To the great surprise of its constructors, one of their engines seemed to oscillate much more rapidly one day than it did generally. After examining it carefully, they saw clearly that on that day the piston had a hole in it, and that the cold water fell in driplets, which in passing through the steam were rapidly dissipated. From this fortuitous observation is to be dated the complete suppression of external refrigeration and the adoption of the rose spout which carries a *shower of cold water* through the whole extent of the cylinder, at the time pointed out by the descent of the piston. The action thus acquires the desired rapidity.

Let us see also, if chance has not a share in another improvement equally important. The first engine of Newcomen requires the closest attendance on the part of the person, who was constantly employed in opening, and shutting the cocks, either to introduce aqueous steam into the cylinder, or to throw into it a jet of cold water for the purpose of condensation. It happened one day that this person was a youth named Henry Potter, who was very anxious of joining in the joyous games of his playfellows. He is burning with the desire of joining them, but the task which is confided to him, does not allow half a minute's absence. His head is excited, passion gives him genius, he discovers relations of which, until that moment he had never had any idea.‡ Of two cocks, one was to be opened at the moment when the beam, which Newcomen first introduced into his engines with such effect, had terminated its descending oscillation, and it was obliged to be closed exactly at the end of the opposite oscillation. The management of the second was precisely contrary. Thus the positions of the beam and those of the cocks was necessarily dependent on each other. Potter took advantage of this remark, he observed that the beam could be used to communicate to the other parts, all those movements which the action of the engine required, and immediately carried his conception into execution. The ends of several strings were attached to the handles of the cocks, and the other ends Potter fastened to convenient points of the beam, so that the oscillations of the beam acting on the strings by ascending and descending, opened and shut the cocks and supplied the place of manual labour; and for the first time the steam engine acts of itself, for the first time it has no other attendant near it than the stoker, who, from time to time comes to renew and keep up the fuel under the boiler. For the strings of the boy Potter, manufacturers soon substituted rigid vertical rods, fixed to the beam and armed with levers, which press upwards and downwards the heads of the different cocks. These rods have now been supplanted by other combinations, but however humiliating the confession may be, all these inventions are simply modifications of the mechanism which was suggested by a boy who wanted to join his playfellows.

In collections of apparatus there are a good many machines, of the utility of which to manufacturers great hopes have been formed, but which the dearness of their construction, or their maintenance, has reduced to mere curiosities. Such would have been the final lot of Newcomen's machine, at least in localities deficient in fuel, if the labours of Watt, of which I must now give you an analysis, had not introduced an unexpected perfection. This perfection, however, must not be considered as the result of any casual observation, or of a single ingenious inspiration, for its author arrived at it by assiduous study, and by experiments of extraordinary beauty and delicacy. It might be said, that Watt had adopted Bacon's celebrated maxim, "To write, speak, meditate, or act, when we are not well provided with *facts* to excite our thoughts, is to navigate without a pilot along a coast bristling with dangers; it is to launch out in the immense ocean without compass or helm."

There was in the collection of the University of Glasgow, a small model of Newcomen's steam engine, which had never worked properly. Anderson, the Professor of Natural Philosophy, gave it to Watt to repair. Under the skilful hand of the workman, the faults in its construction disappeared, and from that time the model worked every year in the lecture room before the wonder-struck students. An ordinary man would have been contented with this success, but Watt, according to custom, only saw the opportunity for deeper studies. His researches were successively directed to every point which seemed to clear up the theory of this machine. He determined the quantity of expansion of the water when it passes from a liquid state to that of steam; the quantity of water which a given weight of coal can vaporize; the quantity of steam in weight which one of Newcomen's engines, of known dimensions, consumes at each oscillation; the quantity of cold water which is necessary to be injected into the cylinder to give the descending oscillation of the piston a certain power; and, finally, the elasticity of steam at different temperatures.

Here was enough to have occupied the life of a laborious mechanic; Watt, however, found out the means of succeeding in many and most difficult pursuits, without interrupting the labours of the workshop. Dr. Cleland wished to take me to the house to which our colleague used to retire to make experiments on leaving his shop, but unfortunately we found it pulled down. Our sorrow was great, but of short duration; on the site of the foundation, still existing, ten or twelve hardy labourers, seemed as if sanctifying the birth-place of the modern steam-engine. They were hammering different parts of a boiler, larger certainly than the humble dwelling which formerly adorned the spot. On this site, and in similar circumstances, the most elegant mansion, the finest statue, the most sumptuous monument, would have been less fitting to the genius *loci* than the gigantic boiler.

If the properties of steam are still present in your minds, you will perceive at once that the economic action of Newcomen's machine requires two irreconcilable conditions. When the piston descends, the cylinder must be cold, or it would meet steam still very elastic, which would greatly retard its action and diminish the effect of the external atmosphere. When, therefore, steam at 100° C (212° F.) rushes into the same cylinder, if the surfaces are cold this steam warms them by a partial liquefaction, and until they acquire a temperature of 100° C. (212° F.) the elasticity is considerably diminished. The consequence is, a slowness in the movements, for the counterpoise does not lift up the piston before there exists in the cylinder a springiness sufficient to counterbalance the action of the atmosphere. Thence also an increased expense, since, as I have explained, steam is very dear. We shall see directly the immense importance of this economic consideration, when I inform you that the Glasgow model used at each oscillation a volume of steam several times greater than that of the cylinder. The expense of the steam, or, what comes to the same, of the fuel, or, rather, if you prefer it, the indispensable pecuniary expense of maintaining the movement of the machine, would be several times less if we could get rid of those successive coolings and heatings, the inconveniences of which I have pointed out.

This problem, apparently insolvable, Watt resolved by the simplest means. He found it sufficient to add to the former disposition of the machinery a vessel distinct from the cylinder, and only communicating with it by means of a narrow tube provided with a cock. This vessel, which is now called a *condenser*, is Watt's principal invention, and notwithstanding my desire to shorten the subject, I cannot avoid explaining its action.

(*To be continued.*)

* Savery had already had recourse to a current of cold water, which he turned upon the *exterior surface* of a metal vessel, to condense the steam which this vessel contained. Such was the origin of his association with Newcomen and Cawley, but it must not be forgotten that the patent of Savery, his machines, and the work in which he describes them, are many years later than the memoir of Papin.—*Note of M. Arago.*

† A recent carricature represents some one inviting an Irishman to a dinner of roast beef and potatoes. "Oh!" says the Irishman, "I have just had a dinner of that same, barrin the meat." This seems to be the case with M. Arago and his friends, De Caus and Papin, they contributed every thing except what was most essential.—*Note of the translator.*

‡ This is one of those overflown descriptions in which M. Arago delights to indulge. A mischievous boy, wanting to play truant, immediately becomes a subject of divine inspiration. It is our duty to perform our task strictly, so that we feel bound to make this apology to our readers for not veiling this phrase in more sober terms.—*Note of the translator.*

There proceeds also from the bottom of the cylinder a pipe Q, of which the lower end is turned upwards, and is covered with a valve *v*; this part is immersed in a cistern of water called the hot well, and the pipe itself is called the eduction pipe. To regulate the strength of the steam in the boiler, it is furnished with a safety valve, constructed and used in the same manner as that of Savery's engine, but not loaded with more than one or two pounds on the square inch.

The mode of operation remains to be described. Let the piston be pulled down to the bottom of the steam cylinder, and shut the regulator or steam valve *p*. Then the piston will be kept at the bottom by the pressure of the atmosphere. Apply the fire to the boiler till the steam escapes from the safety valve, and then, on opening the steam regulator, the piston will rise by the joint effect of the strength of the steam, and action of the excess of weight on the other end of the beam. When it arrives at the top of the cylinder, close the regulator *p*, and, by turning the injection cock O, admit a jet of cold water, which condenses the steam in the cylinder, forming a partial vacuum, and the piston descends by the pressure of the atmosphere, raising water by the pump rod H from the mine. The air which the steam and the injection water contain, is impelled out of the snifting valve V, by the force of descent, and the injection water flows out at the eduction pipe Q; and by repetition of the operations of alternately admitting steam and injecting water, the work of raising water is effected.—*Tredgold.*

THE LIFE OF JAMES WATT *(concluded.)*

If a free communication exist between a cylinder full of steam and a vessel exhausted of steam and air, part of the steam in the cylinder will pass with great rapidity into the vessel, and the motion will continue until the elasticity is uniform throughout. Supposing, then, that by means of an abundant and continual injection of water, the vessel could be kept constantly cold throughout its extent, the steam would be condensed on its arrival, all the steam with which the cylinder was originally filled would be successively brought in, and the cylinder would thus be relieved from the steam, without its surfaces being in the least refrigerated, and the new steam with which it might be necessary to refill it would lose none of its elasticity.

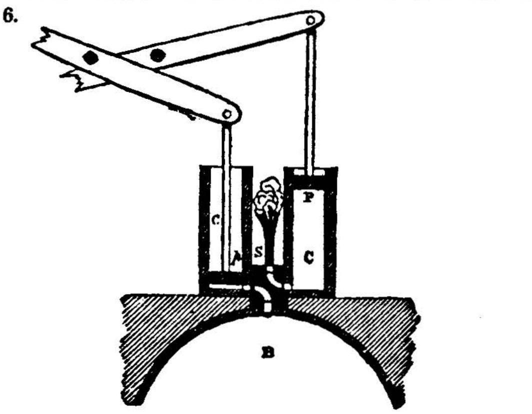
The *condenser* attracts to itself the steam of the cylinder, on the one hand, because it contains cold water, and on the other, because the remainder of its capacity does not contain any elastic fluid. But the moment that a first condensation of steam has been effected, these two successful conditions disappear; the condensing water becomes warmed by absorbing the latent caloric of the steam; a considerable quantity of steam is formed at the expence of this warm water, and the cold water contained atmospheric air, which has been liberated during the elevating of the temperature. If after each operation, this hot water were not taken away, together with the steam and air which the condenser contains, it would in the end produce no result. Watt, effected this triple evacuation by means of an ordinary air pump, of which the piston is carrried by a rod attached to the beam and set in motion by the engine. The power employed in keeping the air pump in motion diminishes by so much, the power of the machine, but this is nothing in comparison with the loss which ensued in the old process, by the condensation of the steam on the cold surfaces of the body of the cylinder—*see fig.* 9.

One word more, and the advantages of another invention of Watt's will be apparent to every body. When the piston descends in Newcomen's engine, it is the atmosphere which impels it; this atmosphere is cold, and must consequently cool down the surfaces of the metallic cylinder, open at the top, which the cold air successively covers throughout.* This cooling down is only overcome during the ascending course of the piston, at the expense of a certain quantity of steam. No loss of this kind, however, exists in the improved engines of Watt; the atmospheric action is totally shut out in the following way. The cylinder is closed at top by a metal covering, perforated only in its centre by an opening provided with close stuffing, through which the piston rod moves freely, without allowing a passage either for the air or the steam. The piston thus divides the cylinder into two distinct and closed portions; when it descends, the steam of the boiler passes freely in the upper portion by a pipe properly placed, and forces it down in the same way as was done by the steam in Newcomen's engine. This motion is executed without any hinderance, the bottom of the cylinder only being in communication with the condenser, in which all the inferior steam is turned into water. From the moment that the piston has gone down, it is only required to turn a cock to open a communication between the two parts of the cylinder situated above and below the piston; when both parts are filled with steam of the same degree of elasticity, the piston is then in a state of equilibrium, and is raised to the top of the cylinder, as in the atmospheric engine of Newcomen, by the mere action of a slight counterpoise—*see fig.* 10.

While following up his search into the means of saving steam, Watt reduced still further, almost indeed to nothing, the waste, which occurred from the cooling down of the outer surface of the cylinder in which the piston works. To effect this, he enclosed the metal cylinder in a larger wooden cylinder, and filled with steam, the ring-like interval which divided them.

Thus was the steam-engine completed—the perfection which it derived from the hand of Watt is evident, its immense utility admits not of a doubt. You would expect therefore, that it would immediately re-place, as a means of draining, the comparatively ruinous engines of Newcomen. Do not deceive yourselves; the author of a discovery has always to contend with those whose interests it may affect, with the obstinate partisans of all that is old, with the jealous and the envious. These classes combined, form, we are obliged to confess, the greater part of the public, and yet in my calculation, I omit double cases to avoid a paradoxical result. This compact mass of opponents, time alone can separate and destroy; but time is not enough, they must be attacked boldly, they must be attacked without ceasing; the means of action must be varied, imitating the chemist, who, is taught by experience that the entire dissolution of certain alloys requires the successive employment of several acids. That strength of character and persistance of will, which in the long run defeat the cunningest intrigues, may not, some-

Fig. 6.



LEUPOLD'S ENGINE.

M. Arago has omitted to notice the contrivance of Leupold, which we shall here give, in order that this ingenious inventor may not be passed over unnoticed.

Leupold was a native of Saxony; in 1723 he commenced publishing a large collection of machines, which extended to several folio volumes; among other inventions, he suggested the *high pressure engine, and four-way cock*, a view is given in fig. 7. Over a boiler B, he placed two cylinders C C, fitted with steam-tight pistons, *p p*. A four-way steam-cock, S, is placed between the boiler and cylinders, so as to alternately admit steam into one cylinder, and let it out from the other. The piston, by the admission of strong steam from the boiler below it, is raised, and depresses the other end of a lever connected to the rod of a plunger of a pump, which causes the water to rise through the pipe, and by the alternate action of the steam in the two cylinders a continual stream of water is raised. Thus the first rude notice of the principle of employing high pressure steam under a piston was given.

Fig. 7 and 8.

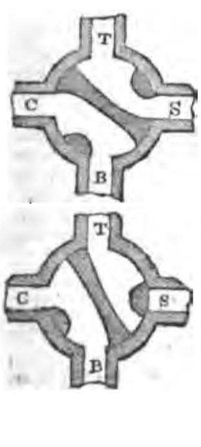
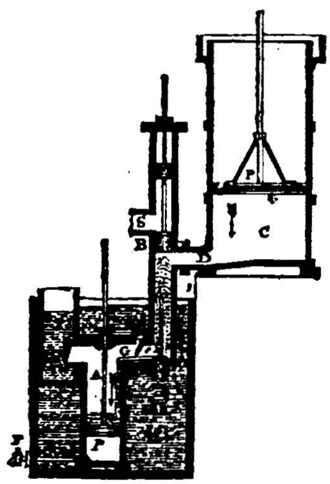


Fig. 7 and 8, show an enlarged view of the *four-way cock*, T is a passage to the top of the cylinder, and B that to the bottom, S the passage for the steam, and C the passage to the condenser. Fig. 7, shows the passage from S to T, open for the steam to pass from the boiler to the top of the cylinder, and the passage from B to C open to allow the escape of the steam from below the piston to the condenser, when the diagonal is turned across to the opposite direction, the passages are then reversed, the steam from the boiler will then pass to the bottom of the cylinder by the passage from S to B, and the steam above the piston will escape through the passage T and C to the condenser. The other figure shows in what manner the steam may be shut off at any period of the stroke.

Fig. 9.



ATMOSPHERIC ENGINE, WITH CONDENSER.

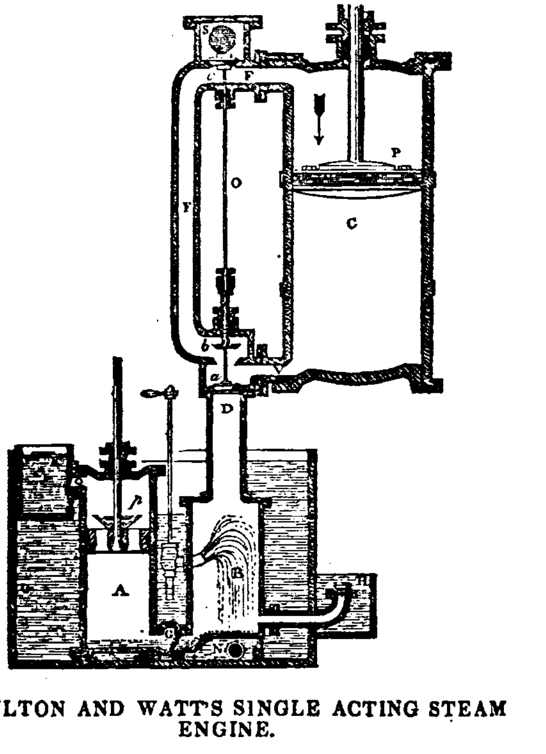
Fig. 9, shows an engine of this kind, where C is a cylinder, open at the top; P the piston. The steam passes from the boiler through the pipe S, and by a slide B into the cylinder at D, and raises the piston. A is a pump with a solid piston, to receive the condensed steam, air, and water, and expel it: the injection is made into the pipe E; and I is the injection cock: F is a cock to let out any air that may collect below the piston p, when the engine is at rest. To begin the operation, the slide B must be raised above S, and steam admitted till all the air be blown out at the valve Q; the pistons being at the top in both the Cylinder and pump: then shut off the steam by the slide B, and open the injection: and in consequence of the condensation produced by the jet, the atmosphere will press on the top of the piston and press it down, and during the first descent, the cock F should be open, but afterwards closed: the injection being stopped, and the slide B moved to close the passage to the condenser, on opening that for the steam, the pistons will again ascend, and the air and water of condensation will be expelled at the valve Q. The alterate opening and closing of the passage and the injection cock are required to continue the action. The engine may be regulated by closing the valve B at any period of the ascent, and the cock I at any period of the descent.

times, be united with an inventive genius, and Watt himself in case of need, would furnish the strongest evidence of this. His admirable invention, his happy idea of the possibility of condensing steam in a vessel entirely separated from the cylinder in which the mechanical action takes place, dates from 1765. Two years elapse, and yet he has hardly taken any steps to apply it on a large scale. His friends at last obtained an introduction for him to Doctor Roebuck, who established the Carron foundry, still enjoying a high celebrity. The manufacturer and the inventor united; Watt gave up to him two-thirds of his patent, an engine is made on the new principles and confirms all his theoretical provisions. His success was complete, but at this period the fortune of Doctor Roebuck received a severe check; Watt's invention would have doubtless restored it, all that was wanting was a sleeping partner to supply funds, but Watt thought it was better to give up his discovery and change his trade.

In 1767, whilst Smeaton was surveying between the rivers Firth and Clyde, for one of those gigantic works of which this part of Scotland afterwards became the scene, we find that Watt employed himself in similar operations for a rival line by Loch Lomond. Some time after, he drew up a plan for a canal to carry coal from Monkland to Glasgow, of which he superintended the execution. Several plans of the same kind, and, among others, of a navigable canal across the isthmus of Crinan, since finished by Rennie; extensive plans for the improvement of the ports of Ayr, Glasgow, and Grenock; the construction of bridges at Hamilton and Rutherglen; and an investigation of the ground across which the famous Caledonian canal was to pass, then occupied our colleague until the end of 1773. Without detracting from the merit of these labours, I must be permitted to consider their importance as merely local, and to assert that their conception, direction, or execution would never have given a name like that of James Watt.

If forgetting my duties to the academy, I endeavoured to make you smile instead of relating what is useful and true, I could find here matter enough for a striking contrast. I could remind you of such and such an author, who, in our weekly meetings, demands loudly to communicate this little remark, that trifling reflexion, the few notes drawn up only the evening before; I would paint him to you cursing his fate, when the strict letter of the regulations, when the earlier order of inscription* of some other member puts off the reading of it for another week, leaving to him, however, as a guarantee during this wretched week, its being in safe custody in our archives as a sealed packet. On the other hand, we should see the creator† of a machine destined to form an epoch in the annals of the world, submit without murmur to the stupid caprices of capitalists, and bend down his superior genius during eight years to the compilation of plans, to minute surveys, to tedious details of estimates, of repairs, and of square yards of masonry. Let us confine ourselves to remarking, that this conduct of Watt arose from a serenity of character, a moderation of wishes, and genuine modesty. So much indifference, however noble might have been the reasons for it, is still open to blame: society is in the right to reprobate in the strongest terms those of its members who by hoarding prevent the circulation of the specie of the country; is it, however, less blameable to deprive one's native land and fellow countrymen, one's fellow men, of those treasures a thousand times more valuable, which spring from the mind, hoarding up for one's self those immortal conceptions, sources of the noblest and purest mental enjoyments, and in depriving of them, the manufacturers of mechanical combinations, who would multiply to infinity the produce of national industry; which would to break down for the benefit of civilization and of the human race, the effects of an unequal position in society, which one day would allow us to go through the rudest workshops, without witnessing the melancholy sight of fathers of families, and unfortunate children of both sexes reduced to the state of brutes, and moving rapidly towards the tomb.

Fig. 10.



BOULTON AND WATT'S SINGLE ACTING STEAM ENGINE.

Fig. 10, shows a section of the cylinder C, condenser B, and air pump A, of a single engine, arranged as is most convenient for exhibiting the parts. The steam enters from the boiler to the cylinder by the pipe S, through the valve *c*; and presses down the piston P, which is supposed to be taken at the time of its descent: the steam below it goes into the condenser, and is condensed by the jet which plays into it. The air pump bucket *p* is descending in the air and vapour which the pump had received from the condenser during the previous ascent. When the piston is at the bottom of the cylinder, a motion is given to the rod O, which shuts the valves *a* and *c*, and opens the valve *b*; there is then a communication open by the pipe E, between the top and bottom of the cylinder, and the pressure of the counter weight must be sufficient to overcome the friction of the piston, and expel the steam from the upper to the lower side of the piston: the action of the counter weight has also to expel the air and water of condensation through the valve Q by means of the air pump.

In the beginning of 1774, after having overcome the indifference of Watt, he was placed in communication with Mr. Boulton, of Soho, near Birmingham, a man of enterprise, activity, and varied talents.‡ The two partners applied to parliament for a prolongation of Watt's patent, which was taken out in 1769, and had only a few years to run. The bill gave rise to a sharp debate. "This business," says the celebrated engineer in a letter to his aged father, "could only be carried on with considerable trouble and expense. Without the help of some warm hearted friends we should not have succeeded, for many most influential members of the House of Commons were opposed to us." It seemed to me worthy of enquiry, to ascertain what class of society belonged these influential members of whom Watt speaks, who refused to a man of genius, a small part of the riches which he was going to create. Judge of my surprise, when I found at their head, the celebrated Burke! Can it be true, that a man can distinguish himself by the most arduous studies, be a man of learning and probity, possess in an eminent degree those oratorical qualities which lead and carry away political assemblies, and yet be difficient in simple common sense?§ However, since the wise and important amendments which Lord Brougham has introduced into the patent laws, inventors will no longer be subjected to those protracted annoyances to which Watt was exposed.

As soon as parliament had granted an extension of Watt's patent for twenty-five years, this mechanic and Boulton, in conjunction, commenced at Soho, those establishments which have proved the most useful schools in England of practical mechanics. Steam-engines for draining were erected on a very large scale; and repeated experiments showed that with equal effect, they saved three-quarters of the fuel previously used

* In French assemblies all speakers put down their names in a list, from which they are called in rotation to deliver their discourses, this prevails even in the Chambers, it leads to a dull monotony, and is destructive of the oratorical character.—*Note of the translator.*

† We recollect an old friend of ours, one of the philosophical circle of the last century, who used to tell an appropriate anecdote on the subject of M. Arago's favourite prhase, *the creative power of a mechanic.* He himself, in a trial on the validity of a patent, had used the same remark, when the judge anxious to have a quiet fling at a witness, who was on all such occasions quite *unbrowbeatable*, exclaimed, *Creative power of a mechanic!* why pray Mr. R. what do you mean by that? Why, my Lord, I mean, that power which enables a man to convert a goat's tail into a judge's wig.—*Note of the translator.*

‡ In the notes of the last edition of Professor Robison's work on the steam engine, Watt speaks in these terms of Mr. Boulton. "The friendship with which he favoured me, ended only with his life, that which I felt towards him obliges me to take advantage of this opportunity, the last perhaps which may be allowed me, of acknowledging how much I am indebted to him. It is to Mr. Boulton's ready encouragement, his taste for scientific pursuits, and the skill with which he knew how to make them contribute to the progress of the arts; it is also to his intimate acquaintance with manufacturing and commercial affairs, that I attribute in a great degree the success with which my efforts have been crowned."

Mr. Boulton's manufactory, at Soho, had already been established for some years, when the partnership was formed which is mentioned in the text. This establishment, the first on such a great scale which has been formed in England, is still further remarkable in the present day, for the elegance of its architecture. Boulton manufactured there all kinds of first-rate works, in steel, plated ware, silver, and or-molu, even astronomical clocks and paintings on glass. During the last twenty years of his life, Boulton was employed in improvements in minting money. By the combination of some processes originally French (?) with new presses, and an ingenious application of the steam engine, he succeeded in uniting great rapidity of execution, with extreme perfection in detail. It was Boulton, who effected for the English Government, the re-coinage of all the copper money of the empire. The economy and neatness of this great work rendered false imitations almost impossible. The numerous executions with which, until then, the Cities of London and Birmingham had been afflicted, entirely ceased, and on this occasion Darwin in his Botanic Garden demands, why if at Rome a civic crown was given to him who saved the life of a single citizen, is not Boulton worthy of being covered by us with garlands of oak.

Mr. Boulton died in 1809, aged 81.—*Note of M. Arago.*

§ It is not only very possible, but very certain, and perhaps is the reason why in England political and scientific distinctions are considered as different—*Note of the Translator.*

by Newcomen's engines. From this time, the use of the new engine extended in the mining districts, particularly in Cornwall; Boulton and Watt receiving as payment the value of a third of the quantity of coal which each of their engines saved. The commercial importance of this invention may be conceived by one authentic fact; in the single mine of Chacewater, where three engines were at work, the proprietors found it worth while to purchase up the rights of the inventors for an annual sum of 2,400*l*. Thus, in one single instance, the substitution of the *condenser* with internal injection had effected a saving of 7,200*l*. per annum. in the produce of fuel.

People agree, without difficulty, to pay the rent of a house or a farm; but this feeling ceases when it affects an idea, whatever profit or advantage it may have procured. Ideas, why they are conceived without labour and without trouble! Besides, who knows but in time, every one would have thought of them! In this way, no days, months, or years can give validity to a privilege. To these opinions, which it is not certainly necessary for me to criticise here, custom has almost given the sanction of a fixed decision. Men of genius and *manufacturers of ideas*, seem condemned to remain deprived of all material enjoyments; and, it is very natural, that their history should continue to resemble a legend of martyrs. Whatever we may think of these remarks, it is certain that the Cornish miners paid from year to year with more repugnance the rent which they owed to the Soho establishment. They took advantage of the first objections started by the plagiarists, to assume that they were discharged from all obligation. The question was a serious one: it might have greatly injured the fortune of our colleague, he gave up to it therefore his whole attention and became a legist*. The incidents occurring in the long and expensive suits which Boulton and Watt had to carry on, and which at last they gained, are not now worthy of revival, but as I just now quoted Burke among the opponents of the great mechanic, it is but just to remember that on the other hand, the rights of persecuted genius were maintained before the seat of justice by the testimony of Roy, Milne, Herschel, Deluc, Ramsden, Robinson, Murdoch, Rennie, Cumming, More, and Southern. Perhaps also we ought to add as a curious trait in the history of the human mind, that the counsel (I shall have the prudence to remark that I am only speaking of the counsel of a neighbouring country) to whom malignity imputes a superabundant luxury of words, reproached Watt, against whom they were employed in great numbers, with having invented only ideas; this, we may remark, led to the following apostrophe in Court of Mr. Rous, "Do as you like gentlemen, with these untangible combinations, as you call Watt's engines, they'll crush you like flies, and blow you up out of sight."

The persecutions sustained by a man of mind, where he has a right to expect, with justice, unanimous expressions of gratitude, seldom fail to discourage him, and to give a tone of asperity to his character. Watt's naturally good disposition could not resist such rough attacks; seven long years of law excited in him a feeling which led him sometimes to express himself with bitterness. "What I fear most," wrote he to a friend, "is piracy. I have already been cruelly attacked by plagiarists, and if I had not a tolerable memory, their impudent assertions would almost have persuaded me that I had never made any improvement in the steam-engine. You would scarcely credit, that the ill-feeling of those whom I have most served, goes to that length that they maintain that these improvements, far from being worthy of encouragement, are injurious in the extreme to the national wealth."

Watt, although greatly irritated, was not cast down; his engines, which, at first, like those of Newcomen, were only mere pumps for draining, in a few years he converted into universal movers, and gave them an indefinite power. His first attempt was the application of the *double-acting engine*.

To understand the principle of this, we must refer to the *improved engine*, of which we have already spoken at page 407. The cylinder is closed; the access of the external air is cut off; the piston is forced down by the pressure of the steam, and not by that of the atmosphere; the rising movement is effected by a mere counterpoise, for at the moment, when this action takes place, the steam, circulating freely above and below the cylinder, presses equally on the piston two opposite ways. So that, as every one may see, in the *improved engine*, as in Newcomen's, there is no real power, except during the descending stroke of the piston. A very trifling alteration remedied this serious defect, and gave us the *double-acting engine*. In the engine known under this name, as in that which we have called the *improved engine*, the steam of the boiler passes freely to the top of the cylinder, and forces down the piston without any difficulty, for at the same time, the inferior capacity of the cylinder is in communication with the condenser. This movement once effected, the steam is cut off from entering above, and is now, by opening a certain cock or valve, admitted to the under side of the piston, and raises it up simultaneously, the communication from the bottom of the cylinder with the condenser is closed, and a similar passage is opened from the top of the cylinder to the condenser, and allows the steam to be drawn off from above the piston to the condenser, where it becomes liquefied; when this is done, and the piston arrives at the top, all the cocks and valves again change their movements, and are replaced in their original position. In this way the same effects are reproduced indefinitely. The motor, as has been seen, is here steam exclusively, and the engine, making allowance for an inequality depending on the weight of the piston, has the same power whether in ascending or descending. On that account it was justly called on its first appearance the *double impulse engine*, or *double acting engine*.—*see fig.* 11 *and* 12.

To make his new motor of easy and commodious application, Watt had to conquer other difficulties. He was obliged to find out the means of establishing a *rigid communication* between the inflexible rod of the piston oscillating in a straight line, and a beam oscillating circularly. The solution which he produced of this important problem, is, perhaps, his most ingenious invention. Among the constituent parts of the steam-engine, you have, no doubt, observed an articulated parallelogram, which, at each double stroke, stretches out its sides and collapses them with the ease, I had almost said the grace, with which the gestures of a perfect actor charm you. Follow the progress of its various transformations progressively with the eye, and you see that they are under subjection to most curious geometrical laws. You will perceive *three* angles of the parallelogram describing, in space, arcs of a circle; while the *fourth*, the angle which raises and lowers the piston rod, moves almost in a straight line. The immense utility of the result astonishes mechanics still less than the simplicity of the means by which Watt effected it.*—*see fig.* 13 *and* 14.

Power is not the only element of success in manufacturing processes, regularity of action is equally essential; but how can we expect regularity from a motor which is engendered from fire by shovelfuls of coals, and even from coal of different qualities, under the superintendence of a single workman, often unintelligent, and almost always inattentive. The disposable steam will be so much the more abundant, and will flow into the cylinder with greater rapidity, and move the piston so much the faster, as the fire has more intensity. Great inequalities of action seem almost inevitable, and the genius of Watt had to provide for this palpable defect. The valves by which steam is discharged from the boiler into the cylinder are not always open to the same extent; when the engine is working fast, these valves partially close. A certain quantity of steam must therefore require more time to pass through them, and the rapidity is diminished. The openings of the valves, on

Fig. 12.

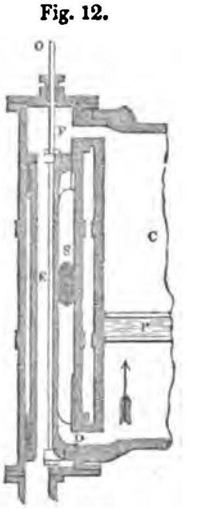
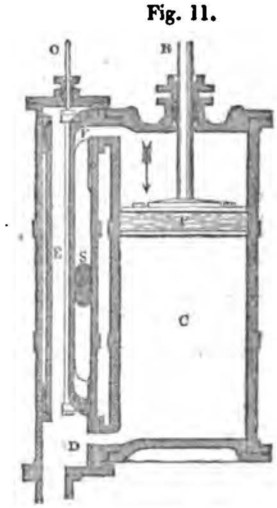


Fig. 11.



BOULTON AND WATT'S DOUBLE ACTING ENGINE.

The parts are shown in Fig. 11, where C. is the cylinder; the steam enters at S, and passes into the upper part of the cylinder at F, or into the lower part at D, as in Fig. 12, showing the piston in the state of ascending, and Fig. 11, as descending. From the lower part of the cylinder in Fig. 11, the steam escapes through D into the condenser B, (see Fig. 10) where it is condensed by a jet of cold water, which plays into it constantly; and the uncondensed gases and water pass through the valve G during the ascending stroke, and expelled at the valve Q into the hot well. When the steam piston P, Fig. 12, ascends, the steam from the upper part of the cylinder passes through F down the pipe E to the condenser. The steam passages D and F are opened and closed by a D-*slide*, so called from its plan resembling the letter D; it is moved by the rod O, by tappets or other methods.

* How different is this from the plain narration of Stuart, and the actual facts. Poor Boulton who had the whole commercial management, for which Watt was totally unfit, is here left entirely out of the question, in order that M. Arago may make a point, and add another to the long string of miraculous qualifications with which he has endowed his unhappy *confrere*. The medicine and surgery might have pased, but what will the gentlemen of Westminster Hall say to this sudden acquirement of a subject for which they find no time sufficient.—*Note of the Translator*.

* These are Watt's terms in giving an account of his articulated parellelogram:

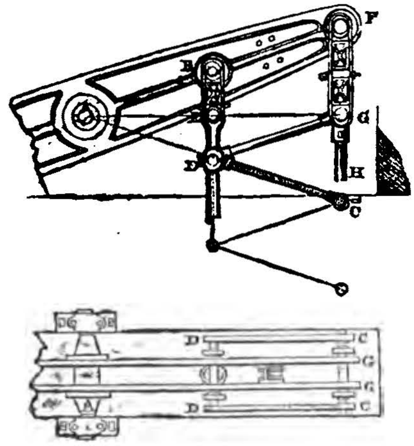
"I have myself been surprised by the regularity of its action; when I saw it move, for the first time, I was as much pleased with the novelty, as if it had been *the invention of another person*"

Smeaton, who was a great admirer of Watt's invention, did not believe that in practice, it could become an economical and general mode of communicating *directly* rotatory movement to an axle. He maintained that steam-engines could always be employed in raising water, which, when raised to a convenient heigth, could be used in its fall, to give motion to the buckets or floats of ordinary water wheels. In this respect, however, Smeaton's ideas have not been carried out, although I saw, in 1834, while on a visit to Mr. Boulton's works, at Soho, an old steam-engine, which is still used to raise water from a large pond, and to pour it into the buckets of a large water wheel, when the season is so dry as not to supply sufficient water from the stream generally used.—*Note of M. Arago*. Leupold suggested the idea of giving rotatory motion by means of first raising the water into an elevated cistern, and then allowing it to fall on an overshot wheel, a drawing and description is given at page 403, vol. iii. *Theatrum Machinarum*.—*Note of Translator*.

the contrary, extend when the action flags. The parts necessary to effect these different changes connect the valves with axes moved by the engine, by means of a contrivance of which Watt conceived the idea from the regulator employed in some of the flour mills. He called it the *governor*, it is also termed the *centrifugal power regulator.* Its efficiency is such that some years ago there was, in the cotton-mill of Mr. Lee, a mechanic of great talent, a clock set in motion by the steam-engine of the factory, and which acted almost as well as the ordinary spring clock by its side.—*see fig.* 15.

Watt's governor is the secret, the principal secret, of the astonishing perfection of the manufacturing prodncts of the age; it is that whioh gives the steam-engine an action free from any vibration, and which enables it with equal success to embroider muslin and to forge anchors; to weave the most delicate fabrics, and to commnnicate rapid motion to the massive stones of the flour mill. This explains why Watt said, without being liable to the

Fig. 13 & 14.



PARALLEL MOTION.

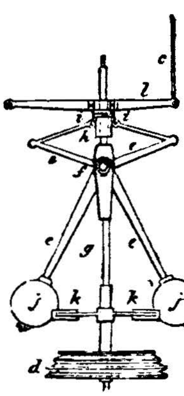
The apparatus adopted for carrying this motion into effect, is represented in fig. 13, which is an elevation, or side view of one half of the engine beam; and fig. 14, a plan of same; similar letters, in both figures, refer to similar parts; the beam moving on its axis A, every point in its arm moves in the arc af a circle, of which A is the centre. Let B be the point which divides the arm, A F into equal parts A B, and B F, and let D C be a straight rod, equal in length to A B, and playing on the fixed centre or pivot C. The end D of this rod, is connected by a straight bar D B, with the point B, by pivot at B and D, on which the rod B D plays freely. If the beam be supposed to move alternately on its axis A, the point B will move up and down in a circular arc, of which A is the centre, and at the same time, the point E will move in an equal circular arc round the point C as a centre, therefore, the middle point E of the rod B D will move up and down in a straight line.

Also let a rod P G equal in length to B D, be attached to the end *f* of the beam by a pivot, on which it moves freely, and let its extremity G be connected with L, by a rod G D, equal in length to B F, and playing on pivots, G and D.

By this arrangement, the joint F G being always parallel to B D, the three points A F G will be, in circumstances, precisely similar to the points, A B E, except that the system A F G will be on a scale of double the magnitude of, A B C; A F being twice A B, and E G twice B E, it is clear, then, that whatever course the point E may follow, the point G must follow a similar line, but will move twice as fast. But, since the point E has been already shown to move up and down in a straight line, the point G must also move up and down in a straight line, but of double the length.

By this arrangement, the pistons of both the steam cylinder and air pump are worked; the rod of the latter being attached to the point E, and that of the former, to the point G.

Fig. 15.



THE GOVERNOR.

Different modes of combining the parts are used by different engineers; one of these is shown in figure 15, where *g* is the revolving axis, *f* the point of suspension, *j j* the balls, *e e* the rods by which the balls are suspended. These rods are connected to the rods *i i*, and by that means raise or depress the sliding piece *h*, and with it the lever *l*, which acts on the throttle valve, by the line C. The parts marked *k k* are two rests to receive the balls when the engine is not in motion.

imputation of exaggeration, that to avoid the runnings in and out of servants, in case of illness, he would have his medicine given to him by arms from his steam-engine. I know very well, that with the common run of the world, this ease of action is supposed to be obtained at the expense of the power employed, but it is a vulgar error; the saying "great noise and little work," is not only true in the moral world, bnt is a mechanical axiom.

A few words more, and we shall get to the end of the technical details. Some years ago great benefit was found from not leaving a free communication between the boiler and the cylinder, during the whole duration of each stroke of the engine. This communication was shut off when the piston, for instance, had made one third of its stroke; the two remaining thirds of the length of the cylinder were then gone through, in consequence of the speed acquired, and particularly on account of the expansion of the steam. Watt had already pointed out this process,* and very good judges place this improvement, on account of its practical application, on a par with the condenser. It is very certain, that since its adoption, the Cornish engines have produced unexpected effects, and that, with one bushel of coals, they do the work of twenty men working for ten hours. We must recollect that, in the coal districts, a bushel of coals costs only *nine pence*, and then we shall see clearly that Watt reduced, in the greater part of England, the price of a man's days' labour of ten hours to less than a *halfpenny!* †

Numerical calculations show so clearly the value of the inventions of our colleague, that I cannot refrain from showing two other comparisons, which I have borrowed from one of the most celebrated correspondents of the Academy, Sir John Herschel.

The ascent of Mont Blanc, from the valley of Chamouni, is justly considered as one of the most laborious tasks which a man can get through in two days. Thus the maximum of mechanical exertion of which we are capable in twice twenty-four hours, is measured by raising the weight of our body to the height of Mont Blanc. This labour, or the equivalent of it, a steam-engine will effect by burning two pounds of coal. Watt has therefore shown, that the daily strength of a man does not exceed that which is contained in a pound of coal.

Herodotus relates that the construction of the great pyramid of Egypt occupied a hundred thousand men twenty years. The pyramid is of limestone; its volume can be easily calculated, and is ascertained to be about thirteen millions of pounds. To raise this weight 125 feet, the height of the centre of gravity of the pyramid, it would be necessary to burn, under the boiler of a steam-engine, 630 chaldrons of coal. There is, among our neighbours, a foundry which could be mentioned, which burns a greater quantity of fue every week.

Copying Machine—Heating by Steam—Composition of Water—Bleaching by Chlorine—Experiments on the Physiological Effects of breathing Different Gases.

Birmingham, when Watt took up his residence there, reckoned, among the inhabitants of its neighbourhood, Priestley, whose mere name speaks everything, Darwin, author of the Zoonomia, and of a celebrated poem on "The loves of the plants," Withering, a distinguished physician and botanist, Keir, a chemist well known by his notes on the translation of Macquer, and an interesting memoir on the crystallization of glass, Galton, who wrote an elementary treatise on Ornithology, Edgeworth, author of several works justly appreciated, and father of the so celebrated Miss Maria, &c. These savanst soon became intimate with the celebrated mechanic, and most of them formed, in conjunction with him and Boulton, a club, under the name of *The Lunar Society.* Such a singular title gave rise to many strange mistakes, although it only meant that they met on the evening of the full moon, a time of the month chosen in order that the members might see their way home on leaving.

Every meeting of the Lunar Society furnished Watt with a fresh opportunity of showing the incomparable fertility of imagination with which nature

* The principle of cutting off the steam, Watt had already clearly shown in a letter to Dr. Small, dated 1769, and it was put in practice at Soho in 1776, and in 1778 at the Shadwell Water Works on economic grounds. The invention and the advantages to be derived from it are fully described in the patent of 1782.—*Note of M. Arago.*

† At a time when so many persons are employed in planning rotatory engines, I should be unpardonably forgetful if I did not mention that Watt not only turned his attention to this subject, as we see in his patents, but that he carried it into execution. These engines Watt gave up, not because they would not act, but because they seemed to him in a working point of view very much inferior to the double impulse and rectilinear action engines.

There are few inventions great or small, among those which have been contributed to the modern steam engine, which were not first developed by Watt. Follow his labours, and we shall find that besides the principal points enumerated minutely in the text, that he proposed that in places where there was a deficient supply of cold water, engines without condensation, that is to say, engines in which the steam after having acted is discharged into the atmosphere. Expansive steam for engines with several cylinders, was also among Watt's plans, and he suggested the idea of pistons perfectly closed, although composed of pieces of metal. It was also Watt who suggested the use of the mercurial guage to show the elasticity of the steam in the boiler and in the condenser; who pointed out a simple and permanent guage,* by means of which the quantity of water in the boiler always can be told at once; who to prevent the quantity of water being diminished to a dangerous extent, combined the movements of the feeding pump to those of a float; who attached to an opening on the coverlng of the principal cylinder of the engine an *indicator*, combined in such a way as to shew exactly the law of evacuation of the steam in relation with the positions of the piston, &c., &c. If I had time I would shew that Watt was not less skilful and successful in his attempts to improve the boiler, to diminish the loss of heat, and to burn completely the quantity of smoke which issued from the ordinary chimneys, how high soever they may be.—*Note of M. Arago.*

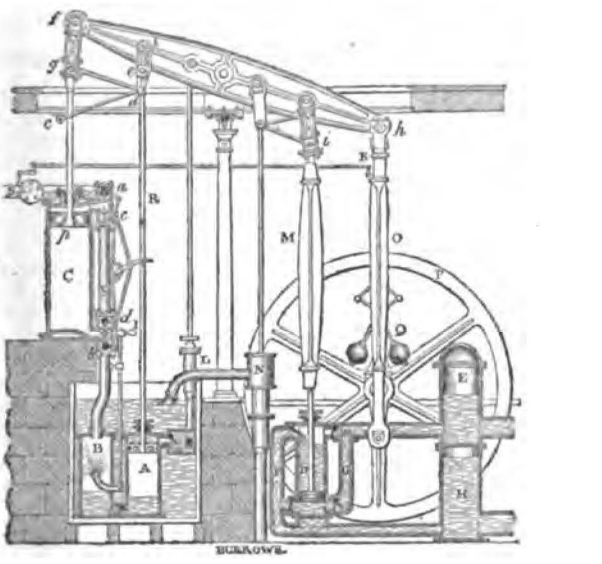
* Stuart attributes this to Smeaton.—*Note of Translator.*

had endowed him. Darwin one day said to the members, "I have been thinking of a kind of pen with two nibs, by which any thing may be written twice, so as to give at once the original and copy of a letter." "I hope," replied Watt almost directly, "that I shall find out a better way of doing it; I will think of it to-night, and let you know to-morrow." The next day *the copying-machine* was invented, and even a slight model sufficiently advanced to show its effects. This machine, which is of such utility, and so generally used in English offices, has lately received several improvements, which have been claimed by different persons; but I can affirm with certainty, that the present form was actually described and drawn in 1780 in the patent of our colleague.

The apparatus for heating by steam is of three years' later date; Watt made use of it in his own house in 1783. It must be observed that this ingenious process was already pointed out by Colonel Cooke in the Philosophical Transactions for the year 1745;* but the suggestion was quite unattended to. Watt, at all events, has not the merit of reviving it; it was he who first applied it, and it was from his calculations of the extent of surfaces necessary for heating rooms of different sizes, which at first served to regulate the application of this process.

If Watt, in the course of his long career, had only produced the engine with a separate condenser, working steam expansively, and the parallel motion, he would hold a first-rate rank among the small number of those whose lives

Fig. 16.



DOUBLE ACTING ENGINE, FOR SUPPLYING WATER.

Fig. 16, represents an engine, with the several parts before explained, combined in one view.

The steam, from the boiler, passes by the pipe S, through the valve *a*, and forces down the piston *p* to the bottom of the cylinder C; just before the piston arrives at the bottom, the pin on the rod of the air pump comes in contact with the lever and reverses the valves, by shutting the valves *a*, *b*, and opening *c*, *d*, which were shut; the steam will now pass down the vertical pipe S, through the valve *d*, and force up the piston *p* to the top of the cylinder, at the same time the steam, which forced it down, will escape through the valve *b*, to the condenser B, by a pipe, which conveys the steam from the valves to the condenser. Thus one double stroke of the engine is performed, and the valves again restored to their original position;—I is the handle to the injection cock for supplying a jet of water into the condenser B, which liquifies the steam; the condensed water, together with the air, is removed by the aid of the air pump A, worked by the rod R, attached to the beam of the engine, and discharged, through the valve at the top, into the hot well, where part is forced back to the boiler, by the force pump L, and the remainder is allowed to run to waste; N is the cold water pump, also worked by a rod attached to the beam, for supplying the condensing well;—Y is the governor, before explained, which is connected with the crank R by the horizontal rod, and regulates the throttle valve in the horizontal steam pipe S;—O is a connecting rod, attached to the end of the beam, and, at the lower part, to the crank that turns the fly wheel P, which equalizes the power of the engine;—M is a rod for the purpose of working the pump D, to raise water—when the piston descends, the water contained in the pump, will be forced through the lower valve, up the pipe G, into the upper air vessel E, thence it passes, in a continued stream, to an elevated reservoir; as the piston of the pump is descending, a fresh supply passes up the pipe F, through the upper valve, into the superior portion of the pump, and which, when the piston rises again, is forced through the opposite valve, into the air vessel E, as before, and also, as the piston is being raised, a fresh supply of water passes through the lower valve, from the pipe F, and refills the pump, as at first.

* I have read in a work by Mr. Robert Stuart, that Sir Hugh Platte had foreseen before Colonel Cook, the application of steam for heating apartments. In the author's Garden of Eden, published in 1660, he suggests something analagous for the preservation of plants in hot-houses. Sir Hugh Platte proposed to place coverings of tin, or of other metal over the vessels in which meat is cooked, and then to send through openings in the cover, tubes, by which steam could be introduced to heat them wherever it was wanted.—*Note of M. Arago.*

make an epoch in the annals of the world. Well! his name seems to me to be attached with credit also to the greatest and most prolific discovery of modern chemistry—*the discovery of the composition of water.* My assertion may appear rash, for numerous works, in which this important part of scientific history is treated authoritatively, make no mention of the name of Watt. I trust, however, that you will follow up this discussion without prejudice, that you will not allow yourselves to be diverted from the investigation by authorities, which are less weighty than is generally supposed; and above all, that you will not forget to remember how few authors, in these days, trace up a subject to its original source; how troublesome it seems to them to expose themselves to the dust of a library, and, on the contrary, how convenient it appears to be to reduce the whole labour of a work to the mere effort of compilation. The task which your confidence has entrusted to me, seemed to impose more serious obligations. I have hunted up numerous printed documents, and all the papers of a voluminous correspondence still in manuscript, and if fifty years after the event, I appear to claim, in favour of James Watt, an honour too carelessly granted to one of his most illustrious countrymen, it is because it seems to me useful to show that in the bosom of academies truth makes way sooner or later, and that, with regard to inventions, there is no prescription which can be claimed, or act of limitation imposed.*

The four fictitious elements, fire, air, water and earth, the various combinations of which are to give birth to all known bodies, are one of the numerous legacies of that brilliant philosophy which for ages dazzled the noblest intellects in the world, and led them astray. Van Helmont, first shook, although slightly, the principles of this ancient theory, by calling the attention of chemists to several permanently elastic fluids, several *airs* in fact, which he termed *gases*, and the properties of which differed from those of common air, the supposed element. The experiments of Boyle and Hooke raised difficulties still more serious, they proved that common air, which is indispensable for respiration and combustion, exhibited in these two phenomena notable changes in their properties, necessarily implying the idea of composition. The numerous observations of Hales; the successive discoveries of carbonic acid by Black; of hydrogen by Cavendish; of nitrous acid, oxygen, muriatic acid, sulphurous acid and ammonia by Priestley, definitively disposed of the ancient idea of a simple and elementary air among those chance conceptions, almost always false, which are the offspring of those who have the audacity to believe themselves called not to discover, but to guess the mysteries of nature.

In the midst of so many remarkable circumstances, water still preserved its elementary character. The year 1776 was at last signalised by an observation which was to bring about the subversion of this general belief. It must be acknowledged that from the same year, also are to be dated those singular efforts which were a long time made by chemists to disbelieve in the natural consequences of their own experiments. The observation to which I am going to refer was made by Macquer.

This judicious chemist having placed a white porcelain saucer over the flame of some hydrogen gas which was burning quietly from the neck of a bottle, observed that this flame was without any smoke properly so called, and that it deposited no soot. That part of the saucer which was touched by the flame was covered with driplets evident enough of a fluid similar to water, and which on examination proved to be pure water. That was most certainly a singular result. You must notice that it was in the middle of the flame, in the part of the saucer touched, that the driplets of water were deposited. This chemist however did not pay attention to this fact, he was not surprised at what was really surprising; he merely mentions it without any remarks, he did not perceive that he had a great discovery at his finger's ends.

Does then genius in sciences of observation consist of the faculty of saying at the right moment, *why?*†

The physical world reckons volcanoes which have never made but one eruption, and in the intellectual world similarly there are men, who after one

* M. Arago now comes to another of the wonderful discoveries which are to confer honor on his memoir, and exhibit the novelty of his views, and he does well to blow the trumpet before the Shiloh which he promises. The 'parturient montes' is a result but too customary with M. Arago to call for remark; it is sufficient to repeat the trite saying, that be has nothing which is new that is tine, and little that is true which is new. He certainly has the merit of stepping first in a career, which none of Watt's admirers had ever yet the hardihood to imagine that it would be worth the while of him or his idol to pursue, and he may claim all the merit of research in a subject which admits of little, and in which the great deal he assumes has been thrown away upon error.—*Note of the Translator.*

† M. Arago, led away by the quibbling *ignus fatuus* of his own imagination, stops to give a new definition of genius, something like that which defines man to be a cooking animal, or an unfledged fowl. M. Arago, politician and philosopher, academician and deputy, is considered, by some, to be the Lord Brougham of France, and, led away by the vanity of figuring as an orator in the chamber, and as a rhetorician in the academy, he deserts those studies in which alone he succeeded, and from which alone he can derive a solid reputation. If he resemble Lord Brougham, he resembles that great man in his defects, rather than in his talents, and has the same point of contact as the lower members of the animal kingdom have with their exalted fellow man. M. Arago deserts the care of science to exhibit as an orator; Lord Brougham, like Cicero, possessing an eloquence, which the fears even of his enemies do not allow them to dispute, dedicates his leisure to severer studies. M. Arago may have the superficiality of Lord Brougham, but he wants his elegance of style, and clearness of reasoning, the variety of his studies, and the skill with which it is brought to bear on the subject of his research. If Brougham be exposed to this charge, he amply makes up in breadth what he loses in depth, while M. Arago without eloquence in matters of science, mistakes declamation for an easy flow of language, and thinks to supply the logic of the advocate with the *concetti* of the middle ages. M. Arago might be the 'magister morum' in the schools of science, but in the world at large he is only a narrow-minded and conceited pedagogue.—*Note of the Translator.*

bright fit of genius, disappear entirely from the history of science. Such was Warltire, of whom the chronological order of dates leads me to relate a truly remarkable experiment. In the beginning of the year 1781, this philosopher conceived that an electric spark could not traverse certain gaseous combinations without subjecting them to certain changes. An idea so novel, unsuggested by any existing analogy, and of which so many important applications have since been made, would I should have thought have earned for its author, that all men of science should not forget to attribute to him the honour of it. Warltire was deceived with regard to the precise nature of the changes which electricity might engender; fortunately for him he foresaw that they would be accompanied with an explosion, and for this reason he first made the experiment in a metal vessel, in which he inclosed air and hydrogen. Cavendish soon after repeated the experiment of Warltire. The *certain date* of his labours (I designate in this manner any date resulting from an authentic document, or an academical or a printed paper) is anterior to the month of April 1783, since Priestley quotes Cavendish's experiments in a paper on the 21st of the same month. The quotation moreover informs us only of one thing, that Cavendish had obtained *water* by the detonation of a mixture of oxygen and hydrogen, a fact already demonstrated by Warltire, In his paper of the month of April, Priestley added an important circumstance to those which resulted from the experiments of his predecessors. He proved that the weight of the water which is deposited on the surfaces of the vessel at the moment of the detonation of the oxygen and the hydrogen is the sum of the weight of the two gases.

Watt, to whom Priestley communicated this important result, saw immediately in it with the penetration of a superior man, a proof that water was not a simple body. "What are the products of your experiment?" wrote he to his illustrious friend, "*water, light* and *heat*. Are we not from that warranted in concluding that water is composed of two gases, oxygen and hydrogen, deprived of a portion of their latent or elementary heat, and that oxygen is water deprived of its hydrogen, but united to latent heat or light. If light be only a modification of heat, or a mere circumstance of its manifestation, or a component part of hydrogen, oxygen gas must be water deprived of its hydrogen but united to latent heat."

This clear, plain and methodic passage is extracted from a letter of Watt's of the 26th April, 1783. The letter was communicated by Priestley to several savants in London, and afterwards delivered to Sir Joseph Banks, President of the Royal Society, to be read at one of the meetings of that learned body. Circumstances which I suppress because they are of no importance in the present discussion, caused the reading of this letter to be deferred for a year, but the letter was preserved in the records of the society, and is published in the 74th volume of the Philosophical Transactions, with its true date of the 26th of April, 1783. It was embodied by the Secretary of the Royal Society himself, at the time of going to press, with a letter from Watt to De Luc, dated the 26th November, 1783.

I do not ask any indulgence for this profusion of details; it must be observed that a minute comparison of dates can alone show the truth fully, and that it is a question of one of those discoveries which confer the most honour on the human mind. Among the claimants to this prolific discovery, we shall find two of the greatest chemists of which France and England can boast—every one will name Lavoisier and Cavendish. The date of the public reading of the paper in which Lavoisier gave an account of his experiments, and in which he developed his views on the production of water by the combustion of oxygen and hydrogen is two months later than the date of the deposition of the already analyzed letter of Watt in the records of the Royal Society of London. The celebrated paper of Cavendish, entitled *Experiments upon Air*, is later still, it was read on the 15th January, 1784. We ought certainly to feel surprised that facts so well authenticated, could become the subject of a sharp controversy, but I must call your attention to a circumstance to which I have not yet alluded. Lavoisier declared in positive terms that Blagden, the Secretary of the Royal Society of London, was present at his first experiments on the 24th of June, 1783, and that "he informed him that Cavendish had already tried in London to burn hydrogen gas in closed vessels, but without having obtained any very considerable quantity of water." Cavendish also relates in his paper the communication made to Lavoisier by Blagdon, and according to him it was much more extensive than the French chemist acknowledged. He said that the communication related to the conclusions to which his experiments lead, namely, the theory of the composition of water. Blagden made a party himself in the dispute, wrote in Crell's Journal, in 1786, confirming Cavendish's assertion. According to him the experiments of the academician of Paris were only a mere verification of those of the English chemist. He maintained that he had informed Lavoisier that the water produced at London had a weight precisely equal to the sum of the weight of the two gases consumed. Lavoisier, adds Blagden in conclusion, *has told the truth, but not the whole truth.*

Such a reproach is severe—were it true, should I not much diminish the weight of it, if I show that, Watt excepted, all those whose names figure in this history, are more or less exposed to it. Priestley relates in detail, and as his, experiments from which it appears that the water engendered by the detonation of a mixture of oxygen and hydrogen has a weight exactly equal to that of the two gases consumed. Cavendish some time afterwards claimed this result as his own, and insinuated that he had communicated it verbally to the Birmingham chemist.

Cavendish deduces as a consequence from this equality of weight that water is not a simple body. In the first place he makes no mention of the paper placed in the archives of the Royal Society, in which Watt developed the same idea. It is true that when it came to be printed, Watt's name is not forgotten; but it was not among the records that the idea of the celebrated engineer was seen; but he declares that he knew of it, by its having been read lately at one of the meetings. Now, however, it has been clearly proved, that it was not read till some months after that in which Cavendish speaks of it.

On entering upon this important discussion Blagden announces his intention to clear up every thing, and to put it upon a firm basis. He does not flee in fact, from any accusation, from the citation of any date, so long as it is a question of securing to his friend and protector Cavendish, the priority over the French chemists; as soon however as it relates to his two fellow-countrymen, his explanations become vague and uncertain. "In the spring of 1783," said he, "Mr. Cavendish showed us that he drew as a consequence from his experiments, that oxygen is nothing more than water deprived of its phlogiston, (that is to say, deprived of its hydrogen). *About the same time*, news arrived in London, that Mr. Watt of Birmingham had been led by some observations to a similar opinion." This expression, *about the same time*, to speak in Blagden's way, cannot be *the whole truth. About the same time*, settles nothing; questions of priority may depend on weeks, days, hours and minutes. To be clear and precise as he had promised, he should have said whether the verbal communication made by Cavendish to several members of the Royal Society, preceded or followed the arrival in London of the news respecting the labours of Watt. Can it be supposed that Blagden would not have explained a fact of this importance, if he could have quoted an authentic date in favour of his friend?

To render the *imbroglio* complete, the compositors and printers of the *Philosophical Transactions* also took a hand in it. Several dates are incorrectly related, and in a separate copy of his paper distributed by Cavendish to several scientific men, I perceive an error of a whole year. By an unfortunate fatality, for it is a real misfortune to give way involuntarily to unfortunate and unmerited suspicions none of these printed errors are favourable to Watt. God forbid that I should endeavour to inculpate by these remarks the literary probity of the illustrious savants whose names I have quoted. They only prove that in matters of discovery, the strictest justice is all that can be expected from a rival or a competitor, however eminent his reputation may already be. Cavendish hardly listened to his steward when he consulted him about the investment of his millions; you can tell now whether he was equally indifferent as to his experiments. We shall not be therefore too fastidious in requiring in imitation of judges of civil causes, that the historians of science should only collect written documents as available proofs; perhaps too I ought to add, published documents. Then, but only then, would a stop be put to those disputes perpetually breaking out at the expense of national vanity; and thus the name of Watt would resume in the history of chemistry the exalted position which belongs to him. The solution of a question of priority when it is based, like this in which I have just been engaged, upon an attentive examination of printed papers, and on a minute comparison of dates, assumes the character of a true demonstration.* However I do not consider myself bound to dispense with running rapidly over the various difficulties to which well judging minds seem to me to have attached some importance.

How can we, say they, admit that in the midst of an immense whirlwind of commercial affairs, that busily engaged with a multitude of lawsuits, that obliged to provide every day by inventions for the difficulties of an infant factory, Watt could have found time to follow step by step the progress of chemistry, make new discoveries, and propose explanations of which masters of the science would never have thought?†

I shall give a short but conclusive answer to this objection: I have now in my possession copies of an active correspondence, principally relating to chemical subjects, which Watt carried on during 1782, 3 & 4, with Priestley, Black, De Luc, Smeaton, Gilbert Hamilton of Glasgow, and Fry of Bristol.

Here, however, is an objection which seems to me more specious, as it is prompted by a deep knowledge of the human heart. The discovery of the composition of water proceeding at the same time as the admirable inventions combined in the steam-engine, can it be supposed that Watt would have consented with goodwill, or at least without testifying his displeasure, to see himself stripped of the honour, which it ought eternally to confer upon his name?

This reasoning fails in its very premises; Watt never renounced the share which legitimately accrued to him in the discovery of the composition of water. He scrupulously caused his paper to be published in the *Philosophical Transactions*. A detailed note states authentically the date of presentation of each paragraph of this document. What could a philosopher of Watt's character do more, or what ought he to do, but await patiently the day of ustice. Besides, it wanted but very little that an unfortunate blunder did

* When Don Quixote attacked the sheep, he asked Sancho whether he did not see the banners of the opposing armies flying in the air, and the trumpets calling to combat; and M. Arago, with equal confidence, talks of an attentive examination of printed papers, and a minute comparison of dates, with all the coolness of a German professor, who has just smoked out a laborious mass of absurdity upon a question of Greek history, from the accumulated dust of a thousand volumes. M. Arago has a very small whistle to shew for his money.—*Note of the Translator.*

† M. Arago, like Walter Scott in his History of Napoleon, having raised fictitious objections, finds no difficulty in answering them by a similar ingenious process; of this nature are the men of straw now before us, which it is much more easy to demolish than the more serious objections which have really been made. As Tom Thumb says, "he made the giants first, and then he killed them.—*Note of the Translator.*

not deprive our colleague of his natural forbearance. The Genevese philosopher after having informed the illustrious engineer of the unaccountable absence of his name in the first publication of Cavendish's paper, and after having qualified this omission in terms which a regard for reputation so exalted does not permit me to relate, thus writes to his friend, "I should almost recommend you, considering your position, to draw from these discoveries practical consequences for your fortune. You must avoid exciting jealousy." These expressions wounded the delicate mind of Watt. "If I do not claim my rights instanter," replied he, "do not impute it to an indolence of character, which renders it more easy for me to submit to injustice, than to contest to obtain redress. As to pecuniary considerations they have no value with me; besides my prospects depend not on the patronage of Mr. Cavendish and his friends, but on that of the public at large."

Can I have any fear of having attached too much importance to the theory, which Watt conceived for explaining Priestley's experiments? I think not. Those who would refuse to this theory its just tribute because it now seems an inevitable deduction from facts, forget that the finest discoveries of the human mind have been particularly remarkable for their simplicity. What did Newton himself, when by repeating an experiment known fifteen centuries before, he discovered the composition of white light? He gave such a natural interpretation of this experiment, that it now appears impossible to find another. "Every thing," said he, "which is attained by whatever process from a pencil of white light, was contained in it in a state of combination, for the glass prism has no creative power. If the parallel, and infinitely divided pencil of solar light which falls on its first face, goes out from the second by divergence and with a sensible breadth, it is because the glass separates what in the white pencil was naturally unequally refrangible." Such terms are nothing more than the literal translation of the well known experiment of the prismatic solar prism. This interpretation, however, escaped Aristotle, Descartes, and Robert Hooke.

Let us, however, without leaving the subject, come to arguments, which bear upon it more directly still. Watt's theory of the composition of water arrives in London. If, according to the ideas of that day, it is so evident, and so simple as it now appears, the council of the Royal Society will of course adopt it. No such thing; its *strangeness* throws a doubt even over the experiments of Priestley; they even go so far as to *laugh at it*, said De Luc, *like the story of the golden tooth.* A theory, the conception of which presented no difficulty, would certainly have been despised by Cavendish; remember, with what energy, Blagden under the dictation of this man of genius claimed the priority over Lavoisier. Priestley on whom was to be reflected a great part of the honour attached to Watt's discovery; Priestley, whose sentiments of affection for the great engineer cannot be denied, wrote to him on the 29th of April, 1783. "Look with surprise, and indignation on the figure of a machine by means of which *I have irretrievably undermined your beautiful hypothesis.*" In conclusion, an hypothesis, of which the Royal Society made game, which brought out Cavendish from his habitual reserve, and, which Priestley, putting all self-love out of the question, endeavoured to refute, deserves to be recorded in the history of the sciences, as a great discovery, whatever idea knowledge, now become vulgar, may give us of it in these days.*

Bleaching by chlorine, that beautiful invention of Berthollet, was introduced into England by James Watt, after the journey to Paris, which he made towards the end of 1786. He constructed all the necessary apparatus, directed their arrangement, was present at the first trials, and then gave over to his father-in-law, Mr. MacGregor, the management of this new process. Notwithstanding all the solicitations of the illustrious engineer, our celebrated countryman *obstinately refused*† to be associated with an undertaking, which exhibited no chance of failure, and of which the profits seemed sure to be very great.

Hardly had the discovery been effected of the numerous gaseous substances which now perform such a great part in the explanation of chemical phenomena, than the idea was suggested of using them for medical purposes Doctor Beddoes carried out this thought with sagacity and perseverance; and he was enabled by means of private subscriptions to set up an establishment at Clifton, near Bristol, called the *Pneumatic Institution*, in which the therapeutic properties of all the gases were proposed to be carefully studied. The Pneumatic Institution was fortunate enough to have for some time at its head, the young Humphrey Davy, who was then entering on the career of science; and it could also boast of reckoning among its founders James Watt. The celebrated engineer did still more; he conceived, described and executed in his workshop at Soho, apparatus for engendering gases and administering them to patients, and I find several editions of his papers in 1794, 1795, and 1796.

The ideas of our colleague were directed to this subject, when several of his relations and friends had been unfortunately carried off by pulmonary diseases. It was particularly to affections of the respiratory organs that Watt conceived the application of the specific properties of the new gases could be directed. He expected also some advantage from the action of iron or zinc precipitated by hydrogen in impalpable molecules, and prepared in a certain manner. I should add, moreover, that among the numerous medical certificates published by Doctor Beddoes, and announcing results more or less effective, there is one signed John Carmichael, relative to the radical cure of hæmoptysy of Richard Newberry, a servant, whom Mr. Watt himself caused to respire from time to time a mixture of steam and carbonic acid. Although I must acknowledge my complete incompetency on such a subject, I may certainly be permitted to regret that a method, which reckoned among its adherents Watt and Jenner, should be now abandoned without our being able to quote consecutive experiments in opposition to those of the Clifton Pneumatic Institution.*

* Lord Brougham was present at the public meeting in which in the name of the Academy of Sciences, I rendered this tribute of gratitude and admiration to the memory of Watt; on his return to England, he collected some valuable documents, and studied over again the historical question to which I have given so much attention, devoting to it unscrupulously, that kind of judicial examination which might be expected from one who was once Lord High Chancellor of England. I owe it to a kindness of which I feel all the value, that I am able to lay before the public the results still unpublished of the labours of my illustrious colleague; they will be found in the appendix to this eulogium.—*Note of M. Arago.*

† This phrase is quite correct, however fabulous it may appear in the age we live in. (It is almost needless to say that this is a *note of M. Arago.*)

* Twenty years before the establishment of the Bristol Pneumatic Institution, Watt had already applied his chemical and mineralogical acquirements to perfect the produce of a pottery which he had established with some friends at Glasgow, and in which he was a shareholder to the end of his life.—*Note of M. Arago.*

Watt in Retirement—Particulars respecting his Life and Character—His Death—Numerous Statues erected to his Memory.

Watt had married in 1764 his cousin Miss Miller. She was an accomplished lady, whose cultivated mind, unchangeable mildness, and cheerful disposition soon rescued the celebrated engineer from that indolence, depression, and misanthropy, which nervous morbidity, and the injustice of the world threatened to render permanent. Without the irrestible influence of Miss Miller, Watt would not perhaps have given to the world his admirable inventions. Four children, two boys and two girls, were the offspring of this union. Mrs. Watt died in childbirth of a third boy who did not survive. Her husband was then employed in the north of Scotland with the plans for the Caledonian Canal. Why am I not permitted to transcribe here in all their simplicity, a few lines from the journal, to which he consigned every day his secret thoughts, his hopes, his fears; why can I not show him to you lingering after his misfortune on the threshold of the house where his *kind welcome* no longer awaited him; wanting the strength to enter the rooms in which he was no longer to be delighted by the *comfort of his life!* Perhaps the true picture of such profound grief, might shame to silence those systematic theorists, who without being stopped by thousands and thousands of irrefutable denials, refuse the virtues of the heart to every man whose mind has been trained by the fertile, sublime, and imperishable truths of the exact sciences.

After a few years of widowhood, Watt had again the happiness to find in Miss MacGregor a helpmate worthy of him from the variety of her talents, the soundness of her judgment, and the firmness of her character.†

On the termination of the privileges which parliament had granted to him, Watt (in the beginning of 1800) retired entirely from business, in which he was succeeded by his two sons. Under the enlightened management of the younger Mr. Boulton and the two Watts, the Soho factory continued to prosper, and even to acquire a new and important developement, and it still holds first rate standing among English manufactures of large machinery. Gregory Watt, the second son of our colleague, had already begun to distinguish himself in the world in a most brilliant manner by his literary talents, and his geological labours, when he was cut off at the age of 27 years, by a pulmonary affection. This unhappy circumstance greatly agitated the illustrious engineer, so that the affectionate attention of his family and friends were scarcely able to maintain tranquility to a heart halfbroken. This grief too natural would seem to explain the almost absolute silence which Watt manifested in the latter years of his life. I am far from denying that it may have had some influence; but why should we have recourse to extraordinary causes, when we read as far back as 1783, in a letter from Watt to his friend Doctor Black, "Remember that I have no wish to entertain the world with the experiments I have made," when we find elsewhere these words so very singular in the mouth of a man who has filled the wide world with his name, "I only know two pleasures, indolence and sleep." This sleep, however, was very light, and we may say, moreover, that the most trifling excitement was sufficient to arouse Watt from his favourite indolence. Every object which came before him received gradually in his imagination, changes of form, construction and nature, which would have rendered them susceptible of important applications. These conceptions, for want of an opportunity of bringing them out were lost to the world. The following is an anecdote which will illustrate my idea.

A company had erected on the right bank of the Clyde at Glasgow, extensive buildings, and powerful machinery, for the purpose of supplying water to every house in the city. When the works were completed, it was found out that on the left bank there was a spring or kind of natural filter which communicated to the water qualities evidently superior. To remove the establishment was out of the question, and therefore they thought of passing right across the river at the bottom a rigid iron pipe, of which the mouth was to come out in the drinkable water. The construction of the timber work for carrying such a pipe on a muddy and shifting bottom, very rough and always covered with several feet of water, appeared to require a considerable expense. Watt was consulted, his answer was already made; having seen a lobster on the table some days previously, he had investigated, and found out how the mechanism of it could in iron produce a jointed conduit which

† Mrs. Watt (Mac Gregor) died in 1832, at a very advanced age. She had the misfortune to survive the two children, who were the offspring of her marriage with Watt. —*Note of M. Arago.*

would have all the flexibility of the tail of this crustacea. It was therefore a complete jointed pipe that he suggested, capable of bending in all present, and future windings of the bed of the river; in fact an iron lobster's tail two feet in diameter and a thousand feet long was what according to Watt's plans and drawings, the Glasgow company carried into execution with complete success.*

Those who were fortunate enough to be personally acquainted with our colleague, do not hesitate to assert that his social qualifications surpassed even those of his mind. Candour almost childish, the greatest simplicity of manners, a love of justice carried even to a scrupulous extreme, and an inexhaustible kindness of disposition, are virtues which have left in England and in Scotland ineffaceable remembrances. Watt habitually moderate and mild, became strongly excited when an invention was attributed to any other but its right author, when particularly some low flatterer endeavoured to enrich himself at another's expense. In his opinion scientific discoveries were the first of treasures, and whole hours of discussion never seemed to him too much in the attempt to render justice to modest inventors, dispossessed by plagiaries, or merely forgotten by public ingratitude.

The memory of Watt may be cited as prodigious, even in comparison with what has been related of this faculty of privileged persons. The extent of it was however his least merit, it assimilated to itself whatever was of the least value, and rejected the superfluity almost instinctively and at once. The variety of our colleague's acquirements would be truly incredible, were they not attested by most eminent men. Lord Jeffrey, in an eloquent notice happily characterised the bold and subtile intelligence of his friend, when he compared it to the wonderfully organized trunk, by which with equal ease the elephant picks up a straw or uproots an oak. These are the terms in which Sir Walter Scott speaks of his fellow-countryman in the preface to *The Monastery*.

"It was only once my fortune to meet Watt, when there were assembled about half a score of our northern lights. Amidst this company stood Mr. Watt, the man whose genius discovered the means of multiplying our national resources to a degree, perhaps, even beyond his own stupendous powers of calculation and combination; bringing the treasures of the abyss to the summit of the earth,—giving to the feeble arm of man the momentum of an Afrite,—commanding manufactures to arise,—affording means of dispensing with that time and tide which wait for no man,—and of sailing without that wind which defied the commands and threats of Xerxes himself. This potent commander of the elements,—this abridger of time and space,—this magician, whose cloudy machinery has produced a change in the world, the effects of which, extraordinary as they are, are perhaps only beginning to be felt,—was not only the most profound man of science, the most successful combiner of powers, and calculator of numbers, as adapted to practical purposes,—was not only one of the most generally well-informed, but one of the best and kindest of human beings. There he stood, surrounded by the little band of northern literati. Methinks I yet see and hear what I shall never see or hear again. In his eighty-first year, the alert, kind, benevolent old man, had his attention at every one's question, his information at every one's command. His talents and fancy overflowed on every subject. One gentleman was a deep philologist,—he talked with him on the origin of the alphabet, as if he had been coeval with Cadmus; another a celebrated critic.—you would have said that the old man had studied political economy and belles-lettres all his life;—of science it is unnecessary to speak, it was his own distinguished walk. And yet when he spoke with your countryman, you would have supposed he had been coeval with Clavers and Burley,—with the persecutors and persecuted; and could number every shot that the dragoons had fired at the fugitive Covenanters."

If our colleague had had any wish, he might easily have raised a name among novelists. In the privacy of his usual society, he seldom failed to enrich the terrible, pathetic, or comic anecdotes which he was in the habit of relating. The minute details of his narrations, the names which he introduced, the technical descriptions of castles, country houses, forests, and caves, to which the scene was successively transferred, gave to his improvisations such an air of truth, as not to allow of the slightest mistrust. One day, however, Watt exhibited some embarrassment in drawing his characters out of the labyrinth in which he had imprudently involved them. One of his friends, perceiving the unusual number of pinches of snuff with which the narrator was trying to create legitimate pauses, and thus eke out the time for reflection, addressed to him the following indiscreet question; "Are you for once telling us something of your own invention?" "This question surprises me;" replied the old man; "for the last twenty years that we have spent our evenings together, I have always done so. Could you really believe that I wished to be considered as a Hume or a Robertson, when my attempts were confined to imitating, at an humble distance, the labours of the Princess Scheherazade in "The Arabian nights."

Every year, in a short journey to London, or to some town not so far from Birmingham, Watt made a minute examination of whatever was new since his last visit. I do not even make an exception of the wonderful fleas or Punch and Judy, for our illustrious colleague looked on such things with the delight and disposition of a school-boy. While following, at present, the itinerary of his annual courses, we find, in more than one instance, luminous traces of his progress. At Manchester, for example, we might see the *hydraulic ram* on the suggestion of our colleague, used to raise the water for condensing in a steam-engine, to the feed-cistern of the boiler.

Watt generally resided at an estate near Soho, called Heathfield, which he bought in 1790. The religious veneration of my friend Mr. James Watt, for everything belonging to his father, enabled me, in 1834, to find the library and furniture of Heathfield in the state in which the illustrious engineer left them. Another property, on the picturesque banks of the river Wye, in Wales, affords the traveller numerous proofs of the enlightened taste of Watt and his son, in the improvements on the roads, in the plantations, and in their agricultural labours of all kinds.

Watt's health became stronger with his age, and his intellectual faculties were preserved to the last moment. Our colleague once thought that they were declining, and, faithful to the motto on the seal he had chosen, (an eye under the word *observare*,) he determined on clearing up his doubts by making observations on himself; and there he was, at seventy years of age, searching for some kind of study on which to make the experiment, and lamenting that he could not find any, on which he had not already exercised his mind. He recollected, at last, that the Anglo-Saxon language was reputed to be very difficult, and it therefore became the experimental medium desired, when the facility with which he acquired it, soon showed him the slight foundation of his apprehensions.

Watt consecrated the last moments of his life to the construction of a machine for copying rapidly, and with mathematical fidelity, works of statuary and sculpture of all kinds. This machine, of which, it is to be hoped, that the arts will not be deprived, was already much advanced, and several of its productions, of a very satisfactory nature, are to be seen in the collections of amateurs, both in England and Scotland. The illustrious engineer made presents of them gaily, as the first attempts of a young artist entering his eighty-third year.

Of this eighty-third year, our colleague was not destined to see the end. In the beginning of the summer of 1819, alarming symptoms already defied all the efforts of medicine. Watt did not delude himself as to his position. "I feel," said he to the numerous friends who visited him, "I feel the attachment which you have shown; I thank you for it now, for I am in my last illness." His son did not appear to him to show sufficient resignation, and every day he sought a new pretext to point out to him, with mildness, goodness, and tenderness, "all the reasons of consolation which the circumstances under which an inevitable event must occur, should infuse into him." This mournful event occurred on the 25th of August, 1819.

Watt was interred in the parish church of Heathfield, near Birmingham, in the county of Stafford. Mr. James Watt, whose distinguished talents and noble sentiments endeared, during twenty-five years, the life of his father, erected to him a splendid Gothic monument, for which the church of Handsworth is now remarkable. In the centre stands an admirable statue in marble by Chantrey, a faithful likeness of the old man.

A second marble statue from the chisel of the same sculptor, has also been placed, by filial piety, in one of the halls of that brilliant university in which, during youth, the then unknown artisan, persecuted by the corporation, received flattering and well deserved encouragement. Greenock has not forgotten that Watt was born there; its inhabitants have raised, at their own expense, a marble statue to the illustrious mechanic. It is placed in a handsome library, built on ground presented gratuitously by Sir Michael Shaw Stewart, and in which are collected the books belonging to the town, and the collection of scientific works which Watt gave to it in his life-time. This building has cost 3500*l.*, to the expense of which Mr. Watt, jun., liberally contributed. A large colossal statue in bronze, on a fine granite base, which reigns over George Square in Glasgow, shows to every one how proud this capital of Scotch commerce feels of having been the cradle of Watt's discoveries. The gates of Westminster Abbey have at last been opened, on the demand of an important meeting of subscribers. A colossal statue of Carrara marble, a master-piece of Chantrey, and on the pedestal of which is an inscription by Lord Brougham,* has become, during the last four years, one of the principal ornaments of the English Pantheon. No doubt there is some coquetry in uniting, on the same monument, the illustrious names of Watt, Chantrey, and

* We shall give the drawings and description of this apparatus in our next Journal.—(Ed. C. E. & A. Journal.)

* INSCRIPTION ON MONUMENT.

NOT TO PERPETUATE A NAME
WHICH MUST ENDURE WHILE THE PEACEFUL ARTS FLOURISH,
BUT TO SHEW
THAT MANKIND HAVE LEARNT TO HONOUR THOSE
WHO BEST DESERVE THEIR GRATITUDE,
THE KING,
HIS MINISTERS, AND MANY OF THE NOBLES
AND COMMONERS OF THE REALM,
RAISED THIS MONUMENT TO
JAMES WATT.
WHO, DIRECTING THE FORCE OF AN ORIGINAL GENIUS,
EARLY EXERCISED IN PHILOSOPHICAL RESEARCH,
TO THE IMPROVEMENT OF
THE STEAM-ENGINE,
ENLARGED THE RESOURCES OF HIS COUNTRY,
INCREASED THE POWER OF MAN,
AND ROSE TO AN EMINENT PLACE
AMONG THE ILLUSTRIOUS FOLLOWERS OF SCIENCE,
AND THE REAL BENEFACTORS OF THE WORLD.
BORN AT GREENOCK, MDCCXXXVI,
DIED AT HEATHFIELD IN STAFFORDSHIRE, MDCCCXIX.

Brougham; but I cannot blame it. Glory to those people who thus take every opportunity of honouring their great men.

Thus we see five statues have been, in a short time, raised to the memory of Watt. Must we confess it? These testimonies of filial piety and public gratitude have excited the ill-humour of some of those narrow-minded individuals who think, by standing still, to stop the progress of centuries? If we were to believe them, warriors, judges, and ministers, (I must confess they have not dared to say all ministers,) have alone a right to statues, and I do not know whether either Homer or Aristotle, Descartes or Newton, appear to the modern Aristarchus worthy of a mere bust. Most certainly they would refuse the commonest medallion to Papin, Vaucanson, Watt, Arkwright, or any other mechanic, unknown, perhaps, in a certain world, but whose fame must go on increasing from age to age with the progress of enlightenment. When such heresies dare to parade themselves in the full glare of day, we must not be ashamed of combating them. It is not without reason that the public has been called a sponge for prejudices, and as prejudices are hurtful plants, the slightest trial is enough to root them out, if they are laid hold of in the birth, while, on the other hand, they cling firmly when they have had time enough to grow, and to catch in their numerous folds, whatever is within their reach.

If this discussion wound the self-love of some, I must remind them that it has been provoked. Have not the men of learning of our day made their complaints, because they do not see, among the long rows of colossal statues raised by the authorities, so sumptuously on our bridges and public places, any of those great authors whose inheritance they claim? Do they not know how perishable are these monuments, which the hurricane can shake and overturn, which even frost can nibble away, and bring down to shapeless blocks.

Their statuary, their limner, is the printing-press, thanks to the admirable invention of which, works emanating from science or imagination, when possessing real merit, can set time and political revolutions at defiance. The exactions of the tax-gatherer, the mistrust and terrors of the tyrant, can never prevent these productions from getting over the most strongly guarded barrier; in every shape a thousand vessels bear them from hemisphere to hemisphere; they are pored over in Iceland and the Isle of Van Diemen; they are read by the cottager's fireside and in the dazzling halls of princes. The writer, the artist, and the mechanic, are known by the whole world, by all which is most noble and exalted in man, by the soul, the thought, and intelligence. How mad would he be, who placed on such a stage, should wish his features sculptured in marble or in bronze, by the chisel of a David, to be exposed to the gaze of idle loungers. Such honours, I say again, a savant, a litterator, or an artist, may not envy, but at any rate he should not allow himself to be declared unworthy of them. Such is, at least, the opinion I have formed from the discussion to which I am about to call your attention.

Is it not a circumstance truly strange, that such pompous pretensions, against which I contend, should have been brought forward just on the occasion of five statues being erected, which cost not a farthing to the public treasury. Far be it from me, however, to profit by this mismanagement; I like better to take the question in its general bearings, such as it has been put, the pretended superiority of arms over letters, sciences, and art; for do not deceive yourselves, judges and ministers have only been put in company with men of war to give them a spurious passport.

The little time which is allowed me for this discussion, compels me to be methodical, and in order that my sentiments may not be misunderstood, I declare at once, that independence and national freedom are to me the first of blessings; that to defend them against the foreigner, or against home enemies, is the first of duties; and that to have defended them at the price of one's blood, is the first of titles to the public gratitude. Raise! raise your splendid memorials to the soldiers who fell on the glorious walls of Mentz, on the immortal battle fields of Zurich and Marengo! my offering is ready; but why call upon me to act in defiance of my reason, in contradiction to those feelings which nature has implanted in the heart of man? why ask me to place all military service on the same footing?

What Frenchman, who had but feeling, would, even in the time of Louis XIV, have pointed out, as an act of bravery in our troops, the cruel scenes of the Dragonnades, or the wreaths of flame which destroyed the towns, villages, and rich country, of the unfortunate Palatines? Some time ago, our brave soldiery, after a thousand miracles of patience, skill, and valour, rushing into Saragossa half overthrown, reached the door of a church, in which the preacher shouted, in the ears of his resigned congregation, these pompous words; "Spaniards, I am going to read your burial service." How do I know but that, in this moment, the true friends of our national glory, balancing the relative merits of the conqueror and the conquered, might have willingly changed the parts?

Put morality on one side altogether, I give it up to you; place in the crucible of conscientious criticism the personal claims of some winners of battles, and be sure that, after giving a fair share to chance, an ally who is generally put out of the way because he cannot speak for himself, many supposed heroes will seem to you but little worthy of this pompous title. If it were thought necessary, I should not shrink from an examination into detail; I, however, who, in a career purely academic, have found few opportunities for gathering precise documents on such a subject. I could, for instance, quote to you, from our own annals, a modern battle, a battle gained, of which the official dispatch gives an account as of an event foreseen, prepared for with deliberation and consummate skill, and which, in truth, was a spontaneous movement of the soldiery, without any order from the general in command, on whom the honour has been bestowed, without his having been there, without his knowing where.

To escape the fatal reproach of incompetency, I will appeal to military men themselves for the support of the philosophical thesis which I maintain, and it will be seen with what enlightened enthusiasm they welcome works of mind; it will be seen that in their private opinion works of mind did not hold a second rank. Obliged to restrain myself, I will try by fame to make up for number; I will quote Alexander, Pompey, Cæsar, and Napoleon.

The admiration of the Macedonian conqueror for Homer is historic; Aristotle, at his request, revised the text of the Iliad. This corrected copy became his favourite book, and when, in the midst of Asia, among the spoils of Darius, a magnificent casket decked with gold, with jewels, and with pearls, seemed to arouse the greediness of his lieutenants, the conqueror of Arbela exclaimed, "Save it for me, I will keep my Homer in it. He is the best and most faithful councillor in military matters I ever had. It is but right, moreover, that the richest effort of the arts should serve to keep the most precious triumph of the human mind." The sack of Thebes had already shown more clearly still the unbounded respect and admiration of Alexander for literature. One only family of this crowded city escaped death and slavery, and that was the family of Pindar; one only house remained standing amid the ruins of the temples; the house, not of Epaminondas, but that where Pindar was born.

When on the conclusion of the war with Mithridates, Pompey went to pay a visit to the celebrated philosopher Posidonius, he forbade his lictors to knock at the doors, according to custom, with their rods; and thus says Pliny, for the first time were lowered in the humble abode of a savant, those emblems which had seen the East and West prostrated at their feet.

Cæsar, whom literature may also claim, shows in twenty places of his immortal Commentaries, what rank the different faculties with which nature had so liberally endowed him, held in his esteem. How short, how quick he is, when he tells his battles and his feats of war! See on the other hand, if he finds any detail too much in describing the bridge he had made for his army to cross the Rhine. Here it was that success depended only on conception, and that conception belonged to him alone. It has also been already remarked, that the part which Cæsar assumed in preference in the events of war, that of which he was proudest was a moral influence. *Cæsar harangued his army* is almost always the first phrase of his description of battles gained. *Cæsar did not arrive soon enough to speak to his soldiers, to exhort them to act well,* is the habitual accompaniment of the account of a surprise or of a momentary defeat. The general constantly takes care to lower himself to the writer, and *in good truth,* as the judicious Montaigne says, *his tongue did him in many places notable service.*

Now without any digression, without even recalling that exclamation of Frederick, "I would rather have written Voltaire's Age of Louis XIV. than have won a thousand battles," I come to Napoleon. As we are in haste, I will neither remind you of his celebrated proclamations written in the shade of the Egyptian pyramids, by the *Member of the Institute,* General in Chief of the Armies of the East; nor of those treaties of peace in which works of art and science were the ransom price of conquered people; neither of the profound esteem which the General when Emperor never ceased to manifest towards Lagrange, Laplace, Monge and Berthollet; neither will I speak of the riches which he showered on them. An anecdote little known will more directly fulfil my object.

Every one recollects the ten year prizes. The four classes of the Institute had drawn up short accounts of the progress of science, literature and art. The President and Secretaries were to read them successively before Napoleon, the great dignitaries of the empire, and the council of state. On the 27th of February, 1808, it came to the turn of the French Academy—as may be supposed on that day, there was a more numerous attendance than in general, for who does not think himself a judge in matters of taste? Chénier addressed the assembly. He is listened to in solemn silence, when suddenly the Emperor stops him, and bending forward, his hand upon his heart, and in a voice affected by evident emotion, he cried, "It is too much, gentlemen, you bear me down; I want words to express my gratitude." I leave you to guess the surprise of the assembled courtiers who were witness to this scene, they who from adulation to adulation, had gone so far as to say to their master, without his seeming surprised by it, "When God created Napoleon, he was forced to rest from his labour."

But what were the words which went so straight, so directly to the heart of the Emperor? These were they, "In those camps, where far from the misfortunes of home, our national glory was maintained untarnished, arose an eloquence unknown till then to the people of modern days. We must even confess that when we read in ancient authors the harangues of the most renowned captains, we are often tempted to admire only the genius of the historian; but here doubt is impossible; the records exist; and history has but to gather them together. They came from the army of Italy, those noble proclamations, in which the conqueror of Lodi and Arcola, while he created a new art of war, founded a military eloquence, of which he alone is the best model."

On the 28th of February, the day after the celebrated meeting, which I have just related, *the Moniteur,* with its *well known fidelity,* published a reply of the Emperor to the discourse of Chénier. It was cold, cramped, and insignificant, it possessed all the characters, some would say all the qualifications of an official document. As to the incident which I have related, no mention is made of it, a miserable concession to the ruling opinion, to the thin skinned susceptibility of the general staff! The master of the world, to use the expression of Pliny, giving way for one moment to the emotions of his heart, did not the less bend his staves before the literary title granted to him by an academy.

These reflections on the comparative merit of men of study and men of the sword, although they have mainly been suggested to me by what is said, by what is passing under our very eyes, is not without its application to the country of Watt. I was travelling lately in England and Scotland. The kindness with which I was treated, authorised on my side those dry, cutting and direct questions which under any other circumstances a judge only on the bench could demand. Already seriously engaged with the duty which I had undertaken, of delivering on my return judgment on the illustrious mechanic; already feeling uneasy as to the solemn assembly before which I was to speak, I had prepared this question, "What do you think of the influence exercised by Watt, on the riches, power and prosperity of England?" I do not exaggerate when I say that I have addressed this question to more than a hundred persons belonging to all classes of society, and to every shade of politics, from the highest radical to the most prejudiced conservative. The reply has constantly been the same; every one placed the services of our colleague above all comparison; every one, moreover, quoted to me the speeches made at the meeting when the statue at Westminster was voted as the faithful and unanimous expression of the feelings of the English nation. What do these speeches say?

Lord Liverpool, Prime Minister, calls Watt "one of the most extraordinary men to whom England has given birth, one of the greatest benefactors of the human race." He declares that "his inventions have increased in an incalculable manner the resources of his country and even those of the whole world." Taking the political side of the question, "I have lived," added he, "in an age when the success of a campaign, or of a war, depended on the possibility of getting without delay our fleets out of port. Contrary winds prevail for whole months, and upset from top to bottom all the views of government. Thanks to the steam-engine such difficulties are for ever at an end." "Look," said Sir Humphrey Davy, "at the metropolis of this powerful empire, at our cities, our villages, our arsenals and our manufactures; examine the subterranean caverns and the works executed on the surface of the globe; look at our rivers, our canals, the seas which bathe our shores; and everywhere you will find marks of the eternal benefits of this great man." "The genius which Watt has displayed in his admirable inventions," says still farther the illustrious President of the Royal Society, "has contributed more to show the practical utility of science, to increase the power of man on the material world, and to multiply and diffuse the necessaries of life, than the labours of any person in modern times." Davy does not hesitate at all at placing Watt above Archimedes. Huskisson, President of the Board of Trade, resigning for a moment his claims as an Englishman, asserts that considered in relation with the happiness of the human race, Watt's inventions appear to him to merit the highest admiration. He explains in what manner the saving in labour, the indefinite multiplication and the cheapness of manufactured goods, contribute to excite and extend civilization. "The steam-engine," said he, "is therefore not only the most powerful instrument in the hands of men for changing the face of the physical world, but it acts as an irresistable moral lever in urging forward the great cause of civilization."

In this point of view, Watt appeared to him to hold a distinguished rank among the first benefactors of the human race. As an Englishman, he did not hesitate to say that without the works of Watt, the English nation could never have supported the expenses of their last wars with France. The same idea is to be found in the speech of another member of Parliament, in that of Sir James Mackintosh; see whether it be expressed in terms less positive: "The discoveries of Watt have been the means of enabling England to sustain the most arduous and most dangerous conflict in which she has ever been engaged." Everything taken into consideration, Mackintosh declares, "that no person has more evident claims than Watt to the homage of his country and the veneration and respect of future ages."

Here are some numerical calculations, figures more eloquent still than the several passages which I have just done reading. The younger Mr. Boulton announces that in the year 1819, the manufactory of Soho alone had already manufactured engines of Watt, of which the regular labour would require one hundred thousand horses, and that the saving resulting from the substitution of machinery for animal power, amounted to three millions yearly. In England and Scotland at the same date, the number of engines was more than 10,000; they did the work of 500,000 horses, or of three or four millions of men, with an annual saving of 10 or 15 millions sterling. These results must in the present day be more than doubled.

This is, in short, what was thought and said of Watt by ministers, statesmen, savants, and manufacturers, best qualified to appreciate him. Gentlemen, this creator of six or eight millions of labourers, of indefatigable and assiduous labourers, among whom no combination is to be repressed, no mutiny feared—labourers at a half-penny per day; this man, who by brilliant inventions gave to England the means of sustaining a terrific struggle, in which even her nationality was never put in danger*—this new Archimedes—this benefactor of all mankind, of whom future generations will bless the memory—what was done to honour him in his lifetime?

* M. Arago seems to have strangely mistaken the words of the speakers, if he imagines that they attributed to Watt, the power of contending with France, when they only asserted that it was owing to him that we are enabled to sustain the expense, and have the means of avoiding many difficulties in future.—*Note of the translator.*

The peerage is in England the highest dignity and the highest reward. You will naturally imagine that Watt was made a peer—it was never even thought of.

If we must speak plainly, so much the worse for the peerage that it was never honoured with the name of Watt. Such an omission in a nation so justly proud of their great men, naturally astonished me. When I enquired the cause, what do you think they replied to me? Those dignities of which you speak, are reserved for naval and military officers, for influential orators in the House of Commons, for members of the nobility. *It is not the fashion* (I do not invent, I quote exactly)—it is not the fashion to grant them to savants, authors, artists, and engineers. I knew well enough that it was not the fashion in Queen Anne's time, since Newton was not a peer of England, but after a progress in science and philosophy of a century and a half, when every one of us in the short course of his life has seen so many kings wandering, abandoned, and proscribed, their places on the throne supplied by soldiers without a pedigree, sons of their swords, had I not a right to believe that the practice of giving people a destiny was abandoned—that no one would longer dare, at any rate to tell them to their faces like the inflexible law of the Pharoahs, whatever may have been your services, your virtues, or your knowledge, none of you shall pass the bounds of his caste—that an insane fashion (since fashion it is) should no longer disgrace the institutions of a noble people*.

Let us depend upon the future. A time will come when the science of destruction will bend before the arts of peace—when the genius which multiplies our strength, creates new products, and brings comfort to the mass, will occupy in the esteem of men that place which reason and good sense claim for it in the present day; then Watt will appear before the grand jury of the population of the two worlds; every one will see him, aided by his steam engine, penetrate in a few weeks into the bowels of the earth, where before him none arrived but after the most painful labour; he will excavate there spacious galleries, and will clear them almost instantly of immense volumes of water which daily inundate them; he will snatch from a virgin soil the inexhaustible riches which nature has deposited in it. Joining delicacy with strength, Watt will twist with equal success the immense links of the colossal cable, around which the ship of the line floats in safety, and the microscopic threads of those nets and aerial laces which always occupy such a considerable place in the varied habiliments of fashion. A few oscillations of the same engine will give up to cultivation vast marshes; fertile countries will thus be relieved from the periodical and mortal action of the miasma developed by the burning summer sun. The great mechanical power which used to be sought in mountain regions at the foot of swift cascades, will then, thanks to Watt's inventions, spring up at will without trouble and without embarrassment, in the midst of cities—in every floor of a house. The intensity of the power will vary at the will of the mechanic; it will not depend as before on the inconstancy of natural causes, the meteors of the atmosphere, the different branches of each manufacture may be brought into one common establishment, under one roof. Manufactured productions by their perfection will diminish in price; the people well fed, well clothed, and well warmed, will increase rapidly; they will cover with elegant habitations every part of the territory, even those which may be justly called the steppes of Europe, which centuries of barrenness seem to have condemned to remain the exclusive realm of savage brutes. In a few years hamlets will become important cities. In a few years, towns like Birmingham, in which hardly thirty streets were to be counted, will take their place among the greatest, richest and handsomest cities of a powerful kingdom. Placed upon ships, the steam-engine will replace a hundred fold, triple, quadruple banks of rowers, from whom our forefathers demanded efforts which were justly ranked as the heaviest punishment of the greatest criminals. By means of a few pounds of coal, man will con-

* M. Arago might have reserved his declamation to have made a better hit. Ignorant of the state of society in England, he complains that political distinctions are reserved for political services; and passing over the honours that are devoted to men of mind, he forgets to tell his readers, that a man is not obliged to be a peer to hold first-rate rank in society, and that many men, even merchants, or the sons of merchants, enjoy more consideration without any title at all, than most of his envied peers. He can tell us what Bailly did in the Convention, and what he himself has done in the chamber; how Bulwer, Ward, D'Israeli, and Davies Gilbert have distinguished themselves in the lower house, or Byron among the peers; he can tell us how to avail ourselves of the gauchery of Oliver Goldsmith, or the abstractedness of Newton, and then we may be prepared to follow the course which he, in his wisdom, points out. We do not find that our brethren, the Americans, have made ministers of either Bowditch or Hare, of Washington Irving, or Fenimore Cooper, and we should like to have other experience before we set an example. That we have been ungrateful to eminent men in every career we must confess, but the tributes we have granted have been counted as the noblest reward for which Englishmen could contend. Few reap fame in their life-time; a public funeral, and a sepulchre in the temples of glory, are all that heroes receive in the flesh; yet, who can deny the honours paid to Shakspeare, to Bacon, to Milton, or to Newton; who can deny that Watt has received tributes such as no Englishmen ever before obtained. His contemporaries may complain, the shade of Trevithick may mourn its neglect, but [illegible] of all names, is the last to be singled out as one to which we have been [illegible] in our tribute. We have many great names living now; Moore, Dickens, [illegible] Southey, Knowles, Bulwer, Chantrey, Wilkie, Faraday, Babbage, Charles Bell, [illegible] Hall, and scores of others, yet which of these will clamour for a peerage, when [illegible] honors which a peer would envy. The tribute of popular esteem paid to Charles [illegible] the greatest novelist since Fielding, are worth all the trumpery titles of kings, or [illegible] torted statues of Governments. The Greeks contended not for a title or a pens[illegible] for a perishable crown of leaves, and kings could quit their thrones to earn th[illegible] honour for their brows. Let M. Arago learn, that England reserves for her g[illegible] higher reward than the gewgaws of her mighty empire—to live for ever in t[illegible] her people, and to look for that inheritance in future ages from half [illegible] France may erect statues, and may make peers, but it is for us to give [illegible] shall be claimed by the new world and by the old, by the Negro, th[illegible] Caffre, the native of the Southern Ocean, and Australia's latest Col[illegible] *translator.*

quer the elements, and set at defiance calms, contrary winds, and even tempests themselves. Passages will become quicker, the time of arrival of packets may be calculated like that of a land dispatch. No more shall we await upon the shore for weeks, for months together, our hearts torn by anxiety, to seek with a distrustful eye in the limits of the horizon for the uncertain outlines of the ship, which bears to you a father, mother, brother, or a friend. The steam-engine in fine, dragging in its train thousands of travellers, will run upon the iron road with greater speed than the swift horse carrying only the unweighted jockey.

This is, gentlemen, but a very brief sketch of the benefits conferred upon the world by the machine of which Papin laid the germ in his works, and which Watt carried to admirable perfection. Posterity certainly will not weigh them in the balance with labours much more vaunted, and the real influence of which, before the tribunal of reason, will always remain circumscribed to the circle of a few individuals, or a trifling number of years.

Formerly the age of Augustus was spoken of, the age of Louis XIV., eminent minds have already maintained that it would be right to say the age of Voltaire, Rousseau and Montesquieu. For my part, I do not hesitate to assert that when to the immense services already rendered by the steam-engine, shall be added all the wonders which it promises to us still, grateful nations will speak also of the ages of Papin and Watt.

APPENDIX.

A biography of Watt intended to make a part of our collection of memoirs would be certainly incomplete if it did not contain a list of the academic titles, which the illustrious engineer had received. This list besides only requires a few lines.

Watt was elected

Fellow of the Royal Society of Edinburgh in 1784.
Fellow of the Royal Society of London in 1785.
Member of the Batavian Society in 1787.
Corresponding Member of the French Institute in 1808.

In 1814 the Academy of Sciences of the Institute conferred on Watt the highest honour in its power, that of nominating him *one of its eight* Foreign Members.

By a spontaneous and unanimous vote of the Senate of the University of Glasgow, granted to Watt, in 1806, the honorary degree of Doctor of Law.

ON THE COMPOSITION OF WATER.

AN HISTORICAL NOTE, BY THE RIGHT HON. LORD BROUGHAM, F.R.S., AND MEMBER OF THE NATIONAL INSTITUTE OF FRANCE.

There is no doubt that in England, at least, researches into the discovery of the compositions of water have had for their origin the experiments of Warltire, related in the 5th volume of Priestley.* Cavendish quotes them expressly, as having suggested to him the idea of his labour.† The experiments of Warltire consisted in the firing, by means of an electric spark, and in closed vessels, a mixture of oxygen and hydrogen; two things, it was said, resulted from it, 1st, a sensible loss of weight, and 2ndly, the precipitation of moisture on the sides of the vessels.

Watt says by inadvertence in the note at page 332 of his paper‡, that the aqueous precipitation was observed for the first time by Cavendish, but Cavendish himself declares p. 127, that Warltire had perceived the slight watery deposits, and quotes on this subject the 5th volume of Priestley. Cavendish could not determine any loss of weight; he observes that the attempts of Priestley *had led him to the same result*§, and adds, that the moisture deposited did not contain any impurity (literally *any sooty matter*).

After a great number of trials, Cavendish found out that if a light be put to a mixture of common and inflammable air, composed of 1000 parts of the first and 423 of the second, "about a fifth of the common air, and almost all the inflammable air, lose their elasticity, and *form by condensation* the dew which covers the glass." On examining the dew, Cavendish found that this dew was pure water, and he concluded from it, that all the inflammable air and about a sixth of the common air, returned into pure water."

Cavendish burned in the same manner a mixture of inflammable air and dephlogisticated air (hydrogen and oxygen). The liquid precipitated was always more or less acid, according as the gas burned with the inflammable air contained more or less phlogiston; this acid so engendered was nitric acid.

Mr. Cavendish decided that "almost all the inflammable dephlogisticated air *is turned into pure water*," and further, that if those airs could be obtained in a complete state of purity, all of it would be *condensed*." If common air and inflammable air do not give out acid when they are burned, it is, according to this author, because then the heat is not intense enough.

Cavendish declares that his experiments, with the exception of those relating to acid, were made in the summer of 1781, and that Priestley was acquainted with them; he adds, "one of my friends gave some account to Lavoisier, last spring (1783), as also of the conclusion which I had drawn that dephlogisticated air is water deprived of phlogiston. But at that time, Lavoisier was so far from thinking such an opinion legitimate, that up to the time that he made up his mind to try the experiments for himself, he found some difficulty in believing that almost the whole of two airs could be converted into water."

The friend mentioned in the preceding passage was Doctor, afterwards Sir Charles Blagden. It is a remarkable circumstance that this passage of Cavendish's work seems not to have made part of the original paper presented to the Royal Society; the paper seems to have been written by the hand of the author himself, but the paragraphs 134 and 135 were not in it originally; they are added, with a mark of the place to which they belong: the writing also is not that of Cavendish, the additions are in Blagden's hand-writing. It was he who must have given the details relative to Lavoisier, with whom it is not said that Cavendish kept up a direct correspondence.

The date on which Cavendish's paper was read is the 15th January, 1784. The volume of the Philosophical Transactions of which this paper forms a part, did not appear for six months after.

The paper of Lavoisier (Volume of the Academy of Sciences for 1781), had been read in November and December, 1783. Several additions were afterwards made to it; it was published in 1784. This paper gives an account of experiments in the month of June, 1783, at which Lavoisier announces that Blagden was present; Lavoisier adds, that this English philosopher had informed him "that already Cavendish having burned inflammable air in closed vessels, had obtained a very sensible quantity of water;" but he says nowhere that Blagden mentions the conclusions drawn by Cavendish from these experiments.

Lavoisier declares expressly that the weight of the water was equal to that of the two gases consumed, unless, contrary to his own opinions, sensible weight was attributed to the heat and light disengaged in the experiment.

This account is in discordance with that of Blagden, which according to all probability, was written as a refutation to that of Lavoisier, after the paper of Cavendish was read, and when the volume of the Academy of Sciences had not yet arrived in England. This volume came out in 1784, and certainly it could not have arrived in London, neither when Cavendish read his paper before the Royal Society, nor for still stronger reasons, when he compiled it. It must be besides remarked, that in the passage in the manuscript paper of Blagden, only one communication of experiments is mentioned, a communication to Priestley. The experiments, it is there said, were made in 1781, but the date of the communication is nowhere mentioned, neither are we better informed whether the conclusions drawn from these experiments, and which according to Blagden, were communicated by him to Lavoisier in the summer of 1783. were equally included in the communication made to Priestley. The Birmingham chemist in his paper drawn up before the month of April, 1783, read in June of the same year, and quoted by Cavendish, says nothing of the theory of this latter, although he quotes his experiments.

Several propositions result from the foregoing:

1st. Cavendish in the paper read before the Royal Society on the 15th January, 1784, describes the principal experiment of the inflammation of oxygen and hydrogen in closed vessels, and quotes the water as the product of this combustion.

2nd. In the same paper, Cavendish draws from his experiments the conclusion that the two gases mentioned transform themselves into water.

3rd. In an addition of Blagden made with the consent of Cavendish, the

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* Warltire's letter, dated from Birmingham, the 18th of April, 1781, was published by Dr. Priestley in the 2nd volume of his *Experiments and Observations relating to various branches of Natural Philosophy, with a continuation of the Observations on Air*, forming in fact the 5th volume of *Experiments and Observations on different kinds of Air*, printed at Birmingham in 1781.—(*Note by Mr. Watt, Junior.*)

† *Philosophical Transactions*, 1784, p. 120.

‡ *Philosophical Transactions*, 1784.

§ The note of Cavendish at page 127, appears to imply that Priestley had not perceived any loss of weight, but I do not find this assertion in any of the works of the Birmingham chemist.

The first experiments of Warltire on the conflagration of the gases, were made in a copper globe, the weight of which was 14 ounces, and the volume three pints. The author wished "to determine whether heat was or was not ponderable."

Warltire at first describes the methods of mixing the gas and adjusting the scales, and then says, "I always balanced exactly the vessel full of common air, in order that the difference of weight by the introduction of inflammable air might allow me to judge whether the mixture had been effected in the wished for proportions. The passage of the electric spark made the globe hot; after it had cooled again by exposure to the air of the room, I hung it up again on the balance; I always found a loss of weight, but there were differences between one experiment and another. The mean loss was two grains."

Warltire continues thus, "I have exploded my gases in glass vessels since I have seen you (Priestley) do it lately, and I have observed AS YOU DID, that although the vessel was clean and dry before the explosion, it was afterwards covered with dew and a sooty substance."

On balancing the claims, does not the merit of having perceived the dew seem to rest with Priestley?

In some remarks which Priestley adds to his correspondent's letter, he confirms *the loss of weight*, and adds, "I do not think, however, that the bold opinion that the latent a greater scale. If that is confirmed, it will be a remarkable fact, and one which wil do the greatest honour to Warltire's sagacity.

heat of bodies is a sensible part of their weight, can be admitted without experiments on

"It must be farther observed," continues Priestley, "that at the time that he (Warltire) saw the dew on the inside of the closed vessel of glass, he said that it confirmed an opinion which he had long had—the opinion that common air gives up its humidity when it is phlogisticated."

It is therefore evident that Warltire explained the dew by the simple mechanical precipitation of the hygrometrical water contained in common air.—(*Note of Mr. Watt, Junior.*)

experiments of the latter are dated from the summer of 1781. A communication of Priestley is quoted without determining the date, without speaking of the conclusions, and without even saying when these conclusions occurred to Cavendish. This must be considered as a most material omission.

4th. In one of Blagden's additions to the paper, Cavendish's conclusion is related in these terms, oxygen gas is water deprived of its phlogiston; this addition is posterior to the arrival in England of Lavoisier's paper.

It may be farther observed that in another addition to Cavendish's paper, written by the hand of this chemist, and which is certainly later than the arrival in England of Lavoisier's paper, Cavendish establishes distinctly for the first time, and as the hypothesis of Lavoisier, that water is composed of oxygen and hydrogen. Perhaps no essential difference can be found between this conclusion and that at which Cavendish had at first arrived, that oxygen gas is water devoid of its phlogiston, for it is sufficient to make them identical to consider phlogiston as hydrogen, but to say that water is composed of oxygen and hydrogen, is certainly to come to a clearer and less equivocal conclusion. I may add that in the original part of his paper, in that which was read before the Royal Society before the arrival of Lavoisier's paper in England, Cavendish thought it juster to consider inflammable air as "as water phlogisticated, rather than as pure phlogiston."—p. 140.

Let us now see what was Watt's part, in which dates will play a very important character. It appears that Watt wrote to Dr. Priestley on the 26th April, 1783, a letter in which he discanted on the experiment of inflaming two gases in close vessels, and that then he came to the conclusion that "water is composed of dephlogisticated air, and of phlogiston, both deprived of a part of their latent heat*.

Priestley deposited the letter in the hands of Sir Joseph Banks, requesting him to have it read at one of the next meetings of the Royal Society. Watt then desired that this reading should be put off, in order that he might have time to see how far his theory agreed with the recent experiments of Priestley: at last this letter was not read until April, 1784.† This letter Watt alludes to in a paper addressed to Deluc, dated the 26th November, 1783‡; many new observations and new reasonings appeared in this paper, but almost all of the original letter was preserved, and in printing, it was distinguished by the addition of reversed commas; in the part thus marked, is to be found the important conclusion and notes above. We read further, that the letter was communicated to several members of the Royal Society when it was received by Dr. Priestley in April, 1783.

In Cavendish's paper§ as it was at first read, there is no allusion to Watt's theory; an addition posterior to the reading of the letters of this latter, and written entirely in Cavendish's hand, mentions this theory. Cavendish, in this addition, shows the reasons, which he thought he had not, to complicate his conclusions, as Watt had done, with considerations relative to latent heat. It leaves in doubt the question, whether the author were acquainted with Priestley's letter, of April, 1783, or whether he only saw the letter dated the 26th of November, 1783, and read the 29th of April, 1784; upon which it is important to observe, that the two letters appeared in the Philosophical Transactions, thrown into one. The letter to Priestley, of the 26th of April, 1783, remained some time (two months after the paper of Watt) in the hands of Sir Joseph Banks, and other Members of the Royal Society, during the spring of 1783. This is what appears from the circumstances mentioned in the note at page 330. It seems difficult to suppose that Blagden, Secretary to the Royal Society, did not see the paper. Sir Joseph Banks must have given it to him, since it was intended to be read at the meeting.‖ We may add, that since the letter was preserved in the records of the Royal Society, it was under the care of Blagden, the Secretary. Could it be possible to suppose that the person whose hand wrote the remarkable passage, already quoted, relative to a communication made to Lavoisier, in June, 1783, of Cavendish's conclusions, would not, at least, have informed Cavendish that Watt had arrived at the same conclusions, at farthest, in April 1783. These conclusions are identical, with the single difference, that Cavendish calls dephlogisticated air, water deprived of its phlogiston, and that Watt says that water is composed of dephlogisticated air and phlogiston.

We must remark that in Watt's theory, there is the same uncertainty and vagueness, that we have already found in those of Cavendish, and that all this occurs from the use of the term, not exactly defined, of phlogiston.¶ With Cavendish, it cannot be determined, whether phlogiston means simply inflammable air, or whether that chemist was not rather inclined to consider as inflammable air, a combination of water and phlogiston. Watt says expressly, even in his paper of the 26th November, 1783, and in a passage which is not a part of his letter of April, 1783, that inflammable air, in his opinion, contains a small quantity of water, and much elementary heat.

These expressions on the part of two men so eminent, must be considered as the mark of a certain hesitation touching the composition of water. If Watt and Cavendish held the precise idea that water resulted from the re-union of two gases deprived of their latent heat, from the re-union of the bases of inflammable and dephlogisticated air; if this conception was as clear in their mind as it was in that of Lavoisier, they would certainly have avoided the uncertainty and obscurity which I have pointed out.*

As to what relates to Watt, these are the new facts which we have just established:

1st. There is no proof that any one gave, before Watt, and in a written document, the actual theory of the composition of water.

2nd. Watt established this theory during the year 1783, in terms more distinct than Cavendish did in his paper of 1784. By introducing the disengagement of latent heat as a part of the process, Watt added to the clearness of his conception.

3rd. There is no proof; there is not even any assertion that the results of Cavendish's theory (Blagden calls it his conclusion) were communicated to Priestley before the period, at which Watt informed him of his opinions in his letter of 26th April, 1783. For a still stronger reason, nothing can make us suppose, particularly after reading Watt's letter, that this engineer ever learned anything relative to the composition of water, either from Priestley, or from any one else.

4th. Watt's theory was known to the Fellows of the Royal Society, of several months before Cavendish's conclusions were put upon paper, and eight months before the presentation of this chemist's paper to the Royal Society. We can even go farther and deduce from the facts and dates before our eyes, that Watt first spoke of the composition of water, and that if any one preceded him, we have no proof of it.

5th. In fine, a repugnance at abandoning the doctrine of phlogiston, a sort timidity at separating from an opinion so long established and so deeply rooted, prevented Watt and Cavendish from doing complete justice to their own theory;† whilst Lavoisier, who had broken these fetters first, present the new doctrine in its full perfection.

It might be very possible that, without knowing any thing of each other's labours, Watt, Cavendish, and Lavoisier had, about the same time, taken the great step of concluding from experiment, that water is the produce of the combination of the two gases so often quoted, which is, in fact, with more or less preciseness, the conclusion to which the three philosophers have come. There now remains the declaration of Blagden, according to which Lavoisier had received a communication of Cavendish's theory, even before having made his chief experiment. This declaration Blagden inserted in the very paper of Cavendish;‡ it appeared in the Philosophical Transactions, and it does not seem that Lavoisier ever contradicted it, however irreconcilable it might appear with his own account.

On the other hand, notwithstanding all Blagden's susceptibility abouc Cavendish's priority, there is no where, on his part, the slightest allusion that may lead us to conclude that, before publishing his paper, Watt had heard of that of his competitor.

We cannot affirm too strongly, relative to the question, whether Cavendish had any knowledge of Watt's labours before drawing up the conclusions of his own paper. To maintain that Cavendish was unacquainted with Watt's conclusions, it must be remarked how improbable it is that Blagden and others, to whom his conclusions were known, never spoke to him about it. It might be farther said that Blagden, even in those parts of the paper written with his own hand, and intended to claim the priority for Watt, no where asserts that Cavendish's theory was conceived before the month of April, 1783, although, in another addition to his friend's original paper, there is a quotation relative to Watt's theory.

Since the question of knowing at what epoch Cavendish came to his conclusions, is enveloped in great obscurity—it will not be useless to investigate what was the practice of this chemist when be communicated his discoveries to the Royal Society.

* We can, with full confidence, deduce from the unpublished correspondence of Watt, that he had already formed his theory of the composition of water, in December, 1780, and probably sooner. Besides, Priestley declares, in his paper, of the 28th April, 1783, that, before his own experiments, Watt was attached to the idea that the steam of water could be transformed into permanent gases. (p. 416.)

Watt himself, in his paper, (p. 335,) declares that, for some years, he had been of opinion that air is only a modification of water; and he gives a detailed account of the experiments, and reasonings on which this opinion is founded.—*Note of Mr. Watt, jun.*

† Priestley's letter was read on the 29th of April, 1784.

‡ Without any doubt the Genevese philosopher, then in London, received it at that time. It remained in his hands until the time that Watt heard of Cavendish's paper having been read before the Royal Society. From that time my father took instant measures to have his paper addressed to Deluc, and his letter to Dr. Priestley, of the 26th of April, 1783, immediately read before the Royal Society. This reading, required by Watt, of the paper addressed to Deluc, took place on the 29th of April, 1784.—*Note of Mr. Watt, jun.*

§ Philosophical transactions, 1784, p. 140.

‖ Philosophical transactions, p. 300.

¶ In a note of his paper, of the 26th November, 1783, (p. 331,) is to be read this note of Watt: "Anteriorly to the experiments of Dr. Priestley, Kirwan had proved, by ingenious deductions, borrowed from other facts, that inflammable air is in all probability true phlogiston under an aerial form. Kirwan's arguments do not seem, to me, perfectly convincing, but it appears much better to settle the point of the question by direct experiment." *Note of Mr. Watt, jun.*

* The obscurity in the theoretical conceptions of Watt and Cavendish, complained of by Lord Brougham, do not seem, to me, to be well founded. In 1784 they knew how to prepare two permanent gases, very dissimilar from each other. These two gases, some called fixed and inflammable air; and others, dephlogisticated air and phlogiston; others, in fine, oxygen and hydrogen. By the combination of dephlogisticated air and phlogiston, was produced water having a weight equal to that of the two gases. Water, from that time, was no longer considered a simple body; but was composed of dephlogisticated air and phlogiston. The chemist who drew this consequence may have had false ideas as to the intimate nature of phlogiston, without, that in the least degree, throwing any uncertainty on the merit of his first discovery. In the present day, it has been *mathematically demonstrated* that hydrogen or phlogiston is an elementary body; that it is not as Watt and Cavendish believed, for a time, the combination of a radical and a little water.—*Note of M. Arago.*

† No one could expect that Watt, writing and publishing for the first time, engaged in the cares of an immense establishment, and commercial affairs equally extensive, could contend against the eloquent and practised pen of Lavoisier; but the sketch of his theory (see page 331 of his paper) appears to me, who, I must confess, am not an impartial judge, as luminous and as expressive, as the conclusions of the illustrious French chemist.—*Note of Mr. Watt, jun.*

‡ A letter to Professor Crell, in which Blagden gives a detailed description of the discovery, appears in the *Annalen* for 1786. It is remarkable, that in this letter Blagden says he communicated to Lavoisier the opinions of Cavendish and *Watt*, and that this latter name appears, for the first time, in the recital of the verbal confidences of the Secretary of the Royal Society.—*Note of Mr. Watt, jun.*

A committee of the Society, of which Gilpin was a member, made a series of experiments on the formation of nitric acid This committee, of which Cavendish was chairman, proposed to convince those who doubted of the existence of the acid in question, indicated incidentally in the paper of January, 1784, and then, at greater length, in a paper of June, 1785. These experiments were executed from the 6th of December, 1787, to the 19th of March, 1788. The date of the reading of Cavendish's paper, is the 17th of April, 1788. The reading and publication of this memoir followed, then, at less than a month's interval, the conclusion of the experiments.

Kirwan made some objections against Cavendish's paper on the composition of water, on the 5th of February, 1784. The date of which Cavendish's answer was read, was the 4th of March, 1784.

The experiments on the density of the earth, were carried on from the 5th of August, 1797, to the 27th of May, 1798 The date of reading the paper is the 27th of June, 1798.

In the papers on the Eudiometer, the experiments quoted are of the latter part of 1781, and the paper was only read in January, 1783. Here the interval is greater than in the preceding communications. But, from the nature of the subject, it is probable that the author made fresh trials in 1782.

Every thing makes it probable that Watt conceived his theory during the few months or weeks preceding the month of April, 1783. It is certain that he considered his theory as his own property, for he makes no allusion to any analogous and anterior communication; for he does not say that he had heard that Cavendish had arrived at the same conclusions.

It cannot be believed that Blagden would not have heard of the theory of Cavendish, before the date of Watt's letter, if that theory had, in fact, preceded the letter, and that he would not have hastened to point out this circumstance in the additions he made to his friend's paper.

In conclusion, it is well to remark, that Watt depended entirely on Blagden for correcting the proofs, and every thing relative to the publication of his paper. That appears from a letter of Blagden's still in existence. Watt only saw his paper after it was printed.*

* It is easy to perceive that there is some difference between the case presented by Brougham and that by M. Arago. The former is the production of a skilful advocate, engaged in a bad cause, or one which, at any rate, he considers doubtful; who endeavours, by a sophistic appeal, to blind the judges by the partial case he lays before them. M. Arago, on the other hand, led away by the ignis fatuus of maintaining a paradox, spares no assertion, however basely, and confidently appeals to a witness, who is far from proving his cause. M. Arago boldly asserts, that to Watt alone is the merit of the invention due. Brougham endeavours to prove that Watt is equal to Cavendish, and leaves it to others to imply that to him alone was all the credit due.—*Note of the translator.*

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Tables referred to in Report in the September Journal, No. 24, page 331.

TABLE (D.)

Results of Experiments upon Cubes of Two-inch Sides in Duplicate.									Results of Experiments upon Cubes of One-inch Sides.		
							Cohesive Powers.				
1. Name of Quarries from whence Specimens are procured.	2. Weight in ordinary State, in Grains.	3. Weight when well dried, in Grains.	4. Weight when saturated with Water, in Grains.	5. Weight of Water absorbed, in Grains.	6. Bulk of Water absorbed; Two Cube Inches considered as Unity.	7. Weight of Particles disintegrated, in Grains.	8. Weight producing First Fracture. 1 = 2,53 Cwt.	9. Crushing Weight.	10. Specific Gravity of the dry Specimens.	11. Specific Gravity of the solid Particles.	12. Bulk of Water absorbed; total Bulk considered as Unity.
Ancaster	4585·4	4584·0	4920·3	336·3	0·166	7·1	24	33	2·182	2·687	0·180
Barnack	4443·9	4442·3	4729·4	287·1	0·141	16·6	16	25	2·090	2·623	0·204
Binnie	4613·3	4609·0	4859·0	250·0	0·123	1·4	38	71	2·194	2·660	0·174
Bolsover......	4890·8	4881·4	5042·0	160·6	0·079	1·5	70	117	2·316	2·833	0·182
Box	3767·8	3766·8	4109·0	342·4	0·169	10·0	18	21	1·839	2·675	0·312
Bramham Moor	4149·5	4144·7	4329·5	184·8	0·091	0·7	32	87	2·008	2·659	0·244
Brodsworth ..	4223·4	4218·0	4655·0	437·0	0·215	2·2	26	65	2·093	2·842	0·267
Cadeby	4044·3	4039·2	4559·0	519·8	0·256	6·4	20	23	1·951	2·846	0·310
Craigleith	4698·7	4695·6	4859·0	163·4	0·080	0·6	60	111	2·266	2·646	0·143
Chilmark (A)..	4907·1	4897·0	5072·4	175·4	0·086	5·6	36	90	2·366	2·658	0·109
Chilmark (B)..	4932·5	4916·1	5073·6	57·5	0·028	9·6	38	98	2·383	2·650	0·085
Chilmark (C)..	4872·9	4868·7	5007·0	138·3	0·068	9·8	42	101	2·481	2·621	0·053
Darley Dale (Stancliffe)	4685·2	4678·3	4826·5	148·2	....	....	88	100	2·628	2·993	0·121
Giffneuk......	4565·5	4564·5	4761·3	196·8	0·097	0·9	48	68	2·230	2·666	0·163
Gunbarrel Stanley ..	4661·1	4654·5	4841·0	186·5	0·092	5·2*	34	58	2·260	2·667	0·152
Ham-hill	4700·3	4695·5	4930·0	234·5	0·115	9·5	22	57	2·260	2·695	0·147
Haydor	4305·4	4301·5	4722·2	420·7	0·207	10·9	16	25	2·040	2·691	0·241
Heddon	4557·1	4553·8	4765·0	211·2	0·104	10·1	26	56	2·229	2·565	0·156
Hildenly......	4266·2	4254·5	4601·0	206·5	0·101	5·5	62	68	2·098	2·624	0·201
Hookstone....	4703·9	4700·0	4843·0	143·0	0·070	3·7	62	82	2·253	2·640	0·146
Huddlestone ..	4493·5	4491·4	4735·0	243·6	0·120	1·9	34	61	2·147	2·867	0·239
Kenton	4658·4	4647·9	4848·5	200·6	0·099	7·9	48	70	2·247	2·625	0·143
Ketton	4412·8	4409·7	4715·6	305·9	0·151	3·3	22	36	2·045	2·706	0·244
Ketton Rag ..	[illegible]	[illegible]	5346·6	144·8	0·071	4·84	50	127	2·490	2·692	0·075
Mansfield or [illegible]	[illegible]	[illegible]	4906·0	210·7	0·104	7·1	28	72	2·338	2·756	0·151
[illegible]	[illegible]	[illegible]	[illegible]	188·0	0·092	3·0	36	74	2·277	2·758	0·174
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·134	0·9	22	43	2·053	2·687	0·221
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·221	1·8	26	61	2·138	2·847	0·249
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·080	5·0	56	107	2·321	2·615	0·112
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·135	2·7	30	55	2·145	2·702	0·206
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·104	6·0	55	80	2·239	2·509	0·107
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·172	0·6	24	55	2·134	2·844	0·248
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·123	25·0	36	49	2·227	2·668	0·165
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·138	8·5	38	40	2·103	2·666	0·211
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·215	22·3	14	27	1·891	2·509	0·143
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·104	3·1	32	67	2·070	2·634	0·209

TABLE (C.) OF CHEMICAL ANALYSES.

	Sandstones.					Magnesian Limestones.				Oolites.				Limestones.		
	Craigleith.	Darley Dale (Stancliffe).	Heddon.	Kenton	Mansfield or C. Lindley's Red.	Bolsover.	Huddlestone.	Roach Abbey.	Park Nook.	Ancaster.	Bath Box.	Portland.	Ketton.	Barnack.	Chilmark.	Hamhill.
Silica	98·3	96·40	96·1	93·1	49·4	3·6	2·53	0·8	0·0	0·0	0·0	1·20	0·0	0·0	10·4	4·7
Carbonate of Lime	1·1	0·36	0·8	2·0	26·5	51·1	54·19	57·5	55·7	93·59	94·52	95·16	92·17	93·4	79·0	79·3
Carbonate of Magnesia	0·0	0·0	0·0	0·0	16·1	40·2	41·37	39·4	41·6	2·90	2·50	1·20	4·10	3·8	3·7	5·2
Iron Alumina	0·6	1·30	2·3	4·4	3·2	1·8	0·30	0·7	0·4	0·80	1·20	0·50	0·90	1·3	2·0	8·3
Water and Loss	0·0	1·94	1·8	0·5	4·8	3·3	1·61	1·6	2·3	2·71	1·78	1·94	2·83	1·5	4·2	2·5
Bitumen	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	A Trace	A Trace	A Trace	A Trace	A Trace	A Trace	A Trace
Specific Gravities																
Of dry Masses	2·232	2·628	2·229	2·247	2·338	2·316	2·147	2·134	2·138	2·182	1·839	2·145	2·045	2·090	2·481	2·260
Of Particles	2·646	2·993	2·643	2·625	2·756	2·833	2·867	2·840	2·847	2·687	2·675	2·702	2·706	2·627	2·621	2·695
Absorbent Powers when saturated under the exhausted Receiver of an Air Pump.	0·143	....	0·156	0·143	0·151	0·182	0·239	0·248	0·249	0·180	0·312	0·206	0·244	0·204	0·053	0·147
Disintegration.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.
Quantity of Matter disintegrated	0·6	0·121	10·1	7·9	7·1	1·5	1·9	0·6	1·8	7·1	10·0	2·7	3·3	16·6	9·8	9·5
Cohesive Powers.	111	100	56	70	72	117	61	55	61	33	21	30	36	25	101	57

EXPLANATION.—This Table gives the Results of the Chemical Analyses of Sixteen Specimens of Stone, arranged according to their respective Classes. The Names of the Quarries from whence the Stones are obtained are given in the First Line, and the Specimens are considered to be fair average Samples of the workable Stone in such Quarries. Some Results of Experiments upon the same Stones, extracted from Table D., are added for the Purpose of affording a Comparison of their several Physical Qualities.

EXPLANATION OF TABLE D.

The first column exhibits the names of the quarries whence the several specimens have been procured, such specimens being considered a fair average sample of the stone which those quarries respectively produce.

The second column indicates the weights of the specimens in the state in which the stones are usually employed for building purposes, having been subjected to none but the atmospheric influences since they were taken from their respective quarries and worked.

The third column contains the weights of the same specimens after having been perfectly dried by exposure in heated air for several days. Their relative specific gravities are indicated by these numbers, subject to the errors arising from differences in the sizes of the cubes, which, on account of the accuracy of the measurements, varied but little from each other; the specific gravities, however, taken by the most certain method, will be found in columns ten and eleven. The average difference of weight between two specimens of the same stone is in the dry state 56·7 grains; the greatest difference being 208·8 grains, as observable in that from Box; and the least 0·2 grains, as in that from Bramham Moor. This difference is to be attributed partly to a small inequality in the sizes of the duplicate cubes, and partly to variations of density in pieces of the same material. The greatest difference of weight between two specimens of different stones is 1618·3 grains; the heaviest being that of the Ketton Rag, weighing 5201·8 grains, and the lightest that from Totternhoe, weighing 3583·5 grains: the proportion, therefore, of the weight of the lightest to that of the heaviest is as 1 : 1·452.

The fourth column exhibits the weights of one set of the above-mentioned cubes after having been immersed in water for several days, so as to become completely saturated, such weights having been ascertained immediately after the cubes were taken out of the water and wiped.

The fifth column shows the difference of weight between the same specimen in its dried and in its saturated state, and indicates therefore the quantity (by weight) of water absorbed by each stone. The greatest quantity of water any stone absorbed was 519·8 grains, and the least 57·5 grains; the former from Cadeby, the latter from Chilmark, (B.)

The sixth column shows the relative bulk of water absorbed, eight cubic inches, or the bulk of the cube experimented upon, being taken as unity. From these numbers it appears that the specimen from Cadeby absorbs one quarter of its bulk of water, while the specimen (B.), from Chilmark, does not absorb one thirty-sixth of its bulk; the former absorbs, therefore, about nine times more than the latter.

The seventh column gives the quantity of disintegration, in grains, of the several stones, after having been simultaneously subjected to Brard's process for eight successive days. A description of the details of this process here is considered unnecessary, as they are fully described in the thirty-eighth volume of the "Annales de Chimie et de Physique;" where is also to be found an account of the experiments made by members of the public commissions appointed to ascertain its efficacy, from which it appears that the measures thus obtained may be considered very closely to represent the action of the atmosphere during successive winters on the various stones submitted to examination.

The eighth and ninth columns contain the results relating to the cohesive strength of the stones, or their resistance to pressure. These experiments were made at the manufactory of Messrs. Bramah and Robinson, with a six-inch hydrostatic press, the pump of which was one inch in diameter. According to trials previously made by Messrs. Bramah and Robinson, one pound weight at the end of the pump lever produced a pressure on the face of the cube equal to 2·53 cwt., or to 71·06 lbs. on the square inch. The experiments with the stones were cautiously made; the weight on the lever was successively increased by a single pound; and, in order to ensure greater accuracy, a minute was allowed to elapse previous to the application of each additional weight. The eighth column shows the pressure at which the stone commenced to crack, and the ninth column the pressure at which it was crushed. The unit assumed is the one pound weight placed at the end of the lever. The employment of this unity in the table is preferred to stating the calculated weights, because it is not wished to give a greater appearance of accuracy than can strictly be adjudged to the experiments; but if absolute measures be required, the pressure, either upon the face of the cubes employed or on one square inch of surface, may be estimated, as nearly as the means employed enable it to be ascertained, by multiplying the figures in the table by either of the values of the unit above stated. The results having been obtained with the same press, and under the same circumstances, it is presumed that no objection can be made to them as comparative experiments.

The tenth column indicates the specific gravities of the stones, accurately taken by the means usually employed.

The eleventh column contains the specific gravities of the solid materials of which each stone is composed, on the supposition that the water absorbed when the atmospheric pressure is removed completely replaces the air which before occupied the pores.

The twelfth column shows the bulk of water absorbed by the stones when saturated under the exhausted receiver of an air pump, their entire bulk being taken as unity. The quantity of water absorbed in this process may be considered to represent the space occupied by the pores or interstices in the substance, unless we suppose that in some cases the adhesion between air and the solid particles is so great that the entire removal of the atmospheric pressure is not sufficient to counteract the force. It is certain, when this pressure is not removed, long immersion in water will not occasion the displacement of all the air contained within the pores.

OBSERVATIONS.

The Mansfield red sandstone seems to form a connecting link between the sandstones and the magnesian limestones. The Chilmark limestone is remarkable for having a large quantity of silica in its composition. The Bolsover magnesian limestone is remarkable for its peculiarly beautiful crystalline structure. All the limestones, (including the oolites) except the magnesian, contain small portions of bitumen.

If the stones be divided into classes, according to their chemical composition, it will be found that in all stones of the same class their exists generally a close relation between their various physical qualities. Thus it will be observed that the specimen which has the greatest specific gravity possesses the greatest cohesive strength, absorbs the least quantity of water, and disintegrates the least by the process which imitates the effects of weather. A comparison of all the experiments shows this to be the general rule, although it is liable to individual exceptions.

But this will not enable us to compare stones of different classes together. The sandstones absorb the least water, but they disintegrate more than the magnesian limestones, which, considering their compactness, absorb a great quantity.

The heaviest and most cohesive of the sandstones are the Craigleith and the Park Spring; the lightest and least cohesive is the Morley Moor.

Among the magnesian limestones that from Bolsover is the heaviest, strongest, and absorbs the least water; whilst that from Cadeby is the lightest, weakest, and most absorbent. The magnesian limestones from Jackdaw Craig and Bramham Moor, which closely resemble each other, are remarkable for considerable cohesive strength, united with low specific gravity; they disintegrate but little, and absorb less water than stones of the same class of higher specific gravity.

Among the oolites the Ketton Rag is greatly distinguished from all the rest by its great cohesive strength and high specific gravity; whilst the stone from Box, in the neighbourhood of Bath, is the least cohesive, and has the lowest specific gravity.

(Signed) J. F. DANIELL.
C. WHEATSTONE.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(From the Reports of the Athenæum and Literary Gazette.)

On the most Economical Proportion of Power to Tonnage in Steam-vessels. By Mr. Scott Russell.

The rule by which most proprietors of steam-vessels have been guided is the application of power in small proportion to tonnage; but where velocity was the chief object, higher proportional power has been employed, with a great expenditure of fuel, and not with the ratio of increase to the velocity; or high powers and large consumption of fuel have been attended with only a slight increase of velocity; and, therefore, the employment of low powers, with low velocities, would appear to be most economical. But this conclusion has not been borne out; and, by an examination of the books of expenditure of fuel, belonging to several companies, he had found that experience had proved the use of high steam powers and high velocities more economical than low ones. This had been attributed to Mr. Russell's wave principle, and he had, therefore, carefully investigated the subject. The result at which he had arrived, appeared to him quite new and very remarkable. The general principle was :—that in a voyage by a steam-vessel in the open sea, exposed, of course, to adverse winds, there is a certain high velocity and high portion of power which may be accomplished with less expenditure of fuel and of room than at a lower speed with less power. This was proved arithmetically and by a formula, in relation to the same vessel, with different powers of engine, whereby any other case may be determined.

Fair Weather.—1200 tons, 400 horse-power, 9 miles an hour, 216 miles a day, 1 ton of coal an hour; 2160 miles in 10 days, 240 tons of coal.

1200 tons, 500 horse power, 10 miles an hour, 240 miles a day, 1¼ ton of coal an hour; 2160 miles in 9 days, 270 tons of coal.

Adverse Weather.—1200 tons, 400 horse power, 5 miles an hour, 120 miles a day, 1 ton of coal an hour; 2160 miles in 18 days, 436 tons of coal.

1200 tons, 500 horse power, 6¾ miles an hour, 162 miles a day, 1¼ tons of coal an hour; 2160 miles in 13 and one fifth days, 395 tons of coal.

General Formula.—Let v represent the velocity of a given steam-vessel in a fair weather voyage; v', the same vessel in an adverse weather voyage; v'' a vessel of higher power in the fair one; v''', the same in the adverse one; p, the power of the former vessel; p', latter vessel—

$$\therefore \sqrt{v''' - (v-v')} = v''' = \sqrt{v}\sqrt{\frac{p'}{p}} - (v-v')$$

$$v\frac{p}{p} - \sqrt{\frac{v''-(v-v')}{v'}}$$

in the case of equal expense, when the highest proportion of power that will be economical in fuel may be at once obtained.

Dr. Lardner observed, that it was a new theory; but, from Mr. Russell's exposition, he was satisfied with its accuracy.

Mr. Russell stated, in answer to a question, that the principle was only true in reference to long voyages, because where vessels were not exposed to continued adverse weather, a great additional power would only be an additional expense.

New Fuel; for Steam Navigation, &c.

The learned President (Rev. W. Vernon Harcourt) described to the Section a plan of cementing together small coal and coal-dust for fuel, for which a patent had been obtained by Mr. Oram. [See last vol. of the "Transactions," Notices and Abstracts, p. 85.] For more than twenty years it had afflicted him more than aught short of a moral evil, to see the wicked waste made in this substance, the most precious gift which Providence had bounteously bestowed on mankind. To this country in particular it was of inestimable value; and yet, until now, when he might consider the means of saving and economising it devised, one million of tons out of three millions annually had been burnt and destroyed at the mouths of the pits. Mr. Oram had been attracted to this subject from pursuits of a different kind. In preparing picture-frames, it had occurred to him that to mould this wasted breccia into the form of bricks, cause it to cohere, and fit it for all the uses of fuel, would be a most desirable attainment. At Glasgow it was allowed to remain at the bottom of the pits; at Newcastle it was in no way brought to market by those whose competition led them to supply only superior coals. The material rescued from this "wicked waste" by Mr. Oram might consist of pieces of about the size of walnuts, and all the rest of the slack (and it should be observed, that the best coal was most liable to break in this manner); and these he composed together in a form so much less in bulk, and occupying so much less room in stowage, that the quantity requisite for a steam voyage of three months would not be more than of coals which would only last for two. How important was this at an era when coal was convertible into coach-horses; when our chariots were of iron, and drawn by steeds of fire! It should be remembered too, that coal could never more be formed; that Nature had already deposited her work for our use in this formation, and when once exhausted it could not be renewed. It was therefore the more necessary, in our island blessed with so abundant a supply, to apply economy to its expenditure. Revenue, manufactures, comforts, all depended on this precious treasure; and therefore it was that he considered this result to be of such inestimable worth. It had been said that people had a right to do what they liked with their own; and in a restricted sense this was very true: but in doing what we liked with our own, we had no right to destroy what belonged to posterity: and this had been done to a most injurious extent with the coal-fields of England. He would now read Mr. Oram's communication, only observing that trying and confirming his experiments at Woolwich, under the inspection of Mr. P. Ewart, a year ago, he had obtained a patent, and had since been travelling on the Continent to make arrangements accordingly. Mr. Oram stated that his experiments were made on Pontop coals of the best quality, which were compared with his rubbish in the brick form, and compounded of two thirds of coal-dust and one third of anthracite; which mixture possessed the greatest power, greater than if entirely of coal. By one pound of this fuel, thirteen pounds of water were evaporated, and by one pound of Pontop coal alone only seven pounds and a quarter. Nearly double! The process was a simple one, and had, indeed, been rudely practised in Wales, about Liege, and elsewhere, where the peasantry were in the habit of making up the coal rubbish into balls with clay, and thus supplying themselves with an indifferently burning fuel. Mr. Oram took the dry mud (it must be *dry*) of the Thames or any other large river, or any vegetable earth would do, and the mixture was—30 or 40 gallons of water, 40 pounds of coal tar, 30 pounds of lime, powdered, and 100 or 200 pounds of dry mud, to every ton of coal-dust. The compound was then pressed and dessicated, and an excellent fuel was produced. The oxygen contained in the pores and interstices supplied combustion in abundance, and the muddy ingredients, forming a skin, protected the bricks from the waste which exposure to the atmosphere caused in coal. For they were all aware that if the cook wanted to light a fire quickly, instead of taking small pieces of coal ready to her hand, she would take the trouble to break a lump into fragments for that purpose. Experience had taught her that the atmosphere had deprived the former in some degree of their igneous property, and as every one was prone to perform what they had to do with the least possible labour, she had found out that breaking up the fresh lumps was the least trouble after all. The shape of these bricks was another recommendation. They were convenient for packing; and yet another quality belonged to them of considerable importance. It was necessary in steam-vessels to have the fuel near the boilers, where the heat was intense; and the bricks, shielded by their pellicle, resisted this high temperature, which would greatly deteriorate coal in the same situation. Dr. Buckland then noticed that Mr. Grant, of Portsmouth, the inventor of the admirable plan of biscuit baking, had also employed a composition of this sort. His cement was gas tar; and he had laid his method open for the public benefit, without availing himself of a patent right. It was lighter than coal; but Mr. Oram (and it was only on his authority he made the remark) had pointed out advantages which his mixture enjoyed over that of Mr. Grant.

A gentleman stated the coal of this country (about Birmingham) would not run together, in this way, like the Newcastle coal. He had for years been trying experiments with it; and had tried all those of Mr. Oram, except the lime. He had employed tar, oil, bituminous clay; and though he had succeeded to a certain extent, so as to serve hot-houses, &c., he had never been able to obtain a fuel quite applicable to domestic uses. Could such be obtained for their fires and manufactories, it would be an immense saving.

On the Changes and Improvements in the Embouchure of the Mersey.—By Mr. J. B. Yates.

He referred to the new channel in the harbour of Liverpool, which had been brought before the notice of the Association by Capt. Denham. The intricacy of access to this harbour arises from the accumulation outside of numerous beds of sand, which are frequently and suddenly changing their position and elevation. It can scarcely be doubted, that at some remote period the estuary of the Mersey did not exist at all, or, at most, in a very limited form; a forest and morass may have occupied the land between Formby Point and Helbré. Numerous trunks and roots of large forest trees are, to this day, found along the Cheshire and Lancashire shores, while extensive tracts of peat are observed in many places starting up among the sands. A violent disruption must have taken place at the mouth of the estuary, by which enormous masses of sand and marle have been thrown out, perhaps proved by the homogeneous structure of the banks on either side. In 1828, a number of human skeletons were disinterred opposite the Leasow Lighthouse, affording strong evidence that a burying-ground had formerly existed there; and a similar cemetery is discernible at Formby. This lighthouse stands in place of another, which was nearer to the sea by more than half a mile—a site which, at the time of its erection, seemed to have been firm, dry land, but was rendered useless by the encroachments of the water, which continued to increase. It was not until the sea had broken down the ridge of sand which had formed its boundary, that a strong embankment was made, extending a mile and a quarter in front of the present lighthouse. The sand banks in this estuary are tossed to and fro by the force of the winds and tides, and are constantly changing their shapes and elevations, and, having no escape, they remain pent up in the bay. In 1687, an excellent channel existed opposite to Formby Point, its depth from three to ten fathoms; but, not being marked by buoys, the Rock Channel was at that time the entrance in common use, though dry at low water. It has since become deeper, and thus a change has taken place upon the Hyle Sand Bank. A ridge, running along the middle of this bank, has been cut through by a channel having forced itself in a northerly direction, from Helbré island towards the Light Ship. The channel described by Capt. Denham at the Dublin Meeting is now useless, although used for some time with advantage; but it runs perpendicular to the course of the tide, which accounts for its present state. Fears have also been entertained, that the other channel, called the Horse Channel, was filling up. Lately, a diagonal channel has been formed, by aiding the ebb current of the tide in its natural diagonal course, between Lancashire and Cheshire. This was done by dredging, by means of a double-toothed harrow, twelve feet across, dragged backwards and forwards by a steamer of 100 horse-power over the intruding banks. the inner part of which was stated to rise forty-three feet higher than the outer or seaward part. An enormous wooden scraper is also used. The m tter taken up appears to contain a small portion of peat, and weighs somewhat lighter than the sand found within the estuary. This new channel has been proved to answer the purposes of navigation beyond original expectation, and the approach to Liverpool is even better than before.

Description of a new Railway Wheel, by Mr. Cottam.

The wheels suggested are made on the following principles:—1st. They are wholly of wrought iron, so welded together, that, independent of screws, rivets, or any other kind of fastening, they form one piece with the spokes. 2nd. The spokes of the wheels are placed diagonally, and act as trusses, thereby giving the greatest possible support to the rim, or tire, and, at the same time, being in the best position for resisting lateral pressure. 3rd. Iron in a state of tension or compression, as is usually the case with the tires of wheels, is easily broken by sudden shocks, or by vibratory action. The wheels in question are so constructed, that the fibres of the iron employed are neither compressed nor stretched, but remained in their natural condition. 4th. The strength of iron being as the square of its depth, then the flanged tires of these wheels, which offer sections twice as deep, are, consequently four times as strong as those of any wheels at present in use. This increase of strength is attributable solely to the peculiarity of their construction, and not to any increase in the weight of the material. 5th. The spokes strike the air edgewise, and thus offer the least possible res stance. Wheels where the spokes present a flat surface may be said to act as blowing machines, and, as such, require a greater propelling power. 6th. These wheels, by simply varying the curve of their sp kes, become either rigid or flexible, or, in other words, they may be made to any degree of elasticity. 7th. When worn by friction, the rims or tires may be turned down, and have hoops of railway tire shrunk on them. Thus repaired, these wheels are very strong and durable, and more advantageous than those of other constructi ns.

Mr. Roberts spoke to the successful use of cast iron wheels, which, properly manufactured, he had never found to fail. The most important consideration to be attended to was the absence of oxide of iron, and if any was on the metal it must be removed by a file. If this precaution were attended to, there would be little fear for the stability of cast iron wheels.—Mr. Woods stated, that on the Liverpool and Manchester Railway cast iron wheels were much used. They had employed wheels with wooden tires at the opening of that line, some of which were still in use; and so satisfied were the Directors, that it was their intention to have some new wooden wheels made, and to submit them to the test of experiment.

On Experiments to ascertain the Power of different Species of Wood to resist a Force tending to crush them. By Mr. Eaton Hodgkinson.

All the specimens were formed into short cylinders, about one inch diameter and usually two inches long, the ends being perfectly flat and at right angles to the sides. The apparatus used to crush the specimens was that described by the writer in his experiments on cast-iron ("Seventh Report of the British Association,"). The crushing surfaces were perfectly parallel, and the body to be crushed had its end bedded firmly against them. The force was applied in the direction of the fibres. These experiments were made, like many others acknowledged before, at the expense of Mr. H's liberal friend, W. Fairbairn, Esq. They are the commencement of a research in which the writer has other objects in view. The accompanying calculations will show how far Mr. Hodgkinson has, as yet, carried his experiments, and the results he has obtained. The great interest attached to the subject induces us to append this table, though we are somewhat fearful it is not altogether without inaccuracies:—

Description of Wood.	Dimensions of Cylinder. Diameter. inches.	Height. inches.	Force which crushed the Specimen. lbs.	mean.	Crushing Force per Square Inch. lbs.	
Yellow Pine . . .	1·01	2 00	4381, 4381, 4157	4306	5375	
Cedar	1·00	2·00	4829, 4381, 4157	4456	5674	
Ditto	1·00	1·00	..	4605	5863	
Another specimen, quite dry	1·00	....	3709, 3933, 3933	3856	4912	
Red Deal . . .	1·01	2·00	4381, 4381, 5053	4605	5748	
Other specimens, 2 months turned . . .	1·01	1·00	5277, 5277	5277	6586	
Poplar.—(Not quite dry) .	1·00	2·00	2365, 2589, 2365	2440	3107	
Ditto, turned and dried 2 months . . .	·96	1·00	..	3709	5124	
Larch (green.)-Fallen 2 months	1·00	....	2589, 2589	2514	3201	
Larch (green.)—After ng and drying one month.	·975	....	..	4157	5568	
Plum-Tree (Dry) . .	·98	2·00	6347, 5955, 6347	6216	8241	9367
Ditto	·98	1·00	7131, 8699	7915	10493	
Ditto (Wet) fallen 2 years	·99	....	2813		3657	
Beech	·99	2·00	5563, 5899, 6397	5953	7733	
Ditto, after drying and having been turned 2 months	·99	....	..	5725	9363	
Ash	·98	2·00	6907, 6571, 6173	6550	8683	
Do. after 2 months as before	·99	1.00	..	5725	9368	
Quebec Oak . . .	1·00	2·00	3425, 3211	3323	4231	
Do. after 2 months as before	·99	1·00	..	4605	5982	
English Oak . . .	·98	2·00	4891, 4891, 4891	4891	6484	
Ditto, 2 months after being turned and dried .	·97	·80	6621, 7433	7027	9509	
American Pine.—Full of turpentine . . .	·97	2·00	4555, 3883, 3883	4107	5145	
Ditto, after being turned and dried 2 months . .	·99	2 00	3933, 3933	3933	5434, 5395	5414
Ditto	·96	1·00		3905		
Bay Wood . . .	·99	2·00	5563, 5899, 5899	5787	7518	
Spanish Mahogany . .	1·00	2·00	6949, 6173, 6173	6439	8198	
Teak Wood . .	1·00	2 00	8923, 9595, 9995	9504	12101	
American Birch . .	1·00	2 00	9309, 8861, 9309	9160	11663	
English Birch . . .	1·00	2·00	3709, 3485, 3485	3560	4533	
Do. after 2 months as before	1 00	1·00	4829, 5053, 4605	4829	6402	
Elm	1·00	2·00	8413, 7965, 7965	8114	10331	
Alder	1·01	2.00	5501, 5721, 5501	5576	6960	6895
After 2 months' drying	1.01	1·00	5669, 5277	5473	6831	
Box	1·00	2·00	7579, 7243, 7243	7355	9365, 9265	
Ditto	1·00	1·00	8699, 8307	8503	10613	
Other specimens give .	....	....	..	7579, 8251	9650, 10299	
King Wood.—Dry ornamental wood	1·00	2.00	9931, 9931	9931	12645	
Pear-Tree. (Dry) . .	·99	2·00	5899, 5563, 5899	5787	7518	
Crab-Tree . . .	·99	2·00	5227, 4891, 4891	5005	6409	
Ditto, after 2 months .	·99	....	5501			
Sycamore . . .	·99	2·00	5227, 5227, 5899	5451	7082	
Walnut	·99	2·00	5563, 5563	5563	7227	6645
Another specimen .	·99	....	4555, 4891, 4555	4667	6063	
Elder.—About a month after the specimens were turned	·99	1·00	5171, 5171	5171	7451	8467
Ditto	·95	2·00	..	7009	9973	
Ditto	·92	2·00	5563, 5171, 5171	5302	7976	
Hornbeam . .	1·00	2·00	3709, 3485, 3485	3560	4523	
After two months' drying	1·00	2·00	....	5725	7289	

ON THE THEORY OF THE STEAM-ENGINE.

By Aristides Mornay, Esq.

No. IV.

In our last paper, published in June, we proposed the following formula for calculating the elastic force of steam at different temperatures:—

$$\log. p = \log. (t+448) + \frac{5(t-212)}{t+448} - 1.3424227. \qquad \text{(III)}.$$

This equation coincides, as we have shown, more generally than any other which has been proposed with the results of experiment; besides which it possesses the advantage, that we can obtain from it the elastic force of steam in terms of its density. The equation (II)

$$\log. d = \frac{5\,(t-212)}{t+448}$$

can be put under the form

$$\log. d = 5 - \frac{3300}{t+448}$$

whence we find

$$t + 448 = \frac{3300}{5 - \log. d}.$$

Substituting this value in the equation (I), which is

$$p = \frac{d\,(t+448)}{22}$$

we obtain

$$p = \frac{150\,d}{5 - \log. d} \qquad \text{(IV)}.$$

Thus we can, at any time, deduce the elastic force of steam from its density by a very simple method. Or it may be more convenient to use the volume occupied by a given volume of water, when converted into steam, instead of its density. For this purpose we must substitute for d some function of the volume V, occupied by one cubic foot of water converted into steam. Now, when the density of steam is 1, it occupies a volume $=$ 1700 cubic feet, so that the value of d would be $d = \frac{1700}{V}$, and the above equation would become

$$p = \frac{255{,}000}{V\,(5 - \log. 1700 + \log. V.)}$$

or

$$p = \frac{255{,}000}{V\,(\log. V + 1{\cdot}7695511)} \qquad \text{(V)}.$$

If P be any other elastic force, and V′ the corresponding volume, we shall have

$$\frac{p}{P} = \frac{V'\,(\log. V' + 1{\cdot}7695511)}{V\,(\log. V + 1{\cdot}7695511)} \qquad \text{(VI)}.$$

This equation will furnish us with the means of calculating the mean pressure of the steam on the piston of an engine, in which the steam is used expansively; but we shall return to this subject when we treat of the action of the steam in that variety of engine.

On the Action of the Steam in the Cylinder of a Steam-engine.

The whole resistance overcome by the steam acting on the piston of an engine, may be divided into the *useful effect* and the *incidental resistances*, the latter comprising the friction of the various parts of the engine, and the resistance of the steam on the opposite side of the piston. When we mention the *resistance* simply, it signifies the *total resistance*.

It is self-evident that the pressure of the steam *against the piston* must be precisely equal to the resistance on the opposite side. In a critical notice of the Count de Pambour's theory of the steam-engine, inserted in the September number of this Journal, it was stated that the resistance overcome by the force exerted by the steam against the piston of an engine in motion is not, as asserted by Pambour, *strictly* equal to its whole elastic force. We shall show that the difference is too small to be regarded in calculating the effects of steam-engines.

Let p be the elastic force of the steam in the cylinder, or the pressure in lbs. which it exerts on each square inch of the interior surface of the cylinder, and v the velocity of the piston in feet per minute.

We must, in the first place, determine the height of a column of steam of the given elastic force, whose weight is equivalent to its pressure, in order to deduce from it the velocity with which it would flow into a vacuum, or free from any resistance. Now we know that the height of a column of atmospheric steam, (steam generated under the ordinary pressure of the atmosphere, or 14·7 lbs. per square inch,) whose weight is equivalent to its pressure, is about 58,000 feet, and that the height of the column increases uniformly with the temperature, when the steam is in the saturated state. Thus, if t is the temperature of steam whose elastic force is equal to p, the corresponding height of the column will be

$$H = 58{,}000\,\frac{t+448}{660},$$

or, putting for $t+448$ its value found above,

$$H = \frac{290{,}000}{\log. V + 1{\cdot}7695511}.$$

Now the pressure exerted by the steam against the piston is equal to its whole elastic force, or the weight of the column H, *minus* the weight of the column whose height, which we will call h, is equal to that due to the velocity v of the piston; for it would require the pressure of that column to give the steam the velocity v, which it must assume in order to follow the piston. Thus, if we call r the resistance referred to a square inch of the piston, we shall have

$$r = p - p\,\frac{h}{H}.$$

But we have also,

$$h = \frac{v^2}{3600 \times 2\,g}*$$

or, substituting for 2 g its value 64·38,

$$h = \frac{v^2}{231{,}768}.$$

Substituting this value, as well as that of H, in the expression of the loss of pressure, which is

$$\lambda = p\,\frac{h}{H}$$

it becomes

$$\lambda = p\,\frac{v^2\,(\log. V + 1{\cdot}7695511)}{67{,}212{,}720{,}000}, \qquad \text{(VII)}.$$

To ascertain the mean loss through the whole stroke of the piston, let ρ be the length of the crank, V the velocity of the crank-pin, and L the mean loss of pressure; λ the loss at any given instant, v the velocity of the piston, and a the angle described by the crank from its dead centre at that instant.

If we suppose, to simplify the calculation, that the length of the connecting-rod is infinitely long in comparison with that of the crank, and that the latter moves with an uniform velocity, we shall have

$$v = V \sin. a.$$

Substituting this value in the equation (VII), it becomes

$$\lambda = p\,\frac{V^2 \sin. a^2\,(\log. V + 1{\cdot}7695511)}{67{,}212{,}720{,}000}.$$

The distance travelled by the piston during an infinitely short period of time is $\rho \sin a\,d a$, and the amount of power consumed in producing the motion of the steam during that element of time is,

$$\lambda\,\rho \sin. a\,d a = p\,\frac{\rho\,V^3\,(\log. V + 1{\cdot}7695511)}{67{,}212{,}720{,}000} \sin. a^3\,d a.$$

The whole loss during one single stroke is therefore equal to

$$2\,\rho\,L = p\,\frac{\rho\,V^2\,(\log. V + 1.7695511)}{67{,}212{,}720{,}000} \int^{\pi} \sin. a^3\,d a.$$

$$= p\,\frac{4\,\rho\,V^2\,(\log. V + 1{\cdot}7695511)}{201{,}638{,}160{,}000}$$

whence we deduce

$$\frac{L}{p} = \frac{V^2\,(\log. V + 1{\cdot}7695511)}{100{,}819{,}080{,}000}. \qquad \text{(VIII)}.$$

If V were used to represent the mean velocity of the piston, we should have to multiply V^2 by $\frac{\pi^2}{4}$, by which the last equation would become

$$\frac{L}{p} = \frac{V^2\,(\log. V + 1{\cdot}7695511)}{40{,}860{,}400{,}000}. \qquad \text{(IX.)}$$

It is evident that, the greater the velocity of the piston, and the

* It will be observed that we employ the letter g to represent the uniform acceleration per second, which a body receives when solicited by the force of gravity free from the influence of any disturbing forces.

lower the pressure of the steam used, the greater will be the proportionate loss; therefore we shall take an extreme case if we assume $V = 600$ and $p = 14{\cdot}71$, when V will be 1700, and

$$\log. V + 1{\cdot}7695511 = 5.$$

Substituting these values in the equation (IX), we obtain

$$\frac{L}{p} = \frac{1,800,000}{40,860,400,000} = {\cdot}000044.$$

Thus we see that, although the pressure exerted by the steam against the piston, and consequently the resistance which it can overcome, is not *strictly* equal to its whole elastic force, we are perfectly justified in assuming it to be *practically* so, and disregard the difference, which is in reality much too small to be appreciable.

CANDIDUS'S NOTE-BOOK.

FASCICULUS X.

> I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please.

I. The attractive title of "Church Architecture of the Middle Ages," induced me to turn to the last number of the Dublin Review, for the topic itself has been so hackneyed of late years, that I fancied no editor would now receive any paper upon it, unless some freshness or peculiar interest were imparted to it. But, alack! the said article turned out to be only three pages of the most wishy-washy stuff imaginable. The whole purport and sum of it are merely to assure us that it is quite impossible for any but a Catholic architect to enter at all into the true feeling of our ancient religious edifices. It may be so, but then if what the writer says proves any thing it proves rather too much; the *ergo* resulting from it being that Gothic architecture and Protestantism are things utterly opposed to, and irreconcileable with each other, consequently the only course left us, is to say Good-bye to Gothic architecture, for ever.

II. The newspapers mention Sir R. Smirke as the architect to be employed in rebuilding Bridgewater House; but this, it is to be hoped, will turn out a mere newspaper *on-dit;* for Sir Robert has by this time done quite enough to convince every one how little it is that he can do, and that what style he has, consists only in the absence of all that constitutes style, and the most frigid mannerism in the application of a few forms derived from Grecian architecture; without one spark of geniality or even invention. Beyond what is borrowed—literally transcribed from antique examples, there is nothing whatever in any one of his designs professing to be classical, except indeed it be much that detracts very materially from the prototypes affectedly adhered to in other respects.

III. Who is Mr. William Collier?—undoubtedly a gentleman who thinks he has no reason to be at all ashamed of his name, having affixed it at full length to a paper on "Ancient Architecture," in the Polytechnic Journal. And if he has not thrown any new light on that hackneyed subject, he has at at least treated it most originally, having condensed it into the compass of less than four very moderate pages!!—after which fact no one will question that, as has been asserted by some philosophers, the matter of the whole universe is capable of being compressed into the space of a walnut. At first I apprehended that William Collier was about to be dreadfully prolix, and that his paper would be continued through at least five hundred numbers of the Polytechnic,—that is, to about the year 1880, for he sets out by telling us that "The first foundations of history may be looked upon, &c.," and "We think there can be no doubt that Architecture, when in its infantine state, must have been not only rude or plain, but what may be termed irregular." This is certainly beginning at the beginning, and seems to threaten a prodigiously long journey; however, Mr. William travels at more than railroad speed, for in the course of two or three lines he gets from Noah to the Tower of Babel, and traversing through Greece and Rome sets us down—before he has finished his third page, at the National Gallery in Trafalgar Square!!! After which he shoots off again, and in less than eight lines runs through eight centuries, "during which scarcely anything was erected but in the Rude Gothic Style"!!!! Droll William Collier! It must not be supposed, however, that his flying velocity leaves him no time for criticizing; for he stops at the National Gallery to call it "a mass of rubbish which stands in all its meanness on the spot once occupied by the Royal Mews; and which if appropriated to its proper use might well be turned into a Royal Rabbit Hutch." Perhaps he means for such *rabbit* or *rabid* gentry as himself. Most unquestionably the National Gallery is—thanks perhaps to our penny-wise government—greatly inferior to what it ought to have been, and to what the architect would have rendered it, but to term it a "Mass of Rubbish," is, in my opinion, nothing but the merest rubbish of words, most assuredly not criticism. In the name of common sense what are we to understand by it? I believe it would puzzle Mr. William Collier, himself, quite as much as any body else to explain. Grant that it is in every respect decidedly inferior as a piece of architecture to what might have been anticipated, that as a building it is unworthy of its destination, still with all its sins, it is certainly by no means the poorest of our public edifices, therefore if it at all answers to William Collier's character of it, we may ransack our language in vain for terms applicable to many things greatly inferior—for instance, to the Terraces in the Regent's Park, which Bartholomew calls "mortar-skimmings by the mile." If the National Gallery be a mere "Rabbit-hutch," perhaps neither St. Paul's nor Westminster Abbey, can rank very much higher than a good-sized dog-kennel. What our Sweet-William's notions of magnificence may be, I can hardly guess, farther than that they are undoubtedly enormous. Yet stay!—he has given us some clue, for just before pouncing upon the unfortunate mass of rubbish in Trafalgar Square, he says: "The triumphal arches of Rome give us a vast idea of the perfection to which architecture had been brought during the flourishing times of her consuls and emperors"! Thus then after all, the triumphal arches of Rome, in some respects, specimens of the most corrupt taste in architecture, are extolled as models of perfectien by a gentleman so exquisitely fastidious as to behold nothing better than "a mass of rubbish," in the National Gallery!

IV. I should very much like to see Madame Vestris perform the part of Jane Shore, not exactly on the stage, but by being made to perform penance, and stand in a white sheet on the vile excrescence she has built—that is, caused or allowed to be built, by the side of the portico of Covent Garden Theatre; and which looks as if it had been stolen from the entrance of a suburban tea-garden. If that is a sample of her management, and of the kind of reform she intends to introduce into the inside of her house, it is a very ominous sign indeed, and not a particularly inviting one. It is time there was some punishment or fine for so disfiguring a public building in so horrible a manner.

V. As my Lord Eglintoun seems to be suffering from such a plethora of cash that he is puzzled to contrive how to spend it, some friend should advise him to give a new coat to his castle. At present it looks like any thing but what its name would lead us to expect; it being only a spruce and dapper sash-windowed house, with a few battlements, which so far from 'frowning' are particularly sheepish-looking. Its character altogether is very far more offensive than defensive, for it would not stand out half an hour's seige, before it could be stormed by half a dozen old women.

VI. There was no occasion for the new Custom House at Liverpool, to convince us that an enormous expense may be incurred for a number of large columns without its producing any adequate effect or exhibiting any thing that can fairly be called design. The building in question has three octastyle porticos against as many of its sides; but with the exception of those rows of columns nothing to support the pretensions it so makes. When one beholds such a huge mass of mawkish insipidity, he is tempted to regret, with Charles Purser, that Grecian architecture has not been utterly annihilated, or that we have not been kept in utter ignorance of it.

ARCHITECTURE AT MUNICH.

Patriotism is no doubt a very excellent virtue in its way, but it is one that requires to be reined in a little, for it is sometimes rather an unruly beast, and apt to serve us as his steed did John Gilpin, and to make us cut an equally ridiculous figure in the eyes of all the rest of the world. Thus the title of "Modern Athens!" as applied to Edinburgh and its buildings, is absolutely burlesque, of which the very printer seems to have been conscious, for why else did he stick the mark of admiration after it on the title of the volume for which John Britton, with his usual good taste, thought fit to select such a clap-trap designation as a delicate and delicious compliment to "Auld Reekie." After this we are almost ashamed to say that the epithet of the German Athens, has been bestowed upon Munich. Its *Athenianism*, however, is of a totally different sort from that north of Tweed; for in regard to art, the Scotch and the German Athens stand in the same relationship to each other, that the icebergs of the Frozen Sea do to the luxuriant vegetation of the tropical regions. But why, it will be said, should we make such very disagreeable comparisons? to which question we reply by another, viz., why are people so silly and officious as by their blundering Marplot compliments to thrust such comparisons upon us? Some, again, may be of opinion that however splendid Munich may be, there is no occasion for either us or any one to descant upon what has been there achieved, when it seems likely only to put us out of conceit with ourselves and with our doings here at home. Now, could we impose on all the rest of the world as well as ourselves, that argument might be listened to; yet, whether we choose to make comparisons ourselves or not, we cannot prevent others from making them, and all the more to our discredit, when they find out not only how exceedingly backward we are in art, but that, instead of at all suspecting such to be the case, we fancy we are at all events in advance of the rest of the world. With the Italy of other ages we do not pretend to compete; of its former glories in art we have always been accustomed to hear, and we further know, that were it not for its long accumulated stores, Italy would not, at the present day, acquire reputation by the talent of its living artists; we may endure, without any very great vexation, to hear Frenchmen boast of their Louvre and Versailles, for, like eels, we are now got used to it; but to be told that the little capital of Bavaria, (whose population is hardly more than that of one of our larger metropolitan parishes,) should have so far got a-head of us, that in the brief space of twenty years, edifices of almost unparalleled splendour, such as would formerly have been almost the work of centuries, have been nobly conceived and as worthily executed, is, it must be owned, somewhat mortifying. When we look at what has, within the same space of time, been done here at home, at the works of our Nashes and our Soanes—at the blundering fragment at the corner of Downing Street—at the feeble and minikin taste displayed in the new palace—at such large masses of frigidity and insipidity as the Custom House and Post Office—at the bare rooms of the British Museum, where Art is provided for like a state pauper—at our poverty-stricken pseudo-Grecian buildings—and at most of our beggarly new churches—we have to be ashamed, nay shocked, at the contrast. Well would it be could we be made ashamed to some purpose. In what lay the genius of Nash and some others, except in making money and either spending it or hoarding it, it is for their parasites and flatterers to explain; but we may assert that the praises bestowed upon them were certainly calculated to lower our ideas of art most prodigiously. If Nash was the genius that was pretended, the inference was that a man might be some degrees inferior, and yet a remarkably talented fellow after all—a tolerably brilliant star, though not the big full moon itself.

In almost every thing we have done of late years, even where a building has been upon the whole very good as to design, there is something or other left as a blemish in it, something that too plainly declares its having been done upon the do-well-enough system, the consequence of which is, that, as a work of art, it is generally "*done for*." Sometimes we set out as if we really had plucked up courage enough to attempt something grand, yet owing to an untoward fatality, our courage of that sort has almost invariably oozed away before the work has been completed. Neither is it the least provoking part of the matter, that we go on committing failure after failure without profiting at all by our dearly-bought experience. Of course it is entirely the fault of that eternal mischief-maker—Nobody. Oh, no! it is nobody's fault; nobody, of course, is answerable for it, nobody in the slightest degree to blame. If, therefore, things happen differently at Munich, we suppose it is entirely owing to the stars; for as the facetious editor of the Literary Gazette, or the Athenæum's pet, Tom Hood, would say, the stars are of course very obliging and accommodating towards Bavaria, because it has *Moon*-ich for its capital, which, whether a capital pun or not, is here merely borrowed from Jerdan. However, to be more serious—and it really is a serious matter, whatever else may be plain, it is almost incomprehensible how the present King of Bavaria has been able to erect, out of his privy purse, so many of the splendid edifices which now adorn his capital, and which, though they have not, it seems, beggared him, and are likely to enrich his subjects, almost beggar description. Such, at least, is the case with the lately completed Allerheiligen Kapelle, and with the new basilica of St. Bonifacius, by Ziebland, both of which are in the most gorgeous Byzantine style, the latter divided into a nave with two aisles on each side of it, by sixty-four columns, and an open timber-work roof richly adorned with carving, gilding, and colours, to accord with the embellishment of all the rest, when the walls, like those of the Allerheiligen, shall come to be covered with frescos upon a gold ground. How, not these two edifices alone, but so many others of such elaborate pomp and richness, so truly "märchenhaft schön," should succeed each other as they have done, is truly astonishing. It is so mysterious, that we might be excused for fancying the *Kunstliebend* sovereign has discovered either Solomon's ring or Aladdin's lamp. Yet, perhaps the secret, after all, may be explained by the proverb, "where there's a will there's a way." Had George IV. really possessed the taste and love of art so liberally ascribed to him by his flatterers, his privy purse would surely have been a match for that of Ludwig; but he, poor man, had other and more expensive tastes, and his chief title to fame is that bestowed upon him by Caréme, who assures us that among the very few real proficients in gastronomy in his time were the Emperor Alexander, George IV, and the Marquis de Cussy. How Ludwig dines, or whether he has to provide a *couvert* every day for his Lord Melbourne, we have not heard, and still less do we care.

All this may not be flattering to our national pride; still it ought to open our eyes a little, and make us ask ourselves the question wherefore it should be so, and more especially whether it is always to continue so. The opportunities we have already, from time to time, flung away, cannot now be recalled; yet that is no reason why we should despair, on the contrary, a very great reason indeed wherefore we should begin to exert ourselves, and put forth all our energies in art. If not, we must be content with admiring ourselves, and be laughed at by the rest of Europe—at all events, sneered at by little Bavaria.

An unusually full account of the public buildings at Munich, has just appeared in the Penny Cyclopædia, illustrated with a *situation's plan* of the palace and surrounding edifices, as also with a plan of the upper floor of the Pinacotheca. By way of specimen of that article, which we need hardly recommend further than by so quoting, to our readers, we extract what is said of one work now in progress, and also copy the architectural table at the end.

"The new basilica of St. Bonifacius, now in progress, promises, when completed—which it is expected to be in 1842—to surpass every other religious edifice in the city, hardly excepting the Allerheiligen Kapelle itself. Like that building, it is in the Byzantine or Lombard taste, both as to architecture and decoration, but is upon a much more extensive scale, being 250 feet long and 120 feet wide; and is divided within into a nave and two aisles on each side of it, by sixty-four marble columns of a greenish tint, disposed in four rows. Of the middle aisle, or nave, the width is 51 feet and the height 70; of the four others, the width 15 feet and the heighth 40 feet. The pavement is of marble mosaic, and the roof of open timber work, the beams of which are not only carved, but richly decorated with painting and gilding, and the ceiling between them azure, with gold stars. The walls of the outer side aisles are stuccoed with scagliola, in imitation of different coloured marbles, but those of the other parts of the building will be painted in fresco by Hess, with subjects from the history of St. Bonifacius. In the rear of this magnificent church (the front of which, towards the Karls-strasse, has a portico of eight Corinthian columns with three bronze doors) will be another building attached to it, intended as a theological seminary, directly facing the Glyptotheca, to which it will form a corresponding piece of architecture, on the south side of the Königs Platz."

"On comparing a map of London with that of Munich, the latter, though so very much smaller a city, strikes the eye by the number of public buildings and the great space which they occupy. The plan of Munich, published in the series of maps by the Society for the Diffusion of Useful Knowledge, will be useful to those who take any interest in the present article. This plan does not however show the situation of all the buildings here mentioned, not any of those beyond the Kriegs Ministerium in the Ludwigs Strasse, nor the Basilica of St. Bonifacius, being then erected. But two very conspicuous features in it suggest the propriety of mentioning the spacious new Friedhof, or public cemetery, and the beautiful park near the north-east angle of the Hofgarten and Picture Gallery, called the English Garden. The latter is laid out with plantations, intersected by streams of water, and embellished with statues and various ornamental buildings, the most remarkable of which is the circular monopteros of twelve Ionic columns, erected in 1833, as a monumental temple in honour of the elector Karl Theodore, the founder of the garden; nor is it so remarkable on account of its design, as for exhibiting the first modern application of Greek architectural polychromy, the capitals of the columns and the mouldings of the entablature being enriched with various colours painted in encaustic. The other spot, the Père la Chaise of Munich, has, at its southern extremity, an extensive range of building consisting of a chapel and range of arcades, disposed in the form of a crescent about 550 feet in diameter."

"The following architectural synopsis, on the plan of that accompanying the article London, will serve as a general recapitulation, and facilitate reference with respect to the architects and the dates of the buildings, as far as it has been possible to ascertain the latter correctly."

N.B. The measurements are reduced to English feet.

	Date.	Architect.	Remarks.
Frauenkirche	1468-94	Jorg Gankoffen	Gothic, two west towers 336 feet high—336 by 115 feet.
St. Michael's	1583-95	Wolfgang Müller	
St. Caietan	1670	Agost. Barella	Façade, erected 1767, by Couvilliers; Doric and Ionic.
Trinity Church	1704-14	. . .	Rotunda, dome on 18 Corinthian columns.
General Hospital	1813	Fischer	
Glyptotheca	1816-30	Klenze	Grecian, Octastyle, Ionic portico.
Reitbahn, Riding-house . . .	1822	. . .	Italian, 300 by 80 feet.
Isar Bridge	1823-28	Probst & Klenze	Five arches, length 286 feet.
Theatre	1824-5	Fischer	Hexastyle, Corinthian portico.
Kriegs Ministerium, or War Office .	1824	Klenze	Florentine style.
Odeon	1826	Klenze	Italian style.
Pinacotheca	1826	Do.	Italian, north and south façades 494 feet.
Synagogue	1826	Metivier	
Allerheiligen Kapelle	1826-37	Klenze	Romanesque or Byzantine style, 145 by 103 feet and 84 high.
Bazaar	. .	Do.	Italian, round-arch style.
Hof Arcaden	. .	Do.	
Protestant Church	1827-33	Pertch	Oval plan, 143 by 57 feet.
Königsbau	1827	Klenze	Florentine style, façade 406 feet.
Festbau	. .	Do.	Façade nearly 800 feet long, in the Palladian style.
Prince Maximilian's Palace . . .	1828	Do.	Florentine style.
Leuchtenberg Palace	. .	Do.	Italian style.
Obelisk	1828-33	Do.	Bronze, 95 feet high.
Ludwig's Kirche	1829	Gärtner	Byzantine style, towers 209 feet high.
Pfarr-kirche, St. Maria Hilf . .	1831	Ohlmüller	Gothic, nave and side aisles.
New Public Library and Archive .	1832	Gärtner	Façade 494 feet, Florentine style.
The Reichenbacher Bridge . . .	1832	. . .	Timber bridge, 675 feet long.
Blind Institute	1832	Gärtner	Florentine style, façade 214 feet.
Isar Thor or Gate	1833	Do.	Gothic or Old German style, three towers.
Polychrome Temple	1833	Klenze	Circular monopteros, Grecian Ionic.
St. Bonifacius	1833	Ziebland	Byzantine, nave and two aisles on each side.
Post Office	1834	Klenze	Florentine style, façade 290 feet long, 66 feet high.
Georgianum	1835	Gärtner	
Equestrian Statue of Maximilian I. .	. .	Thorwaldsen	
Damenstiftsgebäude	. .	Gärtner	Florentine style, façade 430 feet.
Monument of Maximilian-Joseph I. .	1835	Klenze & Rauch	Colossal sitting figure; entire height of the monument, which is of bronze, 36 feet.

ARCHITECTURAL PROCEEDINGS IN THE PROVINCES.

BY MR. G. GODWIN, JUN., F.R.S., &c.

SIR—I gladly comply with your request to be furnished with some slight outline of the works in progress, or recently completed, which have passed under my notice during a late tour of some of our provincial towns; firstly, because I believe it will tend to show that a taste for architectural productions is increasing, although perhaps slowly, a fact which cannot be uninteresting to your readers generally; and secondly, because I think all such notices are likely to be serviceable in a wide degree, by leading attention to our art, and stimulating to activity its professors. The remarks are necessarily short—the towns spoken of are few, nevertheless, if from the foot we may judge the statue, they will serve as tolerably satisfactory data.

I may premise that a very excellent spirit seems every where apparent. Ranges of straight brick boxes with holes cut out of them for light and air, and dignified with the name of houses, no longer prevail. If a farm labourer's residence be erected, the gables are adorned with ornamental barge-boards, and the chimnies are carried up in such a form as to give to the building something like architectural character. The inhabitants of the larger towns are beginning to migrate to the suburbs, leaving the former wholly as places of commerce, and for them, in consequence, small villa residences are arising in all directions. These in many cases are excellent in design,—indeed it is said they will not let if they be not at all events more ornamental than the houses of business within the towns, a circumstance easily understood, and which will necessarily induce the bestowal of thought on the subject, and an ultimate improvement.

In the neighbourhood of MANCHESTER for example, at Broughton Hill, and at Cheetham, there are several very elegant residences built from the designs of Messrs. Young and Westall, Mr. Aley, and Mr. Atkinson: these are chiefly in the Italian style, and show much taste and skill. Mr. Atkinson has nearly completed a very pleasing church at Cheetham, named St. Luke's. It is in the style of the perpendicular period of pointed architecture, and presents some details of more than ordinary excellence. The tower and spire, wholly of stone as is the rest of the exterior, are particularly worthy of notice, although they would have been better if the richly crocketted spire had been more lofty,—that it was not so, however, proceeded probably less from the architect's will than from circumstances beyond his controul. A range of detached, or rather perforated buttresses on each side of the building produces a good effect of light and shade. The interior is evidently the result of careful study and has many points of novelty, so far as regards modern churches. The east end is tastefully adorned with canopied niches and panelled work in plaster; and the centre of each compartment of the gallery-front has a small canopied niche and figure also in plaster. Perhaps the least effective part of the church is the roof, the timbers and ribs of which are somewhat too small. The reading desk consists simply of a carved eagle on a stand, in the old cathedral fashion, with a large Gothic chair for the minister; while the pulpit has around its pedestal sculptured figures and is otherwise decorated, shewing that Mr. Atkinson had a power of expenditure not often permitted to architects in these days of mistaken economy. The whole cost nevertheless is said to have been hardly 10,000*l*.

In the town several works are in progress. The Athenæum built under the direction of Mr. Barry is nearly completed, and an Unitarian chapel by the same architect, in Upper Brook-street, is quite so. This latter edifice I did not see: according to an informant however, it is in the early pointed style of architecture, and quite worthy of Mr. Barry's reputation.* In Mosely-street a large and lofty pile of buildings is going on which promises to present a striking elevation. It is in two stories, and although intended only for warehousing goods, exhibits ranges of three-quarter columns at both extremities, and pilasters in the intermediate space, bearing continued entablatures. These buildings have a peculiarity which I have not elsewhere observed. The walls of the basement story are cased externally with cast-iron plates, with what particular intention however, did not appear to me quite clear on a hasty inspection.

You will be glad to learn that the Architectural Society at Manchester are pursuing steadily their useful course. Whether the great improvement in matters of taste apparent in Manchester, is actually the result of their operations or not, one may not venture to say, but certain it is, they cannot fail to do much good by awakening public attention to the importance and agreeableness of architecture as a fine art, and assisting to develope the talents of the younger members of the profession. That they *are* assisting in this latter purpose is perhaps apparent in the fact that Mr. Edward Hall, to whom a medal of

* A notice of this Church is given in the October Number of our Journal. —EDITOR.

the Royal Institute of Architects was justly awarded during the last session, is one of their body. The promptitude and boldness with which the Society came forward on the subject of public competitions both in the case of St. George's Hall, Liverpool, and the Royal Exchange in London, seem to me to reflect upon them very great credit, and to entitle them to the good will of the profession at large. One bar to their advancement, it may be noticed, is the cost of house-rent, which swallows up nearly the whole of their annual income,—a bar unfortunately not confined to this Society alone, but which acts almost as powerfully to lessen the usefulness of the Institute, and of the Architectural Society of London, indeed of every literary and scientific body not aided in this respect by government. Surely something might be done to diminish this evil in the metropolis? If government cannot, or will not assist in the object, several societies might by coalition erect one suitable building of sufficient size for their purposes, using *alternately* such portions of it, as are not generally required by each society oftener than once in the week. With regard to the Institute and the Architectural Society, it is to be hoped that a long time will not elapse before they merge into one powerfully effective body, as the whole cost of one establishment, or nearly so, would then be available for the advancement of architecture,—either by the prosecution of experiments, the publication of designs and proceedings, or the foundation of a maintenance for a travelling student. This however is slightly beyond our present purpose.

At BIRMINGHAM many projects are in agitation; several additional churches are to be built, (but mostly of very small cost,) as well as new Assize Courts, and other edifices for public business. Bishop Ryder's church, built by Messrs. Rickman and Hussey, was consecrated in December last. It is constructed of red brick, (the dominant material in Birmingham,) and stone, and the architects have cleverly adapted these materials to their purpose, by employing the late Tudor style, or that which immediately preceded the entire abasement of pointed architecture by Italian intermixture. The tower has at the sides of it four turrets surmounted by small cupolas similar to some at Hampton Court Palace, which building is an example of the style adopted. Adjoining to the church is a "King Edward's Free-school," built by the same architects. There is a small Gothic church without much pretension, recently built at Edgebaston; and near it Horticultural Gardens with greenhouses and lodges have been formed. On the opposite side of the town is Trinity church, a small stone edifice of the perpendicular period, erected several years ago, but of which I do not remember to have seen any account. The interior is bare, but the exterior is pleasing. Its principal feature is a lofty recessed porch at the west end, and its chief defect the smallness of the mullions in the openings for light, which being besides of wood, painted, give a mean appearance to the whole of the windows. This over-slightness in the details (as all must have observed), is no uncommon fault in modern Gothic buildings. We do not pay the same attention to the geometrical proportions and relationships of the parts in a building, as was paid by the architects of the middle ages,—in fact we know nothing about them, being contented to copy examples and apply them according to our own fancy without inquiring on what principles they were originally produced. A close investigation of some of the best specimens of middle-age architecture seems to lead to the belief that a system of arrangement was pursued in the apportionment of the various parts, of which we have at present no certain knowledge. Wonderful fellows were those free-masons of old! Inscrutable, untiring. Even yet not fully understood.

The pulpit and reading-desk in the church above mentioned, are placed close against the east wall of the building, the communion table standing between them.

Several chimnies for engine houses have been erected lately in the suburbs of extraordinary height, in order to prevent an ill effect which otherwise is caused to the adjoining land by the fumes of certain materials. Some of them are fine pieces of construction. Near DUDLEY many were observed to be injured by recent violent storms. Those of square form had apparently suffered much more than those which are circular on plan. I cannot leave Birmingham and Manchester without remarking on the great improvement in design apparent there in various pieces of ordinary iron-work and common fittings; the most recently constructed street lamp-irons for example display foliage of elegant form, and in many cases the frame-work of machinery is seen to be treated in a very architectural and beautiful manner. In the Town Hall at Birmingham some branches for lights, which have been lately fixed to the side walls, are exceedingly elegant in design. Every fine form disseminated in this way may be regarded as a good seed sown, and tends however slightly, to aid in the general improvement of the public taste now beginning to be observable.

At WORCESTER little seems to be doing at this moment. The County Courts (with an Ionic hexastyle portico) by Mr. Day; a building for the Natural History Society, executed from the designs of Messrs. Phidian and Newy, at a cost of about 5000*l*., and a New Mechanics' Institution by Mr. Harvey Eginton, are among the most recent erections.

The Cathedral built, if I noted rightly, of a red sandstone, (least trustworthy of stones,) is fast decaying, and workmen are constantly engaged in the task of restoration under the guidance of Mr. Eginton. The stone at this moment employed in the restoration, comes it is said, from Lord Mount Morris's estate of Arley, in Wales. For this nobleman, I may mention *en passant*, Messrs. Varden, architects of Worcester, are about to rebuild Arley Castle. It is intended to make it a castellated edifice with moat and barbican, forming an important pile of building. Part of it is to be begun immediately.

A great many new buildings for Banking Companies have been recently constructed in various parts of the country, and have afforded opportunities for the exhibition of the skill of local architects. Two have been erected at GLOUCESTER; one in Westgate-street by Mr. Fulljames, and the other in Eastgate-street by Mr. Dauk; the former presents columns and entablature on a basement, and is somewhat ornate; the other is an unpretending but pleasing Italian building with large projecting cornice and consoles. In the neighbourhood of the Spa, and Pump-room at Gloucester, many new private residences have lately arisen with pretensions to architectural character, as well as a small church by Mr. Rickman, and a free-school by Mr. Dauk. This latter gentleman has also recently built some bonding warehouses on Baker's Quay, which exhibit under rather difficult circumstances much skill in construction. Their cost was about 6000*l*. The exterior of the Cathedral here, with the exception of the centre tower, (which with its perforated turrets at the angles, is one of the most elegant in England,) is fast decaying. Active steps are unquestionably needed in the organization of some comprehensive scheme for the repair and maintenance of our ancient buildings. Why should we be behind hand in this matter? Are our neighbours the French always to take the lead?

At BRISTOL and CLIFTON, where there are many talented local professors, architecture is making very satisfactory strides forwards. Two of the most considerable and excellent of the new erections are, the Red-Maids' School by Mr. Dyer, and the Asylum for the Blind by Mr. Rickman. These buildings adjoin each other, are designed in the pointed style of architecture, (one is a little later than the other), and form a beautiful termination to Park-street. They are wholly of stone externally, partly from Bath and partly from Hanham, a place about five miles distant. The Red Maids' School, I was informed, cost about 13,000*l*., the Asylum about 20,000*l*., including a chapel, the interior of which is very charming. The high pitched roofs of the Red Maids' School are constructed of two queen-posts and collar-beam, and are rendered available as dormitories from one end of the building to the other,—the collar-beam, 6 feet 3 inches from the top of the tie-beam, which latter is the level of the floor, appearing in the apartments and dividing them, as if it were, into bays.

Near to these last-mentioned buildings a very large Roman Catholic Chapel, wholly of stone, is in progress, beautifully situated on elevated ground. The front or west-end displays an hexastyle portico of large proportions, and the sides, a range of three-quarter columns, with at the east-end two projections, north and south. Mr. Goodridge of Bath is the architect, I believe. In this same neighbourhood Mr. Dyer has commenced a building, with large Corinthian portico, for the Conservative Club, and which promises to be of good appearance. At Grenville Place a Wesleyan Chapel in the early pointed style has just now been completed, from the able designs of Mr. Foster. It is constructed of the dark Hanham stone with Bath stone for the dressings; will accommodate 900 persons, and has schools beneath. The cost of the whole was 3000*l*. The same architect is about to erect a church on the Marquis of Bute's estate at Cardiff, under her Majesty's Commissioners. It will be built (of stone dug on the spot,) in the Anglo-Norman style, to seat 2000 persons. The cost is not to exceed 6000*l*., of which 3000*l*. is to be given by the Marquis himself. It appears that 87 designs were submitted in competition for this church, and that, although Mr. Foster's drawings were selected for execution, they did not in some one circumstance accord with the printed directions given to architects. The chief premium was in consequence awarded to Mr. Wyatt, for a design sent by him, and in proper accordance with the instructions.

In the Cathedral at Bristol, which it may be stated, has been sadly injured by party-colourings and barbarous interpolations, is a clever Gothic monument, erected to Bishop Butler in 1834 by subscription. Mr. S. F. Fripp, architect, was the designer of it; and he or one of his name, has also superintended a very pleasing monument in the church of St. Mary Redcliffe, to Dr. Nathaniel Bridges. This latter was put up by subscription in 1835.

Chatterton's monument for which a design was obtained by competition some time ago, is not yet erected. It will stand outside St. Mary's Church, near the north porch, the scene of the extraordinary, but, mis-spent labours of that child of song and sorrow. The church of St. Mary Redcliffe, that

> "———— Maystrie of a human hand,
> The pride of Brystowe and the Westerne lande;"

a most excellent specimen of the architecture of the 15th century,—is sadly marred as was formerly the case with most of our old buildings, by the introduction of an organ screen of pseudo-classic design, constructed at a period when pointed architecture was not understood, and therefore not properly appreciated. The present excellent churchwarden Mr. William Ringer, who has fortunately a correct taste in these matters, has proposed a plan for casing this eye-sore in strict accordance with the style of the church; and I mention it here, although perhaps not exactly connected with the object of the present letter, with the hope that by drawing attention to the circumstance on the part of other of the influential inhabitants of Bristol, it may assist his praiseworthy purpose.

Among various matters in progress at Bristol, is a large Chapel for the followers of Irving. It presents a well proportioned portico of six columns, (from the Choragic monument of Lysicrates,) on a lofty stylobate. It is constructed of stone from the designs of Mr. Pope, but offers nothing beyond the portico calling for remark, the flank walls and the interior being perfectly plain. An enormous hotel, called the Great Western, has been lately built by the same architect: having among other embellishments a range of 12 lofty Ionic columns.

The proposed Suspension Bridge over the Avon at Clifton is in a state of progress, the pier to receive the suspending chains on the Clifton side, is nearly completed, and of that on the opposite rock where much more preparation was necessary, the foundation is brought up nearly to the level of the intended roadway. If happily completed, and there is no reason to apprehend otherwise, it will form one of the most noble monuments in England of modern skill, and will add leaves even to the laurels of Brunel.

At the risk of telling an oft-told tale, I cannot avoid referring to the charming little cottages at Bristol, known as Blaise Hamlet, Henbury, intended for charitable purposes. They were built as long ago as 1811, by the late Mr. Nash, and are so remarkable for picturesque beauty that no architect should visit Bristol without seeing them. They are ten in number, constructed of stone with tiled and thatched roofs, and are enclosed so as to be quite cut off from the neighbourhood excepting through a lodge. If one wished to play at *Arcadia*, this is certainly a spot that might be selected as the scene.

At Bath, where several important edifices are in progress, such as "Queen's College," by Mr. Wilson, and a Scientific Institution, I observed nothing more (through want of time) than that the works on the Great Western Railway are proceeding with rapidity. The pointed style of architecture seems to have been adopted at this portion of the line in designing the bridges and buildings.

The Church of St. Nicholas at Bath, built a few years ago by Mr. Manners, is certainly a very successful modern Gothic building. The spire is especially admirable, and all the details are bold and good. The style is the early pointed, the Temple Church, London, being the model in respect of the parts. Mr. Manners in his restorations at the Abbey Church, where he was engaged two or three years ago, used with success a colouring matter to render the new parts similar in appearance to the old,—an example which in many cases might be advantageously followed.

There is a new Market-house at Wells, built as I was told, about two years since by Mr. Carver of Taunton. At the Cathedral, repairs are being made to the wood and lead work of the roof over the choir, under the direction of Mr. Wainwright of Shepton Mallet. The stone work of the exterior greatly requires attention.

Salisbury Cathedral is under repair in part. The magnificent spire, known to be considerably out of upright, was plombed a few weeks ago, and found to be remaining stationary. Within-side the Cathedral is a clever canopied altar-tomb, recently designed and executed in memory of the Rev. Thomas Burgess, D.D., Lord Bishop of the diocese, by Mr. Osmond, a sculptor of Salisbury, who has paid much attention successfully to Gothic architecture.

In concluding these surface remarks it may be well to observe, although perhaps almost supererogatory, that it is not to be imagined because nothing is here said of bad taste, lack of invention, or errors in construction, and no real objections are taken to any of the various buildings mentioned, that none of these things are to be observed, or if observable, were quite out of the sight of the writer. Briefly to tell the truth, he went out not to look for defects, but for appearances of progress, and has been content succinctly to notice what appeared to him to be such,—welcoming the *much*, without complaining at the moment that it was not *more*.

I am, Sir, your's,
George Godwin, Jun.

Brompton, October 2, 1839.

BRITISH MUSEUM.—No. III.—ETRUSCAN SCULPTURES.

(From The Times.)

Among the votes of Parliament relating to the British Museum in the present year, is one for 6,570*l.*, part of which has been expended in the purchase of a collection of Etruscan monumental sculptures found by Signor D'Anastaci, in Tuscany, the ancient Etruria. They are at present placed in the grand central and in the Phigalian saloon, and are well worthy of attention, as they enable us more distinctly to trace, by being placed in conjunction with others within that edifice, step by step, the improvements in the art of sculpture, which perhaps having had its origin in China, appears gradually, in proceeding towards the west, to have been improving in its march, till it attained the zenith of its perfection in the classic climes of Greece and Italy. The origin of the people to whom these early works of humanity are ascribed, has been matter of question among both the ancients and moderns; it is doubtful whether they were Pelasgians from Greece, or Lydians from Asia, or a race indigenous to Italy. Herodotus says they came from Lydia, oppressed by an exuberance of population, and were called Tyrennians, from Atys, their leader; Cicero, Strabo, and Plutarch assert the same; Count de Caylus gives them an Egyptian origin, and Dempster and Bochart suppose that the original nucleus was increased in numbers by emigrations of Pelasgic colonies from Thessaly and Arcadia; Maffai and Monboddo hold the same opinion; Humboldt thinks they were a connecting link between the Iberian and Celtic race, and later authors have attributed their origin entirely to the latter. The language which they spoke, it is certain, was different from that of any of the nations mentioned. It has been attempted to explain the inscriptions on these tombs by the aid of the Greek, the Latin, and the Hebrew, but it has failed; and lately by the Celtic; how far that has succeeded is doubtful. Niebur asserts that their language had no affinity with any known form of speech, and that this is true is proved by its continuing to be spoken for many centuries after their subjection by the Romans; and it may be gathered from Lucretius that books continued to be read and written in it, and Aulus Gellius says it was familiar in the Augustan age. Their literature presents the singular phenomenon of an alphabet almost entirely deciphered, and a language unintelligible; we think that whatever attempt may be made to understand it, will fail without the discovery of bilingual inscriptions, as are on the Rosetta stone; the attempts that have been made without such help to read the inscriptions of Persepolis and the arrow-headed language of the bricks of Babylon, have been entirely unsuccessful.

The Etruscans, in their most prosperous period, inhabited Etruria Proper and the countries about the Po; the Rhætian and other Alpine tribes were of the same origin as those who occupied the territory of Venetia before the building of Petavivum. Niebur, in his history of Rome, says, the name "Tuscan" and "Etruscan" was foreign to them, as also that of Tyrennian, and that they called themselves Rosillani. Till the introduction of Christianity they continued to instruct the Roman youth in the science of divination, and haruspices of Rome were of their race. The works of their hands still remain the astonishment of posterity; the walls of their cities were formed of Cyclopean masonry, and perhaps the largest stone ever hewn by human labour is the lintel of the Theatre of Fiesule.

The artists of antiquity availed themselves of everything capable of modelling, carving, or casting, and accordingly several of the Etruscan monuments now placed in the Museum are made of clay baked; sometimes different materials were intermixed in the composition for the drapery or ornaments, which was called polychromic sculpture, and those composed of a variety of marbles, polythica. In the Neapolitan Museum are some statues of the same material as those found in the tombs, the size of life. Whence the Etruscans derived the origin of their sculpture, (and that they had all sorts, Dempster, Gori, and the Academy of Cortona have proved, Pliny also mentioning a statue at Bolsena of 50 feet in height), is difficult to determine; the greater part have but little allusion to Grecian story, and their style is entirely different. Strabo has a passage in which he notices the resemblance between the works of the Egyptians and the Etruscans or

Tyrrhenians; but that is no reason to suppose that there was any communication of first principles between the two people. Lanzi says a distinction must be made between the Etruscan style and the work of Etruscan artists; the style was peculiar, and in use till a late period; it was called "Tuscanicus" by the Latins, and all works in the manner of that school "Opera Tuscanica;" many of the subjects in the Etruscan sculpture seem to have been executed when there was no art in Greece, although the above author has endeavoured to prove that they were copied from Grecian models, and there is a celebrated gem in existence in the imperial collection at Vienna, which represents the seven chiefs who conducted the expedition against Thebes, a remarkable circumstance in Grecian story, a representation of which equally early is not found among the Greeks themselves. The signs of Etruscan art are, in some of the specimens, the forms undefined—the hair and drapery arranged with studied regularity and stiffness, and an attempt at effect in the execution. It may be remarked in the figures of these tombs, that there is an overcharged and forward action of parts; the fingers are uplifted, the legs and arms are placed in affected positions; there is nothing of that repose so visible in the Egyptian figures, nor the boldness of the Ægina marbles, but in all the class an absence of expression, grace, and character. It is singular, that when the art improved in Greece, they still kept the same defects; Winckleman is of opinion, that the hierarchy, who were governors as well as priests, were against improvement and innovation, and followed only the ancient models, as was the custom of the Egyptians, whose school remained the same from the days of Pharaoh to the Roman era. That the Etruscans had practice to improve them, is evident from the quantity of their works that have reached our times. Pliny says, that on its final reduction as a Roman province, 280 years before the Christian era, as many as 2,000 statues were taken from Volsinium alone. There is one observation, however, to be made on the style of the Etruscan sculptures—that, however deficient they may be in beauty, in their proportions they are just; they neither offend the eye by their extraordinary leanness, nor, as in the Chinese, by their excessive obesity; the same exactness is found in the proportions of the small, as in the larger figures, which is not the case in those of Selenuntum or Ægina, or always of Greece and Italy; that they possessed a decided taste for the arts, it is only necessary to observe the differences that are made in the improvement of their designs, and the means they found in that early age of rendering the most stubborn materials subservient to their use.

Amour propre is born with man. In regarding the sculptures of the different nations of antiquity, the philosopher may amuse himself in contemplating its effects. The exclusive conceit of China conceives that the origin of sculpture is the finality of its perfection, and boasts that within the bounds of the celestial empire it has neither retrograded nor advanced in a period of 3,000 years; the faithful disciple of Bramah regards with equal admiration the hideous proportions of his seven-armed statue, and thinks it cannot be surpassed; the Egyptian, confident in the excellence of his original conceptions, and in the immensity of their execution, copied no one, and sought not to improve; he thought his works would last to eternity; the subtle Greek flattered himself he could with impunity rob the Egyptian; he counted on his contempt, or his indolence, and he supposed his robbery of imitation would not be discovered, notwithstanding the coarseness of the veil he threw over it, and he destroyed his earlier works to conceal his ignorance, which accounts why so few of the earlier Grecian statues have been found, Pausanias only mentioning a few, superstitiously preserved as early gods. The Romans were equally ungrateful, but they dared not act the same with the Greeks, whose wit would have exposed the theft. The Etruscans, if they imitated the Egyptians, as was the opinion of M. Buonarotti, made no attempt to conceal it, yet much of the style of their painting and sculpture is original; it is true it never reached perfection, nor can the date of any particular monument be given, because no history of the nation remains. The tomb of Porsenna, as is said by Strabo, may have owed its origin to Egyptian commerce, but the variety displayed in all their earlier monuments, is a proof of genius in the people which, had not conquest and the sacerdotal nature of their government prevented, might have been found, in its ultimate development, to have equalled that of any nation of antiquity.

The tombs whence these figures and monuments were brought were in general excavated in the rock, and in a line of road immediately leading to a city, as was the custom of all the ancients, and the outside, where it would admit being adorned, adorned with sculptured ornaments; they were of that kind called *Taphos*, and not like the Celtic tumulus or mound; in some of them it was the custom for the priests to practise the art of divination. The interior of the chambers were so formed, that the ceilings were made to represent beams of wood, and the walls of those belonging to families or individuals of distinction were entirely covered with paintings; these were divided into compartments, and the subjects represented were rarely of a sombre or funereal description; in many of them groups of figures are represented as dancing with female musicians playing on flutes. The dress of the men is commonly a cloak, thrown over the arms and shoulders, without sandals or any other covering; the women have light tunics and mantles floating in the air, both of which are bordered; all the figures are crowned with myrtle; the men wear a necklace of blue beads, and in the back-ground of the picture is generally seen a table covered with painted vases, which contain the wine destined for these votaries of Bacchus; in others there are representations of chariot races; a number of cars, with three horses to each, appear ready to start, and only wait because the steeds of all are not prepared. In some wrestling matches are depicted, over which a figure on horseback presides armed with a lance. It is evident that the subjects on the walls of these tombs are a true representation of the funereal ceremonies of the Etruscans, and that they contemplated death but as a gate through which mortality must pass to obtain a perpetual enjoyment. The chests when opened were frequently found to contain, beside the bones of the deceased, many favourite articles appertaining to their lives, such as female ornaments of gold, parts of the armour of a warrior, besides mirrors, cestusis, dice, table utensils, and pieces of money of ancient fabric, as also vases of glass and terra cotta, some beautifully painted, with many other articles possessed in life. The chest on the right hand from the entrance of the grand saloon of the Museum, was found in a chamber excavated in the rock on the road from Tuscanella to Corneto, the ancient Tarquinia. The bas-relief in front represents the head of Medusa, having on each side a dolphin. A figure of a boy, probably the son of the deceased, stands beside; he is naked, excepting a sash around the loins; the cover is the recumbent effigy of an aged matron. On the cover of the adjoining one is sculptured the statue of a priest of Bacchus, which is shown by the prefericulum he holds in his hand, and the ivy chaplet round his temples, as also by the sacred utensils hanging from the wall on his side; the chest belonging to it presents in front a combat of three warriors, scarcely blocked out; within it were the remains of the body and some other articles. The next chest has a male figure on the top, and an inscription, probably bearing the name of the departed, engraved on the upper cornice of the principal side; the bas-relief on this represents two marine monsters opposite each other, and between them is a disc intended for a Gorgon; the marine figures are finished, but the other is only sketched out. This is strange, but probably can be accounted for, that it was the custom to prepare the receptacle during life, and, not being completed, it was thought sacrilegious to touch it after death; round the neck of this figure is a circular ornament, surrounded with a riband in spirals which it is difficult more accurately to define; it has also a ring in the hand, which it was also the custom for women to hold. There is an inscription, which, according to the theory of Lanzi, may be translated, "Vibius Sithicus or Sextus Velthurius. Medosiæ natus Tanaquilis filiæ, vixit annos quinquaginta." The next cover represents a warrior, as may be judged from the bas-relief of a military car, guided by himself; behind is a genius with expanded wings, followed by three figures bearing palms in procession, and a fourth who has in his arms an instrument resembling the crooked Etruscan trumpet; there is a long inscription upon this coffin, the whole of which, according to the above antiquary, is unintelligible, excepting the name "Arsio Velio," and the age. The adjoining chest to this has a bas-relief of a bearded head, covered with the Phrygian bonnet, the point of which falls over the forehead; beside are two marine monsters mounted by boys, symbolical of the passage of the soul over the ocean to the Elysian fields. The statue on the cover is that of a young female, which has evidently been painted red, as also the ornaments of a golden colour, a practice which seems to have been general among the ancients; on the head is a diadem, and there can be no doubt but the countenance is a portrait of the deceased, who must have been handsome; the dress is in an unfinished state, as is the case with almost all the others. In the Phigalian saloon is a chest by far the most magnificent of the whole collection; it is of larger dimensions than any of the others, and is sculptured on all the sides, which is unusual, and would seem to prove that it was intended for some superior personage. At the head is represented a combat of gladiators in honour of the deceased; the bas-reliefs on the other sides of the monument display the barbarous sacrifice of human victims, men, women, and children, who are hacked to death before the altar, amidst the despair of their relatives and friends; the whole is masterly executed, the grouping of the figures is excellent; the attempt at flight of some, and the useless resistance of others, are boldly delineated, and but that the finish is not equal, we think that this sculpture is not surpassed by any of the splendid specimens of Grecian art around; this beautiful work has unfortunately been much injured, and only a few letters remain of an inscription which probably contained the name of the deceased. The next sarcophagus has no bas-relief of any kind, the cover is a figure of a priestess of Bacchus lying supinely on the chest; she is dressed in the pomp of her sacred calling, and ornaments of gold decorate her person. A fawn, sacred to this god, is lying beside her; in her right hand is a vase with handles, and a thyrsus in the left. The style of this figure varies from that of all the others.

The next chest is of terra cotta; the statue which forms the lid of it represents a young female dressed as the old matron before described, but it is to be remarked of this figure the singular position of the legs; the left is bent under the other, and is seen at the back of the statue; the whole is coarsely finished, except the face, which is more carefully formed. The adjoining one is also a sarcophagus of terra cotta, and has on it two figures of dolphins in relief; the cover is a young woman, whose head is encircled by a garland, reposing with the right hand under the neck, while the other is extended, on the little finger of which is a ring; the leg is in the same awkward position as the one before mentioned.

The last we have to describe is a magnificent tomb, which bears in front two winged genii, sculptured; in the hand of one is a torch; the other bears military trappings, and in the centre are ornaments of leaves; at the sides are heads of animals, in various forms, and at the back are other genii and ornaments. The cover is of a cubical form, terminating at the cornice with tiles and artificial masks, surrounded with festoons; in the middle of the ridge of the roof are two serpents tied in a knot. At the extremities are sphynxes with expanded wings. The whole is sculptured in peperino stone, which is carefully covered over with a coating of lime stucco, and coloured in red, black, white, and green; on the front is an inscription, and the same is delineated in colours on the lid.

ST. KATHARINE'S DOCKS.

Engineer, Thomas Telford, C. E.

SPECIFICATION OF ENTRANCE LOCK AND COFFER DAM.

The lock which is to be enclosed from the river by a coffer dam during the execution of the work, is to be placed on the situation shewn on the plan, and its dimensions are to be as follows, (there are to be three pairs of gates.)

The upper sides of the pointing cills for the lower or river and middle gates are to be 10 feet below low water mark of a spring tide, and the pointing cills for the upper gates are to be laid 6 feet below low water-mark of a spring tide, the level of which is to be reckoned from Trinity datum, which tides is calculated to rise 18 feet from low to high water; the coping of the lock is to be 6 feet 6 inches above the level of high water, so that from the cills of the lower or middle gates to the top of the coping the depth will be 34 feet 6 inches, and the upper gates 30 feet 6 inches. The length between the lower and upper gates is to be 175 feet; the width of the lock is to be 45 feet at top, the platforms for the gates one foot lower than the tops of the pointing cills, and inverts for a caisson at each end of the gates are to be on the same level.

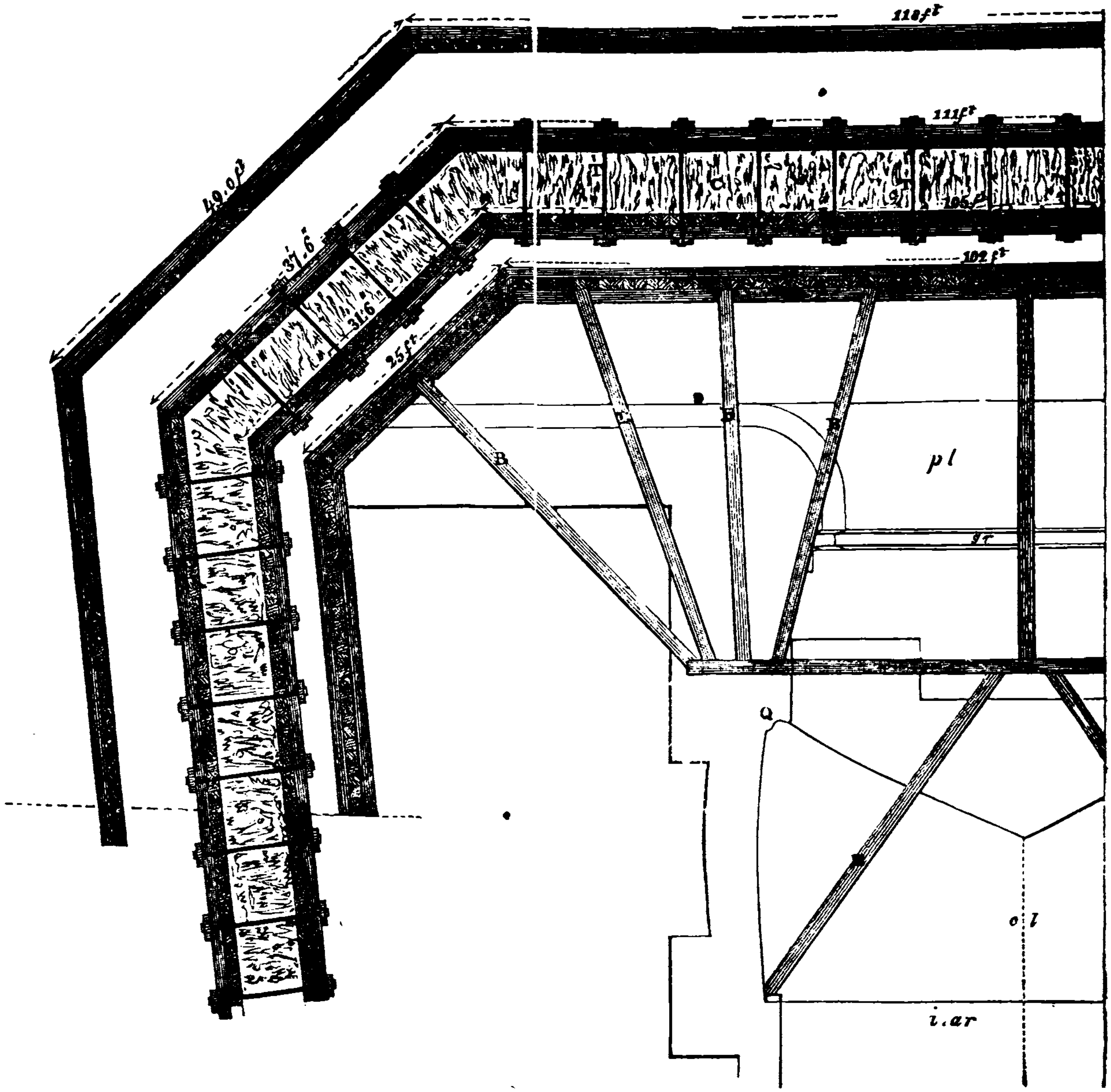
The earth is to be excavated down to the surface of the clay of a sufficient length and breadth to afford space for constructing the lock and its appendages, and for walls for an iron swivel bridge, and also for 5 feet in thickness of puddle at the back of all the walls, and the earth that is excavated to be removed by the contractor to some place to be found by him, excepting such portions as the resident engineer shall direct to be selected and preserved for puddle. All the space between the before mentioned clay and the bottom of the lock, inverts, platforms, chamber walls, counterforts, capstan funnels, bridge walls, and every part of the brickwork and masonry to be carefully filled up with proper puddle or good clay, as shall be directed by the resident engineer.

The platforms for the gates' recesses and river wings, are to have bearing piles of beech or elm timber, and driven as shewn on the plan to be in lengths of 12 feet, and to average 9 inches diameter in the middle, each pile is to be shod with a wrought iron shoe of not less than 10 lbs. weight,—they are also to have a wrought iron circular hoop 3 inches broad and 1 inch thick fitted to their heads, to prevent them from splitting while driving. A row of sheeting piles grooved and tongued must be driven under the pointing cills to each platform, the timber for which is to be beech or elm in lengths of 12 feet and 9 inches thick, they are to be shod with strong plate-iron shoes, and driven close to each other so as to be impervious to water. Similar rows of sheeting piles are to be driven under each groove for a caisson, and also at the toe of each wing wall at each end of the lock, the latter are to be driven in a slanting direction to correspond with the batter of the walls as represented in the drawing, and are to be 9 inches thick by about 12 feet in length; the heads are to be cut off straight and at a proper level, and at the top of each row under the pointing cills and grooves for the caisson a waling of fir timber is to be placed on each side 12 inches broad by 6 inches thick, those walings are to be secured to the piles by screwed bolts with nuts and plates, the iron for the bolts to be 1 inch diameter, and those for the slanting piles to be 1¼ inch, and the distance between each bolt is not to exceed 2 feet, the heads of the bearing piles, under each platform and pier are to be cut off at a level agreeably to the drawing, and upon them cills of fir timber 12 inches square are to be placed and securely spiked down to the piles with one spike to each bearing pile, the spaces between these pile heads, and cills are to be solidly filled and well rammed with good tough clay and gravel, mixed in a proportion of ⅓rd gravel to ⅔rds clay. Fir planking 6 inches thick laid close is to be spiked down to these cills with one spike in each plank upon each sleeper, the spikes for which are to be 12 inches long, those for the cills to be from 20 to 24 inches, of ¾ square iron, the latter to have jagged points; upon these floors of timber are to be constructed the platforms or aprons for the gates, the recess walls, and the piers for the swivel bridge. The ground upon which the inverted arches for the chamber and wings is to be placed must be prepared to a proper form agreeably to the drawing. The platforms or aprons of the gates are to be of Bramley stone in Yorkshire, or Stonadge stone in Derbyshire, or Dundee, Millfield, or Loker stone Scotland (all of the best quality, the contractor is to be at liberty to propose any other quarries for the consideration of the directors) and laid in regular courses, and radiated so as to form an inverted flat arch on the lower side of the cills; these stones are to be 3 feet 9 inches in depth from the top of the outer platform, and those under the sectors for the gates are to be 2 feet 9 inches as shewn by the longitudinal section; these platforms are to extend under the recess walls. The masonry is to be solidly bedded in Pozalano mortar mixed in the following proportions, viz.: two parts Dorking or Merstham lime powder, one part of Pozalana and two parts clean sharp river sand, the lime and Pozalana to be ground together in a dry state. None of the courses are to be less than 15 inches thick on the face, and no stone to be less than 3 feet long, the beds to be correctly dressed to the radius, and the end joints made truly square from the face, the face of the stone to be neatly droved round the edges and face with a chisel 2 inches in breadth, and the same on the beds and end joints, and neatly punched between the said chisel drafts. The inverted arch of the lock is to be elliptical, and of brickwork 2 feet 3 inches thick at the bottom, and increasing upwards as shewn by the transverse section, with stone quoins at every termination. The bricks to be well burnt, hard sound grey stocks laid flush in mortar, mixed in the proportions—1 part Dorking or Merstham lime powder, and 2 parts clean sharp river sand. The chamber and recess walls, and also the wing walls are to be of brickwork, built of similar bricks except the facing for 9 inches inwards, which is to be of well burnt sound marlm paviers, the courses of bricks to be laid at right angles from the face of the walls, unless where otherwise shewn in the section, they are all to be laid flush in mortar as above described. Two courses of bond stone 1 foot 8 inches thick on the face is to be built in the chamber walls of the lock, as shewn in the transverse section; the beds to be radiated and laid at right angles from the face of the walls; the front is to be of the before-mentioned stone, laid header and stretcher alternately, the headers not less than 3 feet long on the face, by at least 4 feet on the bed, the stretchers not to be less than 4½ feet long on the face, by 2½ feet on the bed; the stones to be well dressed as formerly described, and laid flush in mortar; these stones to cover the whole breadth of the walls and counterforts. The stones for the counterforts to bond at least 15 inches into the main wall. The hollow quoins for the round posts of the gates are to be of the before-mentioned stone. No stone to be less than 18 inches thick, or to answer six courses of bricks, and not less than 6 feet long by 4½ feet on the bed, an average from the whole length of each stone, they are to be laid flush and solidly bedded in Pozalana mortar; the face for the round posts to rest against is to be very correctly and very neatly dressed with a chisel, so as to make a water-tight joint betwixt the wood and the stone, the face of the other part to be dressed similar to that of the apron, the beds and end joints are to be truly worked throughout, so that the masonry may be perfectly solid and impervious to water. The quoins at the recesses for the gates are to be of stone of a similar quality to that for the hollow quoins; no stone to be less than 15 inches thick on the face, and 4 feet long by not less than 2 feet 6 inches on the bed, and to be as well dressed as the hollow quoins.

A groove for the caisson is to be formed across the bottom, and up the side walls at each end of the lock as represented in the drawing. On the outside of these grooves, between the wing walls at each en-

PLAN OF COFFER DAM.

Figure 1, shewing the third tier of Braces and part of the Lock.



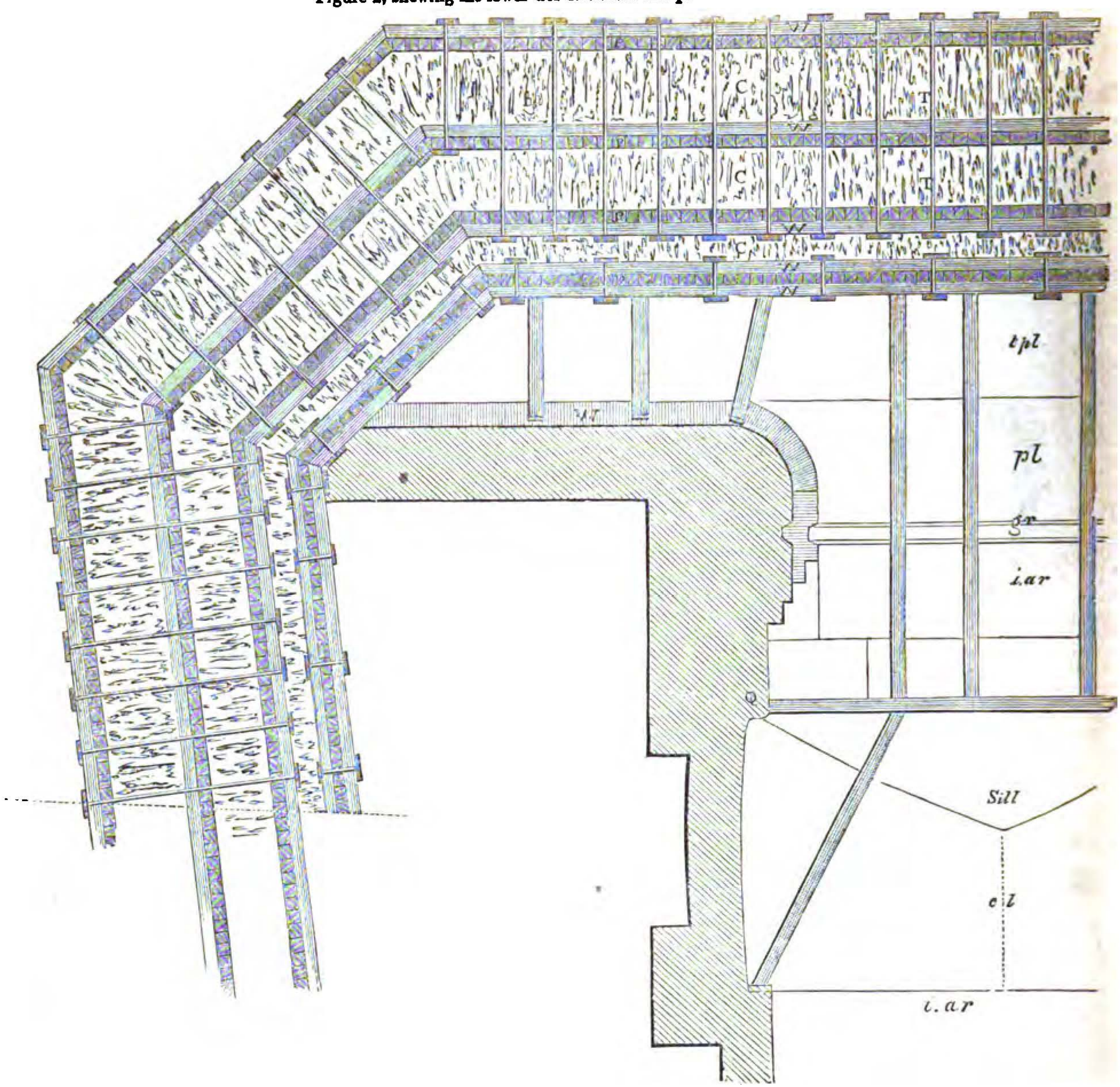
tremity of the lock, there is to be a platform of well squared stone 2 feet 6 inches in depth, also the aforesaid grooves and the lock chambers with quoin stones 3 feet long by 2 feet in breadth. Two courses of bond stone are to be built in the wing walls and counterforts, 15 inches thick agreeably to the drawing, the beds to be at right angles from the face of the wall, the curved part of the river wings, and also of the wings into the entrance basin, are to be faced with stone for 20 feet in height, 10 feet in length, and 3 feet in breadth on the bed, laid header and stretcher alternately, the heads not to be less than 2¼ feet long on the face, by at least 4 feet on the bed, the stretchers not to be less than 4½ feet long on the face, by at least 2 feet on the bed, the face to be well dressed, and the beds and joints correctly worked, and laid flush in mortar; the backing to be of the same sort of stone, laid flush in mortar, to be in lengths from 3 to 5 feet, and in breadths suitab.e to the thickness of the walls, and of the height of the front courses; the stones for the counterforts are to bond into the wall at least 15 inches, and one stone only is to be used in each counterfort.

Above the top of the inverted arches, the chamber walls are to be built concave, or of a curvilinear form in its vertical direction in the front—they are to be 5 feet 3 inches at the level of the lower side of the coping, and the back of the walls being perpendicular, will determine the thickness downwards; there are to be counterforts as shown in the plan and section, they are to be founded at 6 feet above the lowest part of the underside of the inverted arch, and to be carried to within 4 feet 6 inches of the top of the coping, and from the said 4 feet 6 inches to diminish to nothing at the lower side of the coping, all agreeably to the plans and sections.

The chambers, recesses, and wing walls of the lock are to be coped with the before-mentioned stone 18 inches thick and 4 feet on the bed, and no stone to be less than 4 feet long on the face, but as much larger as can be got, the face of the stones to be well and neatly dressed, and the upper front edge to be rounded 3 inches, and the back is to be regularly jointed to 4 feet in breadth, the end joints to be made square throughout, and the bottom beds to be solidly laid on the brickwork in good mortar; there are to be two cast iron dowels 6 inches long and 2 inches square in each joint, run in with Parker's cement.

A puddle of clay and gravel mixed is to be formed at the back of the walls and counterforts 5 feet thick, to be brought up during the progress of building the walls from the ground to 3 feet above high water-mark of a spring tide, this puddle is to be backed up with earth, and laid in layers as before mentioned, to make firm and solid at the back of the walls and on the excavated ground.

Figure 2, shewing the lower tier of Braces and part of Lock.

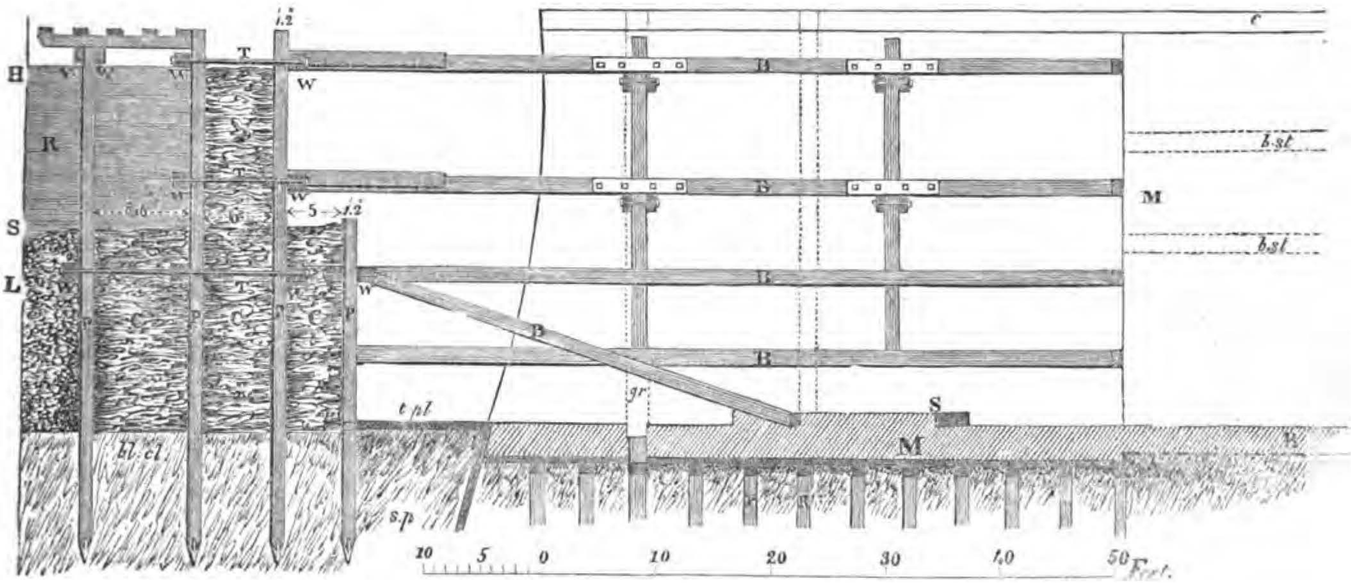


Specification of the coffer dam for the entrance lock, to be 207 feet long, and its form as represented in the drawings.

The principal dam to be made of two rows of piles at a distance of 6 feet apart, of Memel or Dantzic timber 12 inches square, also an outer row of piles of the same timber 12 inches square at 8½ feet from the main dam. An inner row to be driven to strengthen the foot of the main dam at 5 feet from it, of fir timber 12 inches square, the piles to be driven 8 feet below the lowest part of the lock. All the piles to be perfectly straight and parallel on two sides, and shod with wrought iron shoes not less than 15 lbs. each, strong iron hoops also to the heads, the iron 4 inches broad by 1 inch; the guage piles to be driven opposite each other, at the distance of 10 feet apart, and their heads when driven to be 4 feet above high water-mark of an 18 feet tide; when they are driven to the proper depth, two rows of temporary double walings 12 inches by 6 inches to be bolted to them, the upper one to be one foot above high water-mark, and the other as low as the tide will admit, allowing a space of not less than 12 inches wide between the wale pieces, for the piles to fill up the bays between the guage piles, the bolts to be 1½ inch square iron, 3 feet long in the clear, and to pass through the walings and the piles, and also two pieces of timber 6 inches thick to be placed under the head and nut of each bolt; the remainder of the piles to fill up the bays are to be driven, and each bay keyed in with wedge piles to make the dam water tight. When all the piles are driven, the temporary walings to be taken off, the joints between the piles of the outer row of the main dam to be caulked where necessary with tarred oakum, 3 rows of permanent single walings are then to be put on, as shewn on the drawings, of timber 12 inches by 6 inches, and in lengths not less than 20 feet, the two rows of piles to be tied together with screwed bolts and nuts with plates, to pass through the walings and piles, and also the two pieces of timber, the bolts to be of the best scrap iron 2 inches diameter and proper lengths, the distance between each bolt at the bottom tier is not to exceed 5 feet, and the middle tier 7 feet, and the top 10 feet. The dam is then to be filled with good clay to the level of 3 feet above the bottom tier of the bolts, and from thence to 3 feet above high water of a spring tide, with bricks laid in sand.* The guage piles for the outer rows to be driven 10 feet apart, and the heads when driven to be 6 feet above low water-mark of spring tide, two rows of temporary walings 12 by 6 to be bolted to the guage piles

* There appears here to be some discrepancy between the specification and the drawings, the latter show the dam to be filled in with clay up to the level of high water-mark, which we imagine was the way it was executed, then the bricks were laid in sand to the height of 3 feet above the clay.—EDITOR.

Figure 3, Transverse Section of Coffer Dam and part of the Lock.



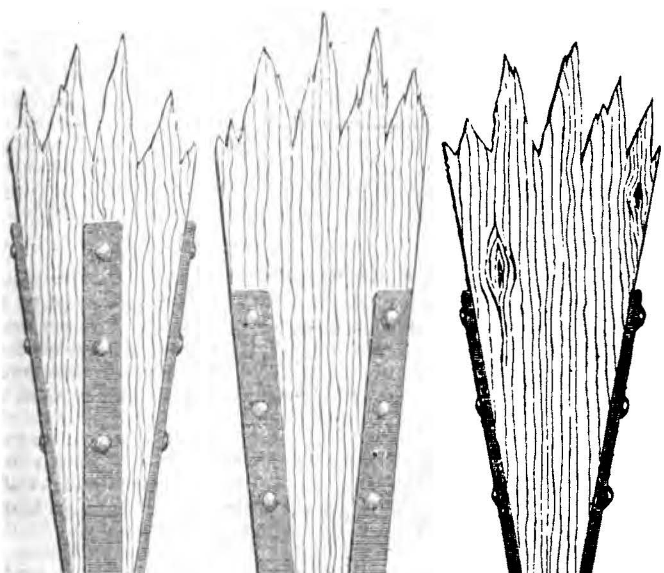
Reference to Engravings, similar letters refer to similar parts of Coffer Dam.—P, piles. W, wales. T, iron ties.—B, braces. C, clay puddle. R, the river. H, Trinity high water-mark. L, ditto, low water-mark 18 feet below. S, surface of river bank, dredged 12 feet below low water-mark. *bl. cl.*, substratum of blue clay. The inner row of piles to coffer dam are cut off level with *t, pl,* the timber platform and form sheet piling to the latter. J, jetty projected 70 feet into the river for loading the bargs with the excavation of the locks and dock.

Lock.—*pl*, platform of masonry. *gr*, groove for caisoon. *M*, masonry. S, pointed sill of gates. Q, quoin to inner post of lock gates. P. R, rows of piles 12 feet long and 9 inches in diameter, upon the top are spiked heads or cross sills 12 by 12 inches, upon which is laid 6 inch planking. Between the heads and cross sills is filled in with rubble. *S.p*, sheet piling at the toe of the wing walls. *i, ar,* and B, invert to lock chamber of brickwork. *b, st,* bond stones 15 inches thick. C, stone coping 18 inches thick.

c, l, centre line of lock and coffer dam.

FORM OF SHOES.

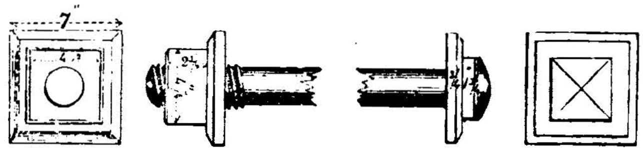
Figure 4, for Guage Piles, Figures 5 and 6, for Bay Piles.



Scale one inch to the foot.

TIE BOLT FOR COFFER DAM.

Fig. 7, Plan of Head. Fig. 8, Bolt. Fig. 9, Plan of Nut.



Scale one inch to the foot.

the same as to the main dam, leaving sufficient space between the piles to fill up the bays the same as above, the temporary walings are then to be removed, and one of 12 inches square to be put on, as shewn by the drawing, and bolted, as above, so as to secure the piles to the main dam, the bolts not to exceed the distance of 5 feet apart, and every second bolt to pass through the two rows of main dam piles and walings, this dam is then to be filled in with clay as above; the inner row of piles, at the distance of 5 feet from the main dam to have a double waling 12 by 6 inches bolted within one foot of the top, and to be firmly braced from the inside, and the top part of the dam must be tied to the shore with chains to prevent it going outwards at low water.

Along the western side of the present lock or gut which passes along the eastern side of the entrance lock, there is to be a coffer dam 140 feet in length, with returns at each extremity, to consist of the same materials as the middle row of the main coffer dam to the entrance lock as directed by the engineer. The timber, iron, clay, bricks, and all other materials for the dams to be found by the contractor, who is also to find all pile-engines, steam-engines, stages, &c., and to the satisfaction of the engineer. A circular trunk 3 feet diameter with sluices, for letting the tide flow in and out, are to be placed through the dam. The mud, gravel, and other matter, now upon the space where the coffre dam is to be constructed, is to be removed by the contractor to the level of 12 feet below low water-mark of a spring tide, and in an uniform inclination to the lowest part of the bed of the river, opposite the said coffre dam.

(To be continued.)

ANCIENT STATUES.

On the different Materials employed by the Ancients for Statues, and on the Varieties of their Marbles. Translated from the French of the Count de Claerac, Knight of various Orders, Keeper of the First Division of the Royal Museum of Antiquities in the Louvre

MARBLES OR STONES MENTIONED IN ANCIENT AUTHORS.

(*Continued from page* 369.)

THE ancients included under the name of *Marmor*, marble, derived from the Greek *marmaron*, signifying splendour and brilliance, all stones, more or less hard, susceptible of a fine polish, and fit for sculpture or architectural decoration, such as marble, alabaster, porphyry, granite and other stones, which are however of very different natures. As it is not within our province to enumerate all the mineralogical characters, we shall be contented with pointing out to amateurs how they may by mere inspection distinguish the kinds of these stones.

PORPHYRY, the name of which shows that the stones to which this name was first given were of a purple or deep red amaranth tinge, is very hard and cannot be scratched with iron; it is cold to the touch like marble, which again is more so than stone or plaster. It is not affected by nitric acid, gives fire to steel, and is interspersed with clear angular specks, in a paste or cement, generally of a uniform deep colour, and which, serving as a ground to them, determines that of the porphyry.

GRANITE, almost as hard as porphyry, and resisting acids, is composed of larger or smaller grains, of irregular forms often rounded, of different natures, and frequently agg'omerated one with another without any intermediate, and of which a portion presents a crystalline laminated appearance, different from the specks in porphyry.

MARBLE which effervesces with acids, is scratched by iron, and rarely gives out sparks to steel; its texture, not so close as that of porphyry or granite, is unmixed with stone of other kinds. It is only translucent in very thin leaves, and is often distinguished by the variety of its shades, and by their irregularity. Its fracture is brilliant, and often in white marble it is *saccharine*, or like loaf sugar.

ALABASTER has often a great resemblance to marble, for which it may be mistaken; however true oriental or calcareous alabaster, from whatever country it may come, is harder than white marble; the scratch is translucent even in great masses, its fracture is crystalline. Whether white or coloured, it shows undulations, festoons and clouds more connected and regular than those of marble.—GYPSEOUS ALABASTER, like that of Volterra, is very soft and may be scratched with the nail; is of a milk white colour, transparent, and does not effervesce with nitric acids.

BRECCIA is composed of smaller or larger angular fragments of marbles or hard stones, united together by a cement forming veins. BROCATELLE are breccias, the spots of which resemble the stuffs called *brocades*, they often contain shells.—PUDDING STONES differ from breccias, by being composed of rounded fragments, either of marble or hard stones. They are often silicious pebbles of different kinds united by a cement of the same kind.—The LUMACELLE are formed of masses of shells.—SHELLY MARBLES, such as the brocatelle, only show them scattered about.—MADREPORE MARBLES contain the remains of madrepores—.ONION MARBLES are of a dirty white with veins and waves of greenish chalk. These bands depend much on the way in which the marbles are sawed or split; they are said to be sawed *in grain*, when they are sawed the way of the bands or layers, and *in counter grain*, when sawed perpendicularly or obliquely to these undulations. In marbles with rays or large flakes, the grain is so different from the counter-grain, that they seem quite a different species.

The want of precision with which ancient authors describe marbles and stones, prevents me from distinguishing them often in works of art. For easier reference we shall arrange them according to the colours supposed to belong to them, but we must confess that this method is liable to many mistakes.

WHITE MARBLES.

—IVORY WHITE, doubtless very compact.—BOSPHORUS, greyish white. —MEGARA CONCHITE, from near the Amphialian promontory, white, soft, and mixed with shells. Statues it seems were made of it.—CORALITIC, found perhaps in Phrygia, near the river Coralius, dead ivory white; the pieces of it worked did not exceed two cubits (about three feet), it seems that it was called also *Sangarius lapis*, Sangarian stone, from a river in Phrygia.—EPHESIAN, very white, used by Pyxodorus, 612 years before Christ.—MOUNT HYMETTUS, near Athens, a greyish white; it was celebrated in the time of Xenophon; the orator Lucius Crassus was the first Roman, who, in the year of Rome 662 (92 years before Christ), decorated his house on the Palatine Mount with six columns of this marble, twelve feet high, which caused it to be named the Palatine Venus, by M. Brutus.—LESBIAN, of a yellowish white; there was also black. Pliny B. 36, ch. 5, believes that from the quarries of Lesbos were extracted the first variegated marbles; he says that Menander, who treated with great care on every thing relating to the different marbles, is the first author who speaks of variegated marbles, and that he says little about them.—LUNI, of a white approaching blue, and of a very fine grain; the quarries near Carrara were discovered about the time of Julius Cæsar, and competed with those of Paros and Mount Penteles.*—MYLASSA, in Caria, a very fine white.—ONYX, or ONYCHITE, found in Cappadocia, in the time of Mark Antony, appears to have been a species of oriental alabaster, nearly resembling phengite.—PARIAN, from the Cyclades, a white marble, most celebrated among the ancients. Herodotus mentions it, and appears to be the LYGDINOS of Anacreon; it was called *lychnite*, because the quarries were worked by lamp light; it is perhaps also the stone of Marpessus, celebrated by Virgil.—PENTELICAN, extracted from Mount Penteles, near Athens (used by Byzes 600 years before Christ), white, much esteemed; however it is formed of layers and striæ, sometimes earthy, and injured by exposure to the air. Pliny does not mention it. It seems that the marble of Mount Phelleus, in Attica, was of the same kind.—PHENGITE, found in Cappadocia in the time of Nero. It seems to have been a white alabaster, veined with yellow, and almost as transparent as specular stone. From a passage in Suetonius in the life of Nero, we are led to believe that phengite was placed on the walls and used as a kind of looking glass. Temples were made of this stone, into which light entered through the walls.—POROS, so named from its lightness and porosity, it resembled Parian marble. The temple of Delphi and that of Jupiter at Olympius were of this marble. Paros and Poros are the only Greek marbles mentioned by Herodotus.—SYNNADIC, from Synnas or Docimium, in Phrygia; it was named also Phrygian or Mygdonian marble; the white resembled alabaster or alabastrite; it was much esteemed. There was also white and purple; perhaps it was purple breccia.—THASIAN, white, of a yellow tinge, like that of Lesbos; it was used in sculpture. —TYRIAN, or Libanian, very white.

YELLOW MARBLES.

ALABASTRITE, a city in Egypt between Antinopolis and Cynopolis, took its name from the great quantity of this marble found there. It was yellowish white, veined, and of a honey colour. It was at first, says Pliny, named *Onyx*; it was our calcareous oriental alabaster. It was used for statues, columns and vases for perfumes,† named *alabastra*, from their being without handles (*labe*), and whence the name was given to the stone. Vases of this fine material are often found in tombs, but there are also very small vases of true onyx or sardony.—CORINTHIAN, yellow.—JERUSALEM. Near this city, in the time of Justinian, was found a marble said to be of a flame colour, no doubt bright yellow red, a kind of rosso antico, or antique red.—MACEDONIAN. It seems to be our gialloantico or antique yellow.—MELOS or ACYTHOS, yellow.—NUMIDIAN, of a bright red and yellow. It seems that in the time of Seneca and Pliny, it was endeavoured to imitate this marble by incrustations, or by painting other marbles.—SCHISTOS, yellow Spanish marble, and which probably like *schist*, separated into leaves.

BLACK MARBLES.

ALABANDA or MILETOS, in Caria, black of a purple hue.—of LUCULLUS, a very fine black, brought to Rome by L. Lucullus Scaurus decorated the atrium of his house with 363 columns of this marble, 38 feet high.—LYDIAN. Touchstone was called Lydian marble or stone; it was also called *Basanite*, from a Greek word signifying *to touch*; this stone is not a marble but a basalt.‡

RED MARBLES.

Rosso antico or antique red, is not easily recognised among the descriptions of marbles given by ancient authors, it was perhaps that of Lydia.—A LYBIAN marble was red and white.§

GREEN MARBLES.

AUGUSTUS, wavy and spotted green, perhaps the sea or Egyptian green.—CARYSTUS, extracted from Mount Ocha, near the city of Eubœa. It was green or mixed with that colour, and probably green cipolino.

* V. also under the head of antique marbles.—[Note of Translator.]

† Some are to be seen in the Egyptian department of the British Museum. —[Note of Translator.]

‡ Lesbian marble, according to Pliny, was also black, Tenarian marble was a greenish black.—[Note of Translator.]

§ Red marble was found at Jerusalem.—[Note of Translator.]

Mamurra was the first Roman, who, in the time of Julius Cæsar, used columns of this marble.—EMERALD. It seems that the emeralds or *smaragdes*, of which the ancients made statues and columns were only green fluor spar, just as the yellow fluor spar passed for topaz, it might even have been only *coloured glass*. It is known that the ancients were very skilful in the art of making glass, and that they even employed it in large columns, such as those with which Scaurus decorated his theatre.—TAYGETES, a mountain of Laconia; it was called also Lacedemonian marble. It was green, according to what authors says of it, it has more relation to pear coloured green* than to verde antique; it was perhaps the *prasinum*. It was worked in the time of Strabo.—TENARUS, in Laconia. According to the same author it was used later than that of Taygetes, and seems to have been a dark green nearly black.—TIBERIUS, discovered in the reign of that emperor. It was green, with dispersed and mixed streaks, resembling the marble of Augustus.—THESSALONICAN seems to have been green, and is apparently our verde antique.†

VARIEGATED MARBLES.

MOUNT ATRAX, on the Peneus, in Thessaly. It appears to have been of several colours, among others white and black; of a pear coloured green. It was used in the church of Santa Sophia.—CELTIC, white, veined with black.—CHIAN, Theophrastes is the first author who speaks of it; it was black, shaded with several colours.—JASSOS, a Carian island, veined with red and white, tending to yellow; it was named also *Carian marble*.—PROCONESSUS, one of the Sporades islands in the sea of Marmara, which derives its name from the great quantity of marbles (*Marmora*) found in its islands. This marble was also named *Cycican marble*, because it was much used there. A fine white, veined with black, and must have been of the kind called *grand antique*. It was much esteemed. The palace of Mausolus, at Halicarnassus, built of bricks, was covered with this marble.—RHODIAN, with golden or pyritic spots. It was perhaps a kind of *portor*.—Of LYSIMACHUS seems to have resembled the preceding.‡

MARBLES OF UNKNOWN COLOUR.

—ALBANO. Of MOUNT CYBELE, in Phrygia.—EGINA.—GABIÆ.—HERACLEA in Caria.—HIEROPOLIS. This was perhaps a porphyry or granite as well as the *Memphis stone*.—MILETUS.—MOLOSSI, in Epirus, veined with different colours.—SCYROS. The same.—SYRACUSAN. It was wrought from the *latomia*, which were quarries before Dionysius converted them into prisons. It seems that this stone contained casts of fishes.—TAUROMENIAN, in Sicily, of several colours.—Of TIBER or Tivoli.—TRAGURIUM or Salone in Dalmatia.

* Green marble of this kind was also found at Mount Atrax.—[Note of Translator.]

† PURPLE MARBLE.—The marble of Alabanda was a purple black. GREY MARBLE.—Marble of this colour was found at Lesbos.—[Note of Translator.]

‡ There was Synnadic marble of white and purple.—[Note of Translator.]

BASALTS, GRANITES, PORPHYRIES, &c.

BASALT.—According to some authors, the name of this stone ought to be *barsalt*, from a Hebrew word, signifying iron, of which it has the colour and the hardness. It has very small and often microscopic grains, and sometimes has the appearance of a fine green bronze. According to Pliny, this stone was brought from Arabia and Ethiopia; Pausanias says that the statues of the Nile were made of basalt, because this river comes from Ethiophia. There was also a porphyry which the ancients might have mistaken for basalt.* LEUCOSTICTOS or LEPTOSEPHOS, porphyry in which white prevailed. It was brought from Arabia and the Thebaid. OPHITE or SERPENTINE. The first name was given by the ancients to green porphyries, on account of their colour and their spots, which are like the skin of some serpents (*ophis*). It was only used in vases and columns. The ophite of *Elephantina* was called *Tephria*, because its colour was ashy (tephra, ashes). There was some almost black, others with white spots. Small columns only were made of it. Much ophite is found in the paved road from Rome to Ostia. PSARON, Lycian porphyry, was so named on account of its spots resembling those of the sturgeon (*psar*). SYENITE, rose porphyry, named *Pyrrhopœcile*, on account of its colour (*pyr*, fire, *poikilos*, varied). It was named also *Psaronion*. THEBAN PORPHYRY was black with yellow spots. OBSIDIAN, volcanic glass or stone, was so named because in the time of Augustus, it was found by a certain Obsidius, who made of it a statue of that emperor. Obsidian is very hard and black, and is translucent in small pieces or in sheets; it is then of a brown black. It was used, according to Pliny, to imitate precious stones, and to work the harder ones. No monuments made of this volcanic stone remain.

(The next section will contain an alphabetical list of all the antique stones, as *rosso*, *nero*, *verd*, *giallo antico*, &c., with explanations of all the Italian terms.)

* They also called touchstone a marble.—[Note of Translator.]

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

HYDROSTATIC JACK.

Figure 1.—Elevation and Section.

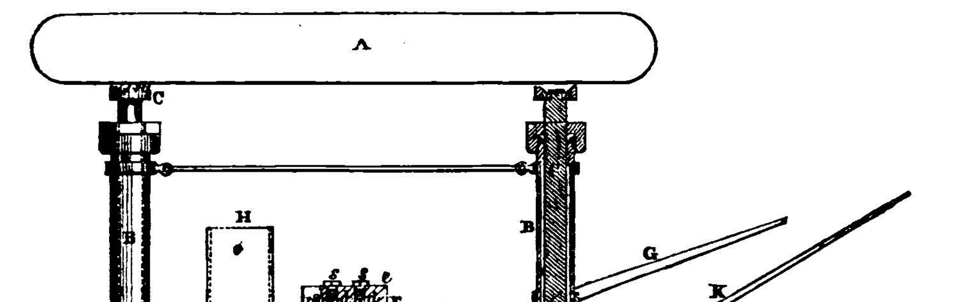


Figure 3.—End View.

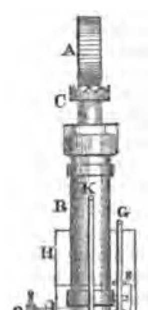
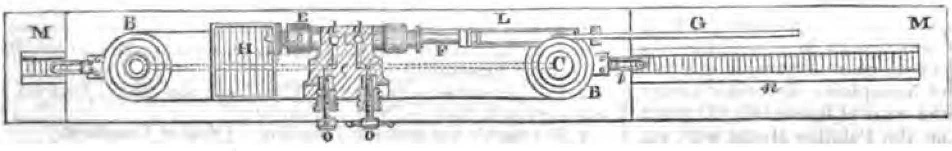


Figure 2.—Ground P an and Section.



CURTIS'S PATENT RAILWAY IMPROVEMENTS.

HYDROSTATIC JACK.

THE machinery or apparatus consists of a machine to place or replace an engine or carriage upon the rail; this machine is an adaptation of the hydraulic press for the purpose of a lifting jack.

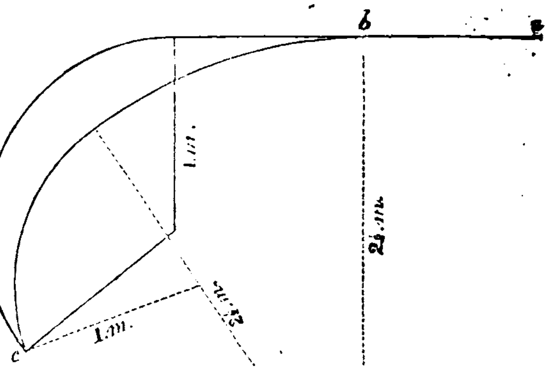
Figure 1 is a side view, one half is shown in section. Figure 2 a plan partly shown in section, and Figure 3 an end view partly shown in section; similar letters refer to similar parts of the machine in each figure, and the description refers to each figure so far as the parts are shown in each. A, is the end rail of the framing of an engine or carriage which may be required to be placed upon the rails. B, two cylinders or tubes of wrought iron or other metal, furnished with stuffing boxes and leathers in the manner usually employed in hydraulic presses; rams or pistons C, C, work in these tubes in the usual way, and the upper ends of the rams are provided with notched ends or otherwise as may be found convenient. E is a force pump fixed horizontally upon the plank L, *e* is a metal block in which the channels are formed for the channels valves, and adjusting screws, the general arrangement of which valves and screws is the same as in the hydraulic press, but I form it in this manner, in order to avoid the use of connecting pipes and the usual fittings, which would be very liable to be broken or deranged. F is the plunger of the force pump E, worked by the bell-cranked lever G. H, a cistern to hold water to supply the pump, which is introduced into the pump through the lying valve, which is kept in its place by a spring in the usual manner; when the pnmp is set to work, the water lifts the vertical valves *d, d*, and passing through channels clearly shown in Figures 1 and 2 in section, enters the cylinders or tubes B, B, and thus raises the rams or pistons C, C; the water may be prevented entering either of the cylinders, as may be desired, by screwing down the screws *s, s*, over either of the vertical valves, when the entire force of the pump will then pass by the free valve and enter the cylinder to which it belongs. This adjustment may be necessary to keep the engine or carriage level, and the same adjustment may be made by stopping the pnmp, and letting out the water from the waste-holes *p, p*, by screwing back either of the adjusting screws *o, o*; the two barrels B, B, are fixed upon a strong plank, about four feet asunder, and the basement plate connecting them together is formed of a wrought iron plate rolled with a rib down the middle; this rib is bored to the requisite distance from each end, and thus the channel is formed for the water from the pump to the cylinders; the cylinders are formed with flanch ends, and the joints made with the basement plate in the usual way, either with a rust joint, or lead, or other jointing; the upper plank L slides upon the long plank M, which is laid across the rails, and the projecting end supported with blocks of timber, or in any other ready and convenient manner; the plank M, has fixed down the centre, the notched plate *n*, the centre of which sinks about an inch and half below the surface, thus forming a longitudinal groove, within which slides a bar of iron fixed to the under side of the plank L; thus the upper plank L is steadied and cannot get out of position. When the engine or carriage is lifted, the bar K is hooked into the link *i*, and the toe of the bar inserted into one of the notches of the plate *n*; then a man, bearing down the end of the bar, drags the apparatus and engine or carriage towards him, the whole sliding upon the plank M. When the engine or carriage is adjusted over the rails, the adjusting screws are screwed back, and the water escapes through the waste holes *p, p*, when the rams descending, the engine or carriage is placed upon the rails; this object being effected, the water is thrown out of the cistern H, and the apparatus placed in the tender or other place provided for it; in some cases, a single cylinder and ram may be employed with a vertical pump, and for other purposes besides that described, likewise the cylinders may be substituted by screws, the other general arrangements being the same; also pipes or fittings for the water channels in any other suitable way than that shown.

One of the machines may be seen at work, (at the Manufactory, John's Place, Holland Street, Blackfriars Bridge,) loaded with a weight of 8 tons, which is lifted one foot high by the force of one man in 5 minutes; thus the worst accident may be set to rights in half an hour by 4 men, although the engine may be buried in the soil up to the axles.

ANCIENT BELL.—The tower of Leak church, near Northallerton, contains three bells, one of which is supposed to have been brought from the adjoining dissolved monastery of Rievaulx, from the name "Aelred Grendale" being upon it, the said Aelred being the third abbot of Rievaulx. He was the noted chronicle of that age, and was the author of "Historia de bello Standardi," the history of the battle of the Standard, near Northallerton, in the year 1138. He died in the year 1167, so that this bell must be 700 years old.

RAILWAY CURVES.

SIR.—Your correspondent R. W. S. in your September number supposes that Mr. Ely had formed an incorrect notion of the plan I submitted to the readers of your Journal, for setting out Railway Curves, under the signature of "A Sub." Such however is not the case; the plan is easily understood, try a simple diagram.



LET the line *a, b*, be the direction of the railway previous to curving C, the point required to be arrived at, I propose, if local circumstances admit, to use, first, a curve of two and a half mile radius, and then for *a short distance* only a curve of one mile radius, instead of curving from the point *d* to C, with one mile radius, the advantages gained are these;

In the former instance, the engine has to travel for only *about half the distance over the objectionable working curve*, and the engine driver, instead of maintaining his velocity till he nearly reaches the curve, and then suddenly shutting off his steam, much to the detriment of the working-gear, (which he would do in the latter case) would gradually close his valve and be able to run with a good velocity much nearer to his destination, with less wear to the rails, and less danger to the train.

I leave the discussion of other subjects that have arisen from my former communication, to R. W. S. and W. Ely.

I am, Sir, your obedient servant,

E. MURRAY.

THE ROYAL EXCHANGE.—REPORT OF THE ARCHITECTS

THE following is the report of the architects, Sir Robert Smirke, Mr. Joseph Gwilt, and Mr. Philip Hardwick, to whom the designs for rebuilding the Royal Exchange were submitted :—

"London, Oct. 2, 1839.

"We beg to report to the joint committee for the management of the estates of Sir Thomas Gresham, that, in compliance with their request, we have inspected the plans, designs, and specifications received for rebuilding the Royal Exchange, with the view of selecting the first, second, third, fourth, and fifth best, in reference to, and in conformity with, the printed instructions issued for that purpose.

"Our examination, we trust we need hardly state, has been conducted with every attention to the object in view, and with the utmost care to discharge in a satisfactory manner the duty with which the committee have honoured us, not less on the ground of the national importance of the subject, than that of doing strict justice to the artists who have been engaged in the competition.

"In proceeding to perform the duty in question, we considered it advisable that we should each in the first instance separately make a particular examination of the several designs, taking our individual views on their respective merits, according to the best of our judgments, with reference to the general character of the design, the convenience of the arrangements as exhibited by the plans, the estimated expense of the building, and the practicability of carrying the works into execution, in conformity with the printed instructions to which in all respects the candidates were required to adhere; and, lastly, with the object of ascertaining which, with respect to the instructions of the committee to us, was 'practicable, advisable, and capable of being made a durable edifice.'

"In reference to the convenient arrangement of the apartments, we think it proper to observe, that the committee did not in their instructions specify the object or use to which they were to be appropriated; and we have therefore considered, that if offices and rooms of the required number and size were provided, if they were well lighted, and having the means of being warmed, capable of being made fireproof and with a convenient access to them, the instructions of the committee in that respect would be sufficiently observed.

"After our separate examination abovementioned, we conferred together, and on comparing our observations, it was a great satisfaction to us to find, that in selecting a limited number for further consideration, no difference of opinion arose between us in any respect, each of us on such comparison of our lists having selected the same designs.

"We regret, however, to say that we cannot submit for the choice of the committee five designs out of the number subjected to our notice, which we can, without many changes in them, report as practicable, advisable, and capable of being made durable edifices; and, that the committee may be fully aware of our meaning in this respect, we will shortly state in respect of practicability, that in the best designs of the collection, as regards external architectural merit, whole suites of apartments are placed in upper stories without adequate support being brought up through those below to carry them; that passages are shown without the necessary light; that chimnies are placed in situations from which flues could not be carried up; and that many rooms are without chimnies at all; and that in most, if not in all, the designs otherwise meritorious, what are called 'false bearings' appear to such an extent, that they are not practicable in their existing state, and hence it cannot be said that they would be durable edifices.

"How far, having thus disposed of the question of practicability and durability, some of those we shall hereafter name may be advisable is a matter of some weight. We will take one which is an extreme case, and occurring in a design of great external architectural magnificence, in which a wall 100 feet in height surrounds the area appropriated to the meeting of the merchants. In this latitude, except about the summer solstice, and then only for a few days, the sun's rays would never fall on the pavement of this area, and in the winter solstice they would scarcely reach the top of the arcades. In another of great merit, the merchants' area is reached by a flight of many steps, which may be considered unadvisable, both for the combination of shops with the designs, and for the convenience of those who are to use the edifice.

"There is, moreover, another point connected with our examination which demands our utmost caution in offering this report to the notice of the committee, and that is, attention to the cost, which appears to have been altogether lost sight of in the best class of designs. From the second instructions of the committee (upon our request), dated the 27th of September ult., we have felt it necessary to place out of consideration those three which we have named in the second class, though possessing, for magnificence and beauty, great claims as works of art. We could not, without very elaborate calculation, inform the committee of the probable excess of expense beyond £150,000.; but we have no hesitation in stating that the excess in all of them would be very much indeed beyond the limit assigned, and in this observation we consider we sufficiently for the purpose comply with the request made to us on that point. We would, before leaving these, mention that the sculptures with which they are decorated are so necessary for their effect, that they cannot be considered foreign to the buildings, but must be considered as essential parts of them.

"Under these rather embarrassing circumstances, we have endeavoured to meet the views of the committee by a selection of eight designs for their consideration, rather, however, as works of art than as designs which we can certify in their present state to be practicable and capable of being made durable edifices. The first five of them, we apprehend, may be considered as designs which fall within the predicament of being erected for the sum comtemplated. Under the consideration of impracticability, it may perhaps be said, the selection should not have been made at all, and that we should have descended lower in our selection. Had we taken this course, other difficulties would have presented themselves, for we must have submitted to the committee works not worthy of the age or country, and which, even if strictly practicable, would, in their selection, have done great injustice to the authors of the designs, with all their faults about to be named. The placing these latter, therefore, in the order of merit, is referable to them as works of external art. In either respects their faults of construction and inconvenience may be taken as nearly equal in magnitude.

"In the first class, those that we think may be executed for 150,000*l*., we beg to report as follows:—

"First - - - - - - - -	No. 36
"Second - - - - - - - -	43
"Third - - - - - - - -	37
"Fourth - - - - - - - -	33
"Fifth - - - - - - - -	57

"In the second class, or that in which we consider the cost would vastly exceed the sum of 150,000*l*., equal impracticabilities of execution with those of the first class are to be found; and, notwithstanding the very great talent they exhibit, there are circumstances of inconvenience and unsuitableness which would bring them, as we conceive, into the predicament of being unadvisable for adoption. We wish it, therefore, to be understood, that we report on them respectively as the works of very clever artists, who have produced pieces of composition in which, besides the circumstances abovementioned, stability, arising from solid bearings for upper apartments, and other essential matters, have been sacrificed to grand architectural features.

"The designs of the second class, in our estimation of their order of merit, are as follows:—

"First - - - - - - - - -	No. 50
"Second - - - - - - - - -	46
"Third - - - - - - - - -	27

"We again venture to state to the committee the difficulties which have attended the making of the report herewith submitted, and which, but for the unanimous decision at which we have arrived, we confess, might have left doubts in our minds, if our view had not been confined by the committee to the expenditure of a given sum.

"ROBERT SMIRKE.
"JOSEPH GWILT.
"PHILIP HARDWICK.

"To the Joint Committee for the Management
of the Estates of Sir Thomas Gresham."

PROCEEDINGS OF THE COMMITTEE ON THE SUBJECT.

The joint committee met at Mercers' Hall on Friday, the 18th ultimo, to consider the report, and again inspect the designs, and came to the following resolutions:—

"Resolved,—That the premiums be awarded to the architects, who have produced the plans numbered as under—

"No. 36, the first premium - - - - -	£ 300
43, the second ditto - - - - -	200
37, the third ditto - - - - -	100

being those reported by the architects as the three best designs.

"And it was resolved, that Sir R. Smirke, and J. Gwilt and P. Hardwick, Esqrs. having stated in their report upon the respective merits of the plans selected by them, that they cannot recommend any one to be carried into execution, this committee doth request them to take the 1st, 2d, and 3d plans, as selected by them, into consideration, and prepare a plan and specification for a new Royal Exchange, such as in their judgment should be carried into execution, having reference at the same time to the printed instructions issued by this committee to the architects."

The architects to whom the premiums have been adjudged.

No. 36, 300*l*. to Mr. William Grellier, district surveyor, 20, Wormwood-street.

No. 43, 200*l*. to M. Alexis De Chateauneuff, of Hamburgh; and Mr. Arthur Mee, of Carlton-chambers.

No. 37, 100*l*. to Mr. Sydney Smirke, of Carlton Chambers.

The architects of the remaining designs of the first class.

No. 33, Messrs. Wyatt and Brandon.
57, Mr. Pennythorne

The architects of the second class designs, which were considered too expensive.

50, Mr. T. L. Donaldson.
46, Mr. Richardson.
27, Mr. David Moscatta.

REVIEWS.

A Treatise on a Box of Instruments and the Slide Rule, by T. KENTISH. London: Rolfe and Fletcher, 1839.

This work seems very useful for the purposes for which it is intended as an elementary work for engineers, and for schools, and gives in a short compass the greater part of practical mathematics. As to the mnenotechnic rules appended to it, we have no high opinion of their utility to the student, they are something like Smollet's cabbage cutting machine, which destroyed more than it saved.

History and Process of Photogenic Drawing. London: Strange, 1839.

This is a translation of the French pamphlet by Daguerre and Arago on photographic drawing, and contains an elaborate account of the processes. This art in its present state however is too troublesome and too expensive to admit of general application.

Papers on subjects connected with the Duties of the Corps of the Royal Engineers, Vol. 3.—London, Weale, 1839.

The volume before us keeps up the reputation of its predecessors, and indeed with very little zeal on the part of the Members of the Corps, it cannot fail to be otherwise, as they have such excellent opportunities of observing works executed or in progress, and for making experiments. In this latter career their services towards professional literature might well be much greater, and we confidently anticipate important results from the spirit of inquiry which these volumes indicate.

This volume may very easily be divided into two portions, the first purely military, and the other immediately connected with civil engineering.

The first two papers are on the lines of Torres Vedras, Cadiz, both by officers of the name of Jones. Both are valuable, and the first particularly well drawn up.

The paper on the model-towers approved by Napoleon, has been already given in Muller's and other military works, but never hitherto so completely.

The fourth enters into minute details of the demolition of some of the old works at Sheerness.

Lieut.-Col. R. Thompson contributes a paper on furnaces for heating shot, with some remarks on their application to steam navigation.

The sixth paper is on the fortification of Posen.

The report on Beaufort Bridge by Lieut. Nelson is a well arranged plan for a bridge over the torrent river Kat, at Graham's Town. It consists of a timber bridge of 3 arches, 60 feet span from centre to centre of each pier, with a rise of 5 feet. The author states that he took his idea of the construction from a sketch he made "of a prettily contrived adaptation of the Prussian beams to a light foot-bridge of nearly 100 feet span, with a central rise of about 6 feet," when he was in the Rhenish provinces in 1834. The construction appears exceedingly economic, and at the same time possessing ample strength; the design also shows how architectural effect of a pleasing character may be introduced even into a timber bridge. In the design before us, we have the piers in the bold Egyptian style which look remarkably well, their height being upwards of 40 feet.

The eighth paper contains a rough sketch by Lieut. Nelson, of an admired suspension bridge over the Lahn at Nassau.

Lieut. Denison's description of some of the works on the Rideau Canal affords but too strong a proof of the manner in which the public money has been wasted in ignorance and absurdity, and a striking example of the inefficiency of government education and controul. With timber at hand, the platform and wing walls at the entrance to the lock, instead of being protected with sheet piling, are formed of large stones, so as to ensure the destruction of the works. A great deal of time and money seems also to have been wasted on ridiculous plans for opening the lock gates.

Another paper by Lieut. Nelson is also a foreign contribution, and gives a description of the mode of bending timber in Prussia, to which we shall hereafter have occasion to refer.

The eleventh paper is of American origin, and describes the coffer dam used in the construction of the piers of the Alexandria aqueduct.

The twelfth is a description of a one-arch wooden bridge of 205 feet span at Paradenia, in Ceylon, thrown over the river Mahavillanga, in which an interesting account is given of the difficulties contended witb. It shows too one of the causes of failure in government works, for here it seems the Engineer's department constructed the abutments, and the Quarter-master general's the arch.

The thirteenth paper describes a series of bridges erected across the river Ottawa, in Canada. An account is given of a wooden bridge of 212 feet span, which would have been very extraordinary and very useful, had it not required a number of chains and ropes to keep it from falling to pieces. It is singular that most of the descriptions of works executed under military superintendence contained in this volume are such as to be far from giving a satisfactory opinion of this mode of conducting public works.

The fourteenth paper is a new barometer invented by Mr. S. B. Howlett.—The next paper is on ascertaining the height of mountains.

Lieut.-Col. Reid's communication "*On the Operation of Salt Water on Iron*," we give below.

"Considerable attention has been given of late to the effect which salt water produces in corroding iron; in consequence of that metal being now used for facing wharfs, and other works exposed to the sea. Some papers have been published on the subject, but their object has been, I believe, only to ascertain the durability of iron as a material when in contact with salt water.

"I am not aware that public attention has ever been directed to the curious change which takes place when iron, in contact with silicious pebbles and other stones, is immersed in salt water.

"My attention was first drawn to this subject from a desire of acquiring a better knowledge of those laws of Nature which regulate the cohesion of solid particles; and from a conviction that the study of these laws would afford the best means of improving our knowledge for practical purposes.

"Almost every one has observed pebbles adhering to old anchors which have long lain under the sea. Engineers who have had to remove piles from sea walls or harbours have also noticed similar effects, for the iron shoes at the points of the piles have generally a mass of pebbles strongly incrusted around them. Even in what we call fresh water, (but which on analysis always is found to contain salts in solution,) this effect in a smaller degree is observed.

"Having had occasion to reset part of what are called breakwaters at Portsmouth, which are covered every tide by the sea, I was there enabled in many instances to notice the effects here alluded to. Some of the examples afforded beautiful specimens, and of several varieties, of the carbonates of iron of perfect forms. When examined with a powerful lens very delicate needle crystals were often distinctly visible; these last which I observed were white. Those resembling carbonates of iron varied from black to brown, and to bright yellow: some of the browns were of a very rich colour. These specimens were not found at Portsmouth only; at Hurst Castle planks of considerable dimensions, which the gales had broken from the groins, were found firmly incrusted with silicious pebbles. It was not at first easy to discover from what cause the pebbles adhered to the wood, but on sawing a plank longitudinally it was found to have been driven full of iron scupper-nails. The flat heads of these nails were almost touching each other; the heads had nearly disappeared, and in their place a black shiny crystalline matter had been formed, which firmly united a layer of pebbles to the plank. The opinion I formed on this was that voltaic action takes place between the metallic iron and silicious pebbles when immersed in sea water. If this be the case, we can scarcely doubt but that something of the same nature will occur between iron and other stones, when similarly placed. Part of the breakwaters at Portsmouth were set with very thin sheet iron, between blocks of Swanage stone, as an experiment: in a month afterwards, sand and small pebbles were found firmly fixed between the iron and the stone; and black crystalline matter, such as had been found at Hurst Castle, appeared forming, and the experiment, as far as it has been observed, seemed satisfactory.

"After thus setting the breakwater with stones, alternating with plates of sheet iron, I observed that Mr. Cross had previously pursued studies somewhat similar, and that he was satisfied that iron, when in contact with silex in a fluid medium, exhibits electric phenomena. An observation to this effect will be found in Mr. Leithead's work on electricity.

"The subject of the formation of crystals by voltaic electricity, which is one of great interest, is now making considerable progress, and the object of this paper is to endeavour to show that the pursuit of the study may be practically useful when applied to hydraulic works; and that it well deserves to be ascertained whether plates of thin iron, alternating with stones, and placed under the sea, will not be found to form solid rock, with crystalline veins. Mixtures of iron filings, sand and gravel, let down to the bottom of the sea through tubes, might perhaps consolidate and form a stable foundation for light-houses, and other works for which it is very difficult to form a base.

"Those parts of the Portsmouth breakwaters set with the thin sheet iron will be found between the saluting battery and the spur redoubt, and are visible on close inspection. The experiment has been varied, somewhat in the manner above alluded to, by authority of the Admiralty. Unserviceable iron water tanks from ships of war have been filled with gravel, mixed with iron turnings and a small quantity of lime, in the construction of a groin opposite to Haslar Hospital. The greater part of this groin will be covered by the tides; and thus a good opportunity will there be afforded of observing the effects of iron in contact with pebbles when immersed in salt water."

We must defer Colonal Fanshawe's Report on the effects of tropical climates upon Yorkshire paving.

The following Report by Captain Streatfield "*On the Wood Pavement in the Stables at Brighton*," is so interesting at the present moment, that although at some inconvenience, we feel obliged to call the attention of our readers to it.

"Sir—In reply to your letter, dated 17th ult., respecting the experimental pavement tried in the cavalry stables at this place, I now send an extract from the officer's diary, written by Captain Alderson, descriptive of the wooden block paving proposed and executed by him in January, 1838. The alterations suggested by Captain Alderson of making the fall 2 inches instead of 4, and the grooves ¾ of an inch in depth and width instead of ½ an inch, have been tried, and are certainly improvements on the original plan.

"The stall first done has been constantly in use for upwards of a year, and does not appear to stand the wear and tear quite so well as was anticipated, the lower part of the stall immediately under the horse's hind feet being already worn down at least ¼ of an inch. More time, however, will be required to judge of its durability. The expense of this mode of paving amounts to 2*s*. 3*d*. per foot superficial.

"The pebble pavement laid in concrete, with Purbeck horse pitching paving placed immediately under the horse's feet, which was put down in August, 1837, appears to answer tolerably well, and is doubtless a decided improvement upon the common pebble paving. The expense of this amounts to 6*d*. per foot superficial; the common pebble pavement to 3½*d*. per foot superficial.

"I am disposed to think that a stall paved two-thirds of its length from the bottom with Purbeck horse pitching, and the remaining one-third at the top with common pebble paving laid in concrete, would be the most durable, and on the whole the least expensive. The cost would be 11*d*. per foot superficial."

Want of space compels us to pass over hastily for the present several papers of much interest to our readers.—Among these are the papers and comments on Earthern Ware Pipes, and on the Package of goods.

The twenty-first paper is a description of the Weedon Drawbridge on the London and Birmingham Railway, well deserving of notice on account of the ingenious construction of the bridge.

Habershon's Half-Timbered Houses.

(SECOND NOTICE.)

ALTHOUGH we have fully expressed our opinion as to the ability with which Mr. Habershon has exercised his pen, in animadverting upon the very unfair and calumnious representations of Mr. Welby Pugin, we must yet be allowed to make a remark bearing upon the question of our modern Protestant church architecture, which is, that so far from the numerous structures of that class, erected of late years, having been allowed to afford opportunities for the display of talent, the restrictions of the Church Commissioners, and the conditions imposed by them, have tended greatly to degrade our architectural taste, as far as such buildings are concerned. Not only has economy been, in many instances, pushed to downright parsimony, but the desire of obtaining the maximum of showiness at the minimum of cost, has led to the adoption of some of the very worst vices a building can have—ostentatious paltriness, and flaunting shabbiness. Granting there may be necessity for the most rigid economy, that very necessity ought to dictate something quite the reverse of what has hitherto been aimed at,—decent homeliness, quiet yet dignified simplicity, sobriety not negligence of detail; and not least of all, such moderation in the general composition of the design as befits a moderate sized. There is no reason why, because it is small, either a church or other building, should be made to have an air of *littleness*,—which, it unfortunately seems necessary for us to remark, is quite a different thing from smallness; the difference between the two being that of a dwarf and a child. Such unfortunate and oftentimes quite ridiculous and offensive littleness is all the less excusable, because instead of being at all called for, it is allowed to destroy the character that would be appropriate. Yet, so far from having laid down any instructions or cautions as to such points. The Church Commisioners appear to have had no suspicion that any were needed; while architects, aware of the kind of judges whose taste—or rather tastelessness they have had to please, have not studied to produce merits which they were aware beforehand would never be examined into or appreciated. Any thing above the most ordinary routine and commonplace in design, puts such people quite out, and they accordingly generally select something that has been "rendered easy to the plainest capacity." Instead, therefore, of being charged with want of talent on account of the poorness and littleness of taste manifested in the majority of our new churches, the profession are rather to be pitied for being obliged to accommodate themselves to the ideas and apprehension of such patrons of art as the Church Commissioners have proved themselves to be.

Begging pardon of Mr. Habershon for having brought forward so prominently and dwelt so long upon a topic which although furnished by himself, he may not consider of so much importance as the rest of his book, we now proceed to consider the subjects of his plates. They are drawn, some on stone, others on zinc, and consist either of mere pictorial views, or specimens of detail, such as doors, windows, gables, chimneys, &c. Some of the former, that of Hadzor Village, for instance, partake quite as much of landscape as of architecture in their subjects. Only the generalities of form and composition are expressed in the buildings themselves, whether their accompaniments be rural or street scenery: consequently, however interesting they may be as topographical memorials, the illustrations of this class, do not furnish that precise information required by the architect. It is true his mode of treatment is for the most part justified by the nature of the subjects themselves, which are certainly not at all calculated for direct imitation in hardly any respect, although they may serve to furnish useful ideas and hints,—not, however, to every one, but merely to such as are capable of discriminating between what is and what is not suitable for actual application,—between what pleases merely, because it is quaint, unusual, odd, fantastical, and curious as a relic of former times; and what is intrinsically pleasing and agreeable in itself, apart from the novelty of rarity on the one hand, and the accidental charm of antiquity on the other. Very few persons take this into account, or make the distinction they ought to do: hence repeated blunders and disappointments, and people have found out that instead of the picturesqueness they have aimed at, and by which they have been smitten in what they have taken for their models, they have got only a prim, spruce, smirking, pert looking building—as little picturesque as may be, though evidently intended to pass for such. We wish therefore Mr. Habershon had said something as to the application which may be made of this style at the present day. Very few of the subjects in his volume are calculated for imitation however serviceable they may be in the way of affording hints: some of them, indeed, seem hardly capable of doing that,—for instance the old house in the market-place at Preston, which though curious, is still more ugly than curious, and, putting taste entirely out of the question, seems to combine every inconvenience and disadvantage that a dwelling-house can possibly possess. Bramhall Hall in Cheshire, on the contrary seems deserving of more particular description; for although two views are given of it, they go but little way towards making us acquainted with the peculiarities of style and detail. A ground plan of that house would have been exceedingly welcome, as would also geometrical drawings of some of the compartments of its exterior. Somblebury Old Hall is another striking subject, in which there is much of a very peculiar and good character. In general, however, the buildings here represented do not rise at all above the usual grade of design to be met with in many old farm houses and buildings of that class; here and there some little bit in them may be found worth borrowing from, but it is only in such mere fragments that anything deserving the name of style discovers itself, the ensemble being for the most part mean and bad, both which it is possible for a building to be, though at the same time it may be eminently picturesque. The picturesqueness, therefore, of which the architect ought to aim, is that which is combined with other equally desirable qualities,—with beauty, not rudeness, of form, and elegance, not coarseness, of execution. We cannot therefore so conscientiously recommend Mr. Habershon's work to the architectural student, as we can to the lovers of English antiquity and topography, who will find much in it to interest them.

We have received the two following letters relative to our first review of Mr. Habershon's work:—

SIR—In your review of Habershon's "Ancient half-timbered houses of England," you say, "He makes a terrible hard hit at the vaunted unity of the Roman Catholic Church, which once presented to Europe the singular spectacle of rival anti-popes, both of course equally INFALLIBLE." Now, my dear Sir, your Journal is not a proper vehicle for religious controversy, but I rely upon your sense of justice, inducing you to inform your readers in your next number, that the imputing to Catholics the belief of "infallibility" appertaining to any man, is a gross calumny.

A CATHOLIC.

7th September, 1839.

SIR—Your review of my work on Ancient Half-timbered Houses, having just been put into my hands, I beg to inform you in reply to your leading observation, that it was brought out in six parts, and commenced according to the original date in 1836. In consequence however of my time having been otherwise occupied, as well as from other causes, I have not been able to bring out the last part until within the last two or three months—and this is the reason why the dates vary. I thought it best, as far as concerns Mr. Pugin, to affix the true date to the essay, as that portion of it which concerns him has only lately been written.

I have the honour to remain, Sir,
Your very obedient servant,
MATTHEW HABERSHON.

Bonner's Hall, near Hackney,
Sept. 3, 1839.

Del Duomo di Monreale ed altre Chiese Siculo-Normanne, Ragionamenti Tre. Per Domenico lo Faso Pietra Santa, Duca di Serradifalco. Palermo, 1838.

The Duke of Serradifalco, who actually studied architecture for a time, under Cagnola, is of those enthusiasts in the cause of art, who like the illustrious Cicognara devote themselves to the study of it gratuitously, and out of mere affection, with an earnestness and application very seldom indeed found among those who follow it as a profession. Whether such noble amateurs would in this country be secure from the sneers levelled here against intermeddling, superficial amateurs, we will not stop to inquire; therefore merely observe that perhaps they might, because a Duke *is* somebody, and because it would sound capitally to be able to say, "I entirely agree with—or dissent from my Lord Duke's opinion as to so and so." For our own part we are sorry that we cannot at present brag of any particular acquaintance with the Duca di Serradifalco,—that is, with his book, not having as yet even seen it, although by this time, one would imagine, a copy of such a work would have found its way into the British Museum, whose library, however, we are still more sorry to say, is prodigiously deficient in foreign publications of art, for even our own very limited and humble library, contains several that will there be sought for in vain. All that we at present know of the work whose title is above given, is derived from an article in the last number of the Dublin Review, from which we here quote:

"Prince Serradifalco has already acquired a great literary reputation by his large work upon the monuments of antiquity in his country, of which three volumes are published. In the present work he has begun the examination of the principal monuments of the Norman epoch, as being the most illustrious period of the middle ages. He does not propose [purpose] to give merely sketches and general notions on the subject; but, on the contrary, to treat of it in its fullest extent, and to give to the world a standard work, of which the getting up should not be unworthy of the magnificent objects it undertakes to describe. The work contains, besides vignettes, twenty-seven folio engravings, and one lithographed design; of which fourteen are dedicated to the Church of Monreale, three to the Capella Palatina (or Chapel Royal at Palermo), five to the Cathedral of Cefalù, four to the other Norman churches at Palermo, and two which contain small plans of all the old churches in Sicily, and of the principal churches of the Christian world, by which Sicilian [not *the* Sicilian] architecture can be illustrated.

"These engravings are accompanied and explained by two dissertations, with learned notes, in which are collected from ancient authors, maps and inscriptions, whatever can throw light upon the objects in question."—"The drawings are in general well done, though occasionally, as in the drawing of the Gate of Monreale, or of the sectional plan (table IV. 7) we think the style might have been more faithfully expressed. The drawings should have been coloured to give any idea of the magnificence and splendour of the Mosaics; for the brilliancy of the colours and gold with which the walls are resplendent, is lost in the black engravings."

Undoubtedly: nothing short of such a view of the interior as the exquisite coloured drawing or rather picture of it by Professor Zanth, exhibited last year at the Institute B. A.; can convey any idea of Monreale, or of that modern Monreale the Allerheiligen Kapelle at Munich, where to equal splendour of painting on gold, the pencil of Hess has superadded all the more refined beauties of art.

Happy Munich! thou paradise of art, where under the auspices of its Kunst-liebend Ludwig, it accomplishes what we poor islanders dare not even attempt! Happy Sicily, where Dukes can find both time and disposition to turn their attention to studies of antiquity and art,—free from the curse of politics that sits as an incubus on this unhappy land, amidst the incessant din and jingling of which all that is intelligible is that every party deserves to be exterminated, since according to their report of each other they are equally base, unprincipled, selfish, tyrannical, malevolent, perfidious, or however else they may be branded by the awful fulminations of our newspaper gentry.

Literary World. This justly popular work has completed its first volume; the wood engravings, particularly those of an architectural character, are beautifully executed, and the literary contents are both interesting and useful.

We have been favoured with the *Medical Miscellany*, a new periodical, containing much useful information for the medical student.

New York Canals.—Total amount of tolls received on all the state canals of New York, from the 14th to the 22nd of July, 1839, 36,571 dollars 97 cents. There was received for the corresponding period in 1838, 38,882 dollars 40 cents.

DESIGNS FOR THE ROYAL EXCHANGE.

With every facility possible, it would be a task of some time, to examine singly, and afterwards compare together, the sets of numerous drawings which cover not only the walls of two large rooms in Mercer's Hall, but also two sides of a screen placed in one of them. Therefore, writing as we now do, not only without the possibility of making a second visit, before our journal goes to press, but almost at the latest moment to which its being made up can be deferred, we have hardly time to collect our ideas properly, after a first, and consequently rather hurried view of the designs. Besides this, there is neither catalogue of any kind, not even a mere list, no printed descriptions of any of the designs, and no order observed as to arranging them according to the numbers, by which they are distinguished:—in fact, we do not understand upon what principle they are so numbered, for there seem to be not a single one figured with a number lower than twenty. Yet, as if it were not enough that as little as possible had been done for the convenience of visitors, it was also determined that no one should be allowed to assist himself, either by taking down the numbers or committing his remarks to paper. We were doing the latter, when some official came up to us, and said that no one was permitted to make sketches of any of the drawings, when we told him that we were not copying any part of the drawings, but merely taking memoranda; and on his walking off, resumed our occupation. Shortly after he came up again, and repeated his command more authoritatively, saying, that strict orders had been given not to suffer any person even to take notes, and should we persist, he should be under the necessity of making us withdraw. As further expostulation seemed to be quite useless, nothing else was left us but to comply with the mandate.

Hardly can we suppose the man took that strange authority upon himself; no doubt he acted according to the instructions given him: but then it argues anything but liberality on the part of the Committee to issue such very arbitrary, annoying, and very unusual restrictions. Never was such a regulation ever thought of being enforced before, certainly not either at the exhibition of the designs for the Houses of Parliament, or that of the models and drawings for the Nelson Memorial; in fact, at no exhibition whatever. Was it that the Committee, fancying they had been imprudently liberal in suffering the public to see the designs at all, determined to prevent persons from describing or commenting upon any of them, by prohibiting the use of pencil and paper in the rooms? It certainly looks as if such were the case, and that they were now alarmed for the consequences of their good natured indiscretion. However, we are not going now to comment upon the conduct and proceedings of the Committee, since they call for fuller animadversion than we can at present bestow upon them. All that we can here say relative to them is, that not satisfied with setting aside the competition, as far as the interests of the architects who entered into it are concerned, the sole advantage, the successful have derived from it, consisting in the distinction they have so acquired, even the highest premium being but a very moderate pecuniary compensation; not satisfied with this, the Committee have now entrusted the formation of an entirely fresh design to the very three persons who cannot, with any honour or decency, accept that office, after acting as judges in the matter, who have represented as ineligible, every one of the designs sent in. For does not this look very much as if the competition has been no more than a strategem, to enable the Committee to obtain ideas for the guidance and assistance of those whom they now, it seems, have determined to employ? What, we ask, have the three gentlemen who are now spoken of as the architects actually to be employed, done, to merit that implicit confidence in their abilities, which is now to be reposed in them? If they are entitled to it now, they were surely equally so at the very first, when they could have accepted the commission tendered to them with infinitely better grace,—or we say, without incurring the ugly suspicion and disgrace which must now attach to them, should they ever do so: as we think they will not,—unless they have such exceedingly strong nerves as to be able to brazen out public opinion.

Our own conscience gives us a twitch, for we just now promised to abstain from animadversion on this point, and to confine ourselves to speaking of the designs we have seen. That we have seen them we cannot deny, but we certainly have not been able to examine them in such way as would enable us to speak of their particular merits or faults, or to enter into any detailed notices of them. All that time would permit, was for us to reconnoitre them generally, which having done, we were commencing to study some of them more closely, and take down our notes upon them, when our labour was cut short in the way that has been mentioned. With the exception, therefore, of the few particulars we had *poached*, before we were warned off, we have now no better than our memory, fatigued and confused by looking at so many different drawings, at one time. Thus we are not only deprived of the means of refreshing it, by our notes, but, with a few exceptions unable to identify the numbers affixed to them, such designs as we can indistinctly call to mind. Had we been informed beforehand—and there might have been a written notice to that effect put up at the door of the room—that paper and pencil were rigorously interdicted, we should have proceeded differently, and endeavoured to get one or two of the leading designs by heart; but taken by surprize, and disgusted, we were in no humour to prosecute our examination very diligently. The utmost we can do, therefore, is to make such remarks as now occur to us. Upon the whole we were disappointed; few of the designs came up to what we expected to find, for a building which from all that had been previously said on the subject, seems to be looked forward to as a work that ought to be honourable to the architectural reputation of the country,—a monument of improved taste. On the other hand, there were many designs so greatly inferior to what we expected, as almost to stagger us. One of them, No. 55, is a most wretched, insipid affair, a bald and poverty-stricken Grecian edifice; nor is either No. 24, or No. 26, much better; while No. 40. looks very much like the west front of St. Paul's without the towers, There are several designs with Corinthian porticos, hexastyle, octastyle, or decastyle; forming a prominent feature in their composition, being made to occupy the whole of the west end. One of them, however, (No. 27, if we mistake not,) can hardly be so termed, for although an octastyle, crowned by a pediment, which is filled with sculpture, the columns are merely insulated before the front, yet we will not be sure that considering the rest of the design, and the character of the style, which partakes more of Italian than Greek or Roman, it would be the worse on that account. No. 50 has a Corinthian decastyle portico, and likewise a sculptured pediment. If our memory will serve us, and we do not confound this with something else of the same kind, there are also several columns within the portico, with a vista through three open inter-columns behind, into the interior of the Exchange, or the quadrangle, but as to other particulars, or the rest of the design we are now utterly unable to speak. If we have been rightly informed this design is by Mr. Donaldson, and according to the "Spectator" it is the very best, so excellent in itself, that even now it ought to be adopted if its author can satisfy the Committee that it can be executed for the sum specified. Not having paid sufficient attention to it, we can now neither confirm nor contradict the opinion so strongly in its favour. Mr. Grellier's drawings, too, No 36, which obtained the first premium, did not attract our notice much, for at all events it has not impressed itself upon our recollections, and to recollection alone, unfortunately, we are now obliged to trust entirely; on the contrary, Mr. Chateauneuf's (No. 43), which obtained the second premium, engaged our attention very much, and we had begun to note down some memoranda respecting it, when the surly jakanapes in office insisted upon our putting up paper and pencil. We suppose we may call it Mr. Chateauneuf's, for we suspect that as far as design is concerned his associate Mr. Mee had little to do with it. Though the style is Italian, the expression is decidedly German. It aims not so much at grandeur, as at elegance, and a certain piquancy of taste. The east front is considerably loftier than the rest; owing to which, the elevations of the north and south fronts are not of uniform height throughout, but have an additional story at that end. The west elevation is exceedingly tasteful, and would, we apprehend, be so far preferable to a large portico of a single order, as it would not so greatly overpower the centre of the Bank. Here we must break off, nor do we know whether we shall be able to collect further information against next month; for the exhibition will have closed before our publication appears, only SEVEN DAYS having been granted for the public to visit what ought to be kept open for inspection at least SIX MONTHS! What a public-spirited liberal Committee!

NEW PLAN FOR PROCURING SPRING WATER FOR LONDON.

We were somewhat surprised by the appearance of an advertisement, about ten days ago, stating that "a plentiful supply of wholesome water, so ardently desired," &c., "is now on the eve of attainment." The plan was said to be original, though the place from whence the supply would be taken had been pointed out by the late Mr. Telford. As there was no engineer's name to the advertisement, it appeared a little mysterious, and we doubted whether it had any proper foundation, without meaning disrespect to the gentleman whose name appeared as parliamentary agent.

We have since discovered that this "original plan" is to take the water from a place pointed out by the late Mr. Telford in his report in the year 1834, situated near the town of Watford, and the "originality" consists in uniting the upper and lower springs. We find that borings have been quietly going on for some weeks, and the result of the experiments has been eminently successful. The place is singularly felicitous for a bed of water, being nearly surrounded by high hills, and of a size calculated for the largest reservoir the world ever saw. It is about 160 feet above the Trinity datum of the tide of the Thames, and can consequently descend to any part of the metropolis by its own gravity, and without the aid of steam power. Springs have been discovered at every three feet to the depth of about fifty feet; beneath them a stratum of limestone two feet deep, and beneath that a vast body of water, which rises to the level of the water of the upper springs, and of all the other springs. These are valuable indications, added to which the water is particularly soft, and consequently fit for all domestic uses, which spring water generally is not.

We hear that Mr. Giles is the chief engineer, and that he is assisted by other gentlemen of scientific eminence. We shall endeavour to obtain for our readers all the details of the experiments that have been made, in our next number.

BUNNETT AND CORPE'S CONCENTRIC STEAM ENGINE.

SIR—In the letter of your correspondent (Mr. Macdonald), relative to our Patent Concentric Steam Engine which appeared in your last number, the conclusions he has drawn are so erroneous, that we shall feel obliged by your insertion of this in the following number. Whilst he admits that the result of the trials of the modes of applying the power by the tables published in your former numbers, which shows a gain of more than two to one, are correct, and might naturally have been expected, he asserts that one main feature in the case has been overlooked, viz., that the consumption of steam is equal to the power gained; this is quite at variance with the fact, as we shall endeavour to show. We have now just completed a high pressure engine on the concentric principle, the piston of which is 12 inches broad and 8 inches deep, containing 96 square inches, the crank throw is 9 inches, the stroke consequently 18 inches, the outer curve of steam chamber, an arc of a circle, 2 feet 4 inches in diameter, the inner curve 1 foot diameter. Now supposing this chamber to be completely filled with steam at each stroke, allowing for the concentric form, it would contain 1872 cubic inches. A cylinder on the vertical or horizontal principle of the same area of piston would require 1728 cubic inches to fill it, (which is the extent of the difference, as any increase of the radius of curve tends to reduce it,) just one-twelfth less than the concentric engine, whose gain of power by its direct application, as shewn by the tables, he does not dispute. This is supposing that all the steam it is possible to admit, is thrown into the cylinder at each stroke of the piston, but it is admitted by most engineers that all the steam thrown into the cylinder after the piston has completed two-thirds of its stroke is useless and detrimental, by the arrangement of our slide valves, we effectually cut off the steam at two-thirds of the stroke, which cannot be effected by the present locomotive engines with the single slide, therefore taking one-third from 1872, the quantity of steam we should actually use in the concentric engine at each stroke of the piston would be 1248 cubic inches, considerably more than *one-fourth less* than the present engines, to say nothing of waste by exhausting the steam in the passages, which we entirely avoid. It is, we conceive, no fault in our concentric engine, that it does not differ in principle from the best engines of the day. We have only sought by new forms and combinations to get a more direct application and consequent increase of power; how far we have succeeded, we shall shortly be enabled to show by an engine of about 10 horses power that we are erecting on our premises at Deptford, for the purpose of testing its power, consumption of fuel, &c. Pending that trial it was not our intention of troubling you or your readers with any communication on the subject, but (adopting your correspondent's words), we are inclined to believe that the appearance of this letter may be useful (at least to us) in counteracting whatever erroneous views may have been formed by the perusal of your correspondent's communication. We remain, Sir, your obedient servants,

BUNNETT AND CORPE.

Upper Road, Deptford, October 29, 1839.

Mr. Hancock's steam-carriage accomplished its first trip from London to Cambridge on Monday, 30th September. The carriage left the Four Swans, Bishopsgate-street, at ten o'clock in the morning: the time in actually running the fifty-two miles was four hours and a half, and the first thirty miles, including Wade's Mill Hill, was performed in two hours and a half (the first two miles being through the streets of London), which is at the rate of 12 miles an hour. During the whole of Tuesday, hundreds of persons went to view the carriage, which was standing in the yard of the University Arms Hotel, Cambridge; and at about three o'clock the "steam was got up," and the carriage, crowded with gentlemen, took an experimental trip round Parker's Piece, and other parts of the town.

BRICK DUTIES.

2ND AND 3RD VICTORIA, CAP. XXIV.

This Act repeals the duties and drawbacks of excise on bricks, and grants other duties and drawbacks in lieu thereof, and consolidates and amends the laws for collecting and paying the said duties and drawbacks, and enacts that in lieu of the said duties and drawbacks, there shall be paid the duties and drawbacks following; (that is to say,)

For and upon every thousand bricks, of a size not exceeding 150 cubic inches each brick, which shall be made in Great Britain, or which shall be brought from Ireland into Great Britain, a duty of 5*s*. 10*d*.

For and upon every thousand of bricks, exceeding the foregoing size, which shall be made in Great Britain, or which shall be brought from Ireland into Great Britain, a duty of 10*s*.

For all bricks made in Great Britain on which the duties imposed in respect thereof shall have been charged, and which shall be duly removed to Ireland or exported to foreign parts as merchandize, a drawback of the duties paid.

Section 3 enacts, that the said duties and drawbacks shall be under the management of the commissioners of excise.

Section 4 enacts, that brickmakers to make entry with the excise of their brick fields, &c.

Section 5 empowers officers of excise to enter brick fields and take an account of bricks.

Section 6 enacts, all bricks shall be charged with duty whilst such bricks shall be in the operation of drying or hardening in the field, &c.

Section 7 in charging the duty on bricks ten per cent. to be allowed for waste.

Section 8 enacts, that bricks shall be placed in such form that the officer may readily and securely take an account of them; and penalty for placing them irregularly.

Section 9, bricks may be made of such a shape that it may be difficult to ascertain with accuracy the true cubical contents thereof, whereby doubts or disputes may arise whether such bricks are subject to the higher or to the lower rate of duty imposed by this act; be it therefore enacted, that every maker of bricks shall provide, to the satisfaction of the supervisor of excise, a mould adapted and proper, and similar to the moulds in ordinary use by such maker, for forming and turning out a brick ten inches long, three inches thick, and five inches wide; which mould, when approved of by the supervisor of excise, shall be stamped or branded by him with the word "excise," and shall be delivered into the custody of such maker, to be by him kept for the use of the officer surveying such maker of bricks; and if any dispute shall arise as to whether any bricks, the cubical contents of which may be difficult to ascertain, are of a greater size than 150 cubic inches, and so subject to the higher rate of duty, the officer of excise shall take indifferently from the quantity of bricks the size whereof shall be disputed three bricks, and shall press the clay composing each of such three bricks into the said mould and turn the same out as a brick; and if upon such three trials any two of such bricks, or the clay composing the same respectively, shall not be more than sufficient to fill such mould, and form a brick of the dimensions of ten inches long, three inches thick, and five inches wide, the whole of such bricks shall be deemed and taken to be bricks not exceeding 150 cubic inches, and subject to the lower rate of duty; but if any two of such bricks, or the clay composing the same respectively, shall be more than sufficient to fill such mould, so that a larger brick than of the dimensions aforesaid would be produced if the whole of such brick or the clay composing the same were pressed into a mould of sufficient capacity to receive the whole of such brick or clay, then the whole quantity of the bricks in dispute shall be deemed and taken to be bricks exceeding 150 cubic inches, and subject to the higher rate of duty, and shall be charged with duty accordingly.

Section 17, in order to prevent the duties hereby imposed from being evaded by bricks being denominated tiles, be it enacted, that nothing shall be deemed or taken to be a tile which shall not, when turned out of the mould (except tiles for covering houses or buildings or draining lands,) be a perfect square, or which shall when so turned out be of greater thickness in any one part than one inch and seven tenths of an inch if under eight inches square, or of greater thickness in any one part than two inches and a half if more than eight inches square, or which shall have any incisions made therein so as to allow of being easily separated or divided after being burned: provided always, that it shall be lawful for the commissioners of excise to determine that tiles made otherwise than square shall not be considered as bricks chargeable with duty, on being satisfied that the same are intended to be used solely as tiles.

Section 18, whereas it is expedient to exempt from the duties by this act imposed bricks made for the sole purpose of draining wet and marshy land; be it therefore enacted, that it shall be lawful for any person to make bricks for the sole purpose of draining wet and marshy lands without being charged or chargeable with any duty for or in respect of such bricks, all such bricks being in the making thereof stamped or moulded with the word "drain" in or near the centre of the surface of such bricks, in so plain and distinct a manner that the same may be easily and clearly legible to any officer of excise or other person examining the same both before and after such bricks shall have gone through the process of burning and become fit for use: provided always, that it shall not be lawful for any person to employ or make use of any such bricks for any other purpose than in draining wet and marshy lands, and in constructing the necessary drains, gouts, culverts, arches, and walls of the brickwork proper and necessarily required for effecting and maintaining the drainage of such lands; and every maker of such bricks or other person who shall sell or deliver or use or employ any brick with the word "drain" so stamped or moulded thereon for any other purpose than as aforesaid shall forfeit fifty pounds.

Section 25, this act shall commence on the 22d day of August, 1839.

THE NEW HOUSES OF PARLIAMENT.

On Friday, 27th September, pursuant to notice, the tender for the third contract for the new Houses of Parliament, comprising the carcase of the principal building occupying the river front, and returns or wings projecting forward at each end to the river wall—were opened before the Commissioners of Her Majesty's Board of Works, when after a spirited competition as will be seen from the subjoined list of tenders put in by some of the principal builders in the metropolis. The contract was decided in favor of Messrs. Grissel and Peto, the well-known builders of the York Road, Lambeth.

Messrs. Grissel and Peto	£159,718
Mr. Baker	167,746
Mr. Cubitt	174,452
Mr. Winsland	177,489
Messrs. Lee	179,363
Mr. Grimsdell	181,588
Mr. Piper	183,106
Mr. Hicks	183,899
Mr. Bennett	184,639

It is expected that three years will expire before the above contract will be finished, and that it will be ten years ere the structure will be entirely completed.

INSTITUTE OF THE ARCHITECTS OF IRELAND.

A special meeting of the members of the Institute was held in Dublin on the 8th ult. to install the Viscount Fitzgerald and Vesey into office as President. Addresses were made both by his Lordship and Mr. Morrison, the Vice-President, which in a tone of eloquence called on the members to persevere in the useful course which they had undertaken. It gives us much pleasure to see the interest taken in such an important institution.

STEAM NAVIGATION.

THE ARCHIMEDES STEAM VESSEL.

Our readers will probably recollect that the *Archimedes*, a remarkably fine-formed vessel, of 200 (?) tons burden, fitted with a pair of engines, of 45-horse power each, manufactured by Messrs. Rennie, and the screw propeller, as applied by Mr. Smith, was first tried early last summer, and that the experiments were suspended, in consequence of the unfortunate bursting of one of the boilers. At that time the screw consisted of one whole turn of a single thread, 7 feet in diameter, and 8 feet pitch. The boilers have now been replaced by two new ones, manufactured by Messrs. Miller and Ravenhill; and at the same time a modification has been introduced in the form of the propeller. It consists now of two half-turns of a thread, 5 feet 9 inches in diameter, and 10 feet pitch, placed diametrically opposite to each other on the propeller shaft, so as to occupy a space of only 5 feet in the length of the vessel.

These alterations being completed, an experimental trip was made down the river to Gravesend, on Monday, the 4th ult., and the result was considered highly satisfactory. We regret that we were unable to be present, as we can, therefore, only speak from information we have collected since.

We understand that she run from Gravesend to London Bridge, a distance of 28 to 30 miles, which was accomplished in two hours, both wind and tide being favourable. No conclusion can, however, be drawn from this result, respecting the comparative performance, on account of the co-operation of the wind and tide; but the mean speed of the vessel through the water was ascertained during the trip, by noting the time in which she ran a mile, first with, and afterwards against the tide.

The results of the experiment were the following:—

Time of running the mile with the tide	4′32″
Number of revolutions of the engine shaft *per min.*	22
The speed over the ground was, therefore, *per hour*,	13.2 miles.
Time of running the mile against the tide	9′5″
Number of revolutions of the engine shaft	23
Speed over the ground	6.6 miles.
The mean speed through the water was thus	9.9 "

The mean number of revolutions of the engine shaft was 22½ per minute, which, multiplied by 5⅓ (which Mr. Smith informs us is the multiplying power of the wheel-work, which communicates the motion from the engine shaft to the propeller), gives 120 for the number of revolutions of the screw per minute. If the screw were moving through a solid body, it would advance the length of its pitch in each revolution, or 1200 feet per minute, which is the same as 13.6 miles an hour; but, since the vessel, and consequently also the screw only advanced at the rate of 9.9 miles an hour, there must have been a recession of the screw through the water, in the direction of the shaft, equal to 3.7 miles an hour. The proportion of the available power of the engines effectively employed in propelling the vessel was, therefore, 72.7 per cent., the remaining 27.3 per cent. being expended in obtaining the necessary resistance to the propeller.

Mr. Herapath, in his report in the Railway Magazine for the 19th October, has committed an error of 1.1 mile an hour to the disadvantage of the performance, in consequence of taking the mean time of running a mile, and finding the corresponding speed, instead of taking the mean of the speeds with and against the tide. We believe the latter to be the method usually followed; but, in case there may be any doubt as to its correctness, it is easily demonstrated thus.

The speed with the tide is equal to the velocity of the vessel through the water (which is required to be determined), added to the velocity of the tide, which is an indeterminate quantity. Also the speed against the tide is equal to the velocity through the water, diminished by the velocity of the tide. If, therefore, we call the former V and the latter v, we shall have

$$\text{Speed with the tide} = V + v$$
$$\text{Speed against the tide} = V - v$$

By adding these two quantities together, v is eliminated, and we find that the speed with the tide, added to the speed against the tide, is equal to twice the speed through the water.

THE HONOURABLE EAST INDIA COMPANY'S STEAM SHIP, THE "QUEEN."

The fine vessel, which is of the same class as the government steamers, Medea, Phœnix, Salamander, and Rhadamanthus, was built at Limehouse by Messrs. Curling and Young, the celebrated builders of the British Queen and President, and fitted with a pair of engines of 110-horse power each, by Messrs. Seaward & Co., of the Canal Iron Works. She is furnished with Hall's patent condensers, with apparatus for supplying the boilers with distilled water to make good the waste. The slides are of Messrs. Seaward's patent. The armament consists of four 32-pounders, besides two long guns of 8-inch calibre, one forward and the other aft, intended to carry hollow shot; they move upon slides and fixed pivots, which enables them to take a much wider range than the ordinary carriage can give.

The following are the principal dimensions of her hull and machinery:

Length between the perpendiculars	173	feet
Breadth within the paddle boxes	31	"
Breadth over all	49	"
Depth of hold	19	ft. 6 in.
Builder's Tonnage	766 $\frac{82}{94}$	tons
Weight of the hull	511	"
Diameter of the cylinders	56	inches
Stroke of the pistons	5	feet
Diameter of the air pump	28	inches
Length of Stroke	2	ft. 6 in.
Area of the steam passages into the cylinders	60	square inches
Area of the eduction passages	95	"
Number of tubes, 6 ft. long and ½ inch diameter in the two condensers	2500	"
Diameter of paddle wheels	22	feet
Length of the floats	8	"
Depth of the outer board	10	inches
Depth of the inner	12	"
Advance of the outer board before the inner one	8	"
Number of pairs of floats on each wheel	20	
Number of boilers	2	
Number of furnaces	6	
Length of boilers	14	feet
Breadth of the two boilers	21	ft. 6 in.
Weight of the engines	220	tons
Weight of the boilers	42	"
Weight of the water they contain when filled	30	"
Weight of the coal carried	240	"
Which at 16 tons per diem is sufficient for	15	days

On Thursday the 24th ult. the "Queen," with a party of naval and scientific gentlemen on board, made an experimental trip from Blackwall down the river as far as Greenhithe. When she was got under weigh, we perceived that the *Archimedes*, which was lying a little farther down the river, had her steam up, and was ready for a run. Accordingly, as soon as we were nearly on her quarter, she started, and the two vessels maintained nearly the same relative positions for some time, until we stopped to take a party on board, when the *Archimedes* shot a-head, and as she drew about 5 feet less water than the *Queen*, she was enabled to keep nearer in shore, so as not to feel the full influence of the tide. Notwithstanding this advantage the *Archimedes* did not seem to gain upon us, by which we judge her speed *through the water* to have been rather less, or at least not more than ours. The *Archimedes* returned without having proceeded so far as Erith, or having ascertained her rate through the water; but, by comparison with the speed of the *Queen*, as found at the measured mile in Long reach, we should suppose it to have been about 9¼ statute miles an hour. As she passed us on her return she fired a salute of two guns, we suppose in token of victory. We then proceeded to Long reach, where we noted the time of running a mile, first against both wind and tide, then with both in favour. The results were as follows:

Time of running the mile against the tide	9'3"
Time of running the mile with the tide	4'44"

whence we deduce the speed of the vessel over the ground.

Against the tide	6.32 miles.
With the tide	12.68 "
Mean speed, independent of the tide	9.5 "

The number of revolutions of the wheels per minute, with wind and tide in favour, was 19½—against wind and tide, 18¼, which shews that the difference of speed *through the water* must have been *more than* half a mile an hour.

The mean draught of water was about 14 feet 6 inches, and the dip of the floats 3 feet 9 inches; but, as the ship had a "a list to starboard," the dip of the larboard wheel was a little less, and that of the starboard wheel a little more than the above; which accounts for the fact, that the back-water from the latter was rather considerable, while there was nothing but a slight fall of spray from the former, through which the wheel was distinctly seen.

The pressure in the boiler before the experiment, was 5lbs. on the square inch, but just before we arrived at the measured mile, it had fallen to 4½lbs. The gauge on the starboard condenser marked 29 $\frac{1}{16}$ inches of mercury, and that on the larboard condenser 29 $\frac{1}{4}$; the oscillations were seldom greater than ⅛ of an inch, sometimes even less. The motion of the engines was during the whole trip remarkably smooth and regular.

Having finished the above experiments, we were summoned to an elegant and substantial cold collation, which had been prepared by our hospitable entertainers, the Messrs. Seaward, and the day passed very agreeably, in spite of the weather, which was by no means such as to enhance the pleasure of an excursion by water.

Government Steamer.—Orders have been received at Woolwich dockyard from the Lords of the Admiralty, to build a steam-ship of 200 horses power, to be named the Lizard. She is to be constructed with all possible expedition.

Vernon Steamer and Sailing Ship.—The Vernon is 170 feet long, 36 feet beam, and 22 feet deep, drawing about 15 feet 6 inches water, and of 1000 tons measurement. She is fitted with a steam engine of 32 horses power, manufactured by Messrs. Seaward, and calculated to make, in calm weather, 30 revolutions in a minute; the boilers consume about 2½ cwt. of coals per hour. She lately left Blackwall, on a trial against a strong flood tide, with jib and driver set in the wind's eye, blowing very hard from the S.S.W., the engine propelling her at the rate of about 3½ knots the hour, and performing 18 revolutions per minute. It appears from accounts that have been received of the performances of this vessel since her departure, that the propelling apparatus is of considerable service to her as a sailing ship. She is expected to make the voyage to India in about 70 days.

The "Atlantic" Steam-Ship.—This fine vessel may now be seen, in all her proportions, in the building-yard of the Messrs. Wilson, north side of the Clarence Dock, Liverpool. She is building for the Transatlantic Steam Company, and intended as a companion to the Liverpool in the New York trade. Her tonnage exceeds that of the Liverpool by nearly 500 tons, and she will be ready for launching in the course of six weeks or two months.

The Witham Commissioners having, from repeated observations satisfied themselves that the great speed and racing of the steam-packets on the river are causing much injury to the banks and foreshores, are about restraining them to a lesser speed *by time*,—an alternative to which they have had recourse before. The present packets being propelled by engines of from 25 to 30 horses power, and being high-pressure, are worked generally at from 40 to 50 lbs. on the square inch; such vessels may work with perfect safety in the large tidal rivers or estuaries of the sea, but are altogether unfit for navigations like the Witham; and unless some new mode of propelling steamers can be adopted which will abate the great agitation of the waters from the old paddle-wheel, the sooner the parties liable to uphold the river stop the injury now going on, the better.—*Stamford Mercury.*

Messrs. Acraman, of Bristol.—The spirited house of the Messrs. Acraman are about to enlarge the engineering branch of their trade, already very extensive and of high repute. They have taken into partnership Thomas Holroyd, Esq., late of the firm of Ferguson, Brothers, and Co., of Calcutta, and William Morgan, Esq., of London, Engineer; and the designation of this particular department will, in future, be "Acramans, Morgan, and Co." Mr. Morgan is a gentleman of known experience, and under his able direction the energies of the concern are, we understand, about to be directed to the manufacture, with other machinery, of the most powerful engines, as well as for marine as for rail-road purposes. They have also, we have heard, taken the ground beyond Clift-house, directly facing the course of the river, which they intend as a yard for the building of iron steam-ships. Employment will thus be created for a great number of hands. We cordially wish the concern all success.—*Bristol Journal.*

ENGINEERING WORKS.

OPENING OF THE BUTE DOCKS, AT CARDIFF.

On Wednesday, the 9th ult., the day appointed for opening the splendid docks and ship canal at Cardiff, so munificently undertaken and completed at the cost of the Marquis of Bute, the town of Cardiff presented a most animated appearance, there being a vast influx of people from all the neighbouring towns—from Merthyr and from the hills—all anxious to unite in one general tribute of respect to their common benefactor, and we were delighted to witness the enthusiasm with which the name of the noble Lord was received by all classes and persons of every shade of opinion.

The importance of this undertaking can only be duly estimated by considering the vast improvements which have been made and are now daily making in Bristol and throughout South Wales, new harbours being established, villages rising into towns of importance, and fishing stations becoming busy seaports. The improvements of machinery also will, by means of these docks and the Bristol and Exeter railway, open a direct and speedy communication between Cardiff and London through Bristol, as the distance from Cardiff to Bristol, 12 miles by sea to Uphill, and thence 22 by railway, may be performed in something less than two hours, in addition to its being always a certain passage practicable at all states of tide.

The construction of the docks was entrusted to Mr. Cubitt, of London, as engineer in chief, and to Mr. Turnbull, as the resident engineer.

We will endeavour to give a few particulars of the construction of the docks in our next number.

Wyre Harbour.—At the mouth of the harbour, nearly 800 men are employed, under the superintendence of Captain Denham, in cutting away a small triangular point of sand, which at present narrows materially the immediate channel, a kind of strait, between the sea and the main body of the water constituting the harbour. In connection with this work, workmen are also employed in cutting off a connecting stream between a lower part of the harbour and the sea—thus forcing the whole body of the water, and a portion of the tidal water, to flow in one current, which, if accomplished, will answer the double purpose of scouring the channel from the mouth of the harbour to the sea, and of acquiring an increased supply of water, constantly available for vessels entering or going out of the harbour. If this point be gained, it will add importantly to the utility and value of the haven. The directors have commenced the erection of a dredging vessel, for the purpose of scouring the harbour when necessary, and of removing the small shoals of sand which intercept, here and there, the free navigation. A number of excellent punts are already made, and a steam tug is in constant readiness for towing vessels entering the harbour, when a tug is required, and also for assisting in the various improvements carrying forward for extending the capabilities of the bay, as a port for large vesse's. Sir Hesketh Fleetwood is giving indefatigable attention to the construction of the different works comprised in the undertaking, and is sparing neither pains, labour, nor expense, in order to the successful accomplishment of the entire project. We had the opportunity of visiting Fleetwood the other day, and were much struck with the beauty and excellence of the plans laid down for the erection of the intended town. If completed according to the present designs, it will, beyond all doubt, be one of the most uniform, well built, and elegant towns in the kingdom. So far, however, as the existing plans extend, it will be, by no means, an important town as to size. When we were down, there was a vessel of between seven and eight hundred tons burthen floating in the harbour at low water. We had not the means of ascertaining whether the harbour is capable of accommodating simultaneously several such vessels.—*Preston Chronicle.*

Improvements in Woolwich Dockyard.—It has been found expedient to construct an immense new dry dock for steam and other vessels of war in this Government yard, the Admiralty having resolved upon filling up the former intended new dry dock, which, from strong springs, it was found impossible to make available, after an expenditure of upwards of 70,000*l.* Cofferdams have been formed on the southern side of the magnificent basin, and an excavation commenced, which is proceeding very favourably, under the superintendence of an officer of the Royal Sappers and Miners (Lieut. Dennison), who is attached to the dockyard for the purpose of inspecting the new works. The site of the new dry dock has already been excavated 20 feet, and as yet there has not been any spring met with to arrest the progress of the undertaking, which, when completed, will render the basin and docks of Woolwich yard among the most commodious in the country.—*Times.*

The Menai Bridge is undergoing a complete repair, having suffered considerable damage in the storm last winter. Government has granted 8,000*l.*, but this is by no means sufficient.

The waters of the Fossdike have been drained off, and Mr. Ellison, in company with Mr. Stevenson the well-known civil-engineer, is understood to be surveying the river preparatory to effecting such improvements as are needed to adapt it to the existing demands of trade. We congratulate Mr. E. on his taking this step, without pressing the extra toll of 6*d.* per ton; to that merchants, &c., would never submit, and Mr. E. must perceive that increase of trade on the navigation, when put into a thoroughly navigable state, would quickly repay an outlay of a few thousand pounds.—*Stamford Mercury.*

Ribble Navigation Improvement.—The dredging has proceeded most auspiciously. No machine ever answered the purpose of dredging more effectually or more satisfactorily. At Peg Hill the bar has been, to a considerable extent removed, and the channel through it will, at the end of this week, be sufficient to admit the largest vessels which comes into Lytham. The dredge has cleared from its bed, for this last three weeks, the average quantity of *two hundred and sixty tons* per day. The merchants of Preston, in high spirits respecting the prospect of improved navigation, have already determined to bring their largest vessels up to Preston forthwith; those vessels which hitherto have been compelled to discharge their cargoes at Lytham. It was deemed advisable to procure a steam-vessel, to be applied, when occasion requires, as a steam-tug. An iron vessel, called the "Lily," will, in all probability, proudly and gracefully make its bow to the shores of proud Preston, next week. This vessel will be used throughout the year for the conveyance of goods and passengers. The "Lily" is nearly a new vessel; contains two engines, each twelve horse-power, and only draws three feet six inches of water,—a draft admirably suited for the present state of the river. When the large vessels begin to make Preston their port, the dues arising from the river will be advanced to threefold their present proceeds, as they will have to be paid for crossing three lines, those of Lytham, Freckleton, and Hesketh Bank, instead of one only, as was formerly the case.—*Manchester Chronicle.*

PROGRESS OF RAILWAYS.

Glasgow and Paisley Railway.—This railway is getting on very rapidly; already a great part of the line is in a forward state. A number of houses in Tradeston are at present taking down to make way for the dépôt, and there are likewise several bridges building across the streets. Tradeston is in a complete stir, and when this line of railway is finished, it will materially enhance the value of property both in Glasgow and Paisley.—*Glasgow Chronicle.*

Midland Counties Railway.—The fine weather during the last fortnight has enabled the work people employed in the various departments of this important undertaking to make considerable progress along different parts of the line. The embankment on the left of the Humberstone Road appears to have been proceeded with more slowly than any other portion of the line, but, according to present appearances, may be expected to unite with the Thurmaston section early in the ensuing year. The tunnel under the Freemen's common is getting on expeditiously. Half the distance has already been accomplished, and as workmen are engaged night and day in the task, the whole must be concluded by Christmas. The two stations near the London Road are also proceeding with activity, as is the bridge leading over the railway to the union workhouse. The bridge leading from Regent Street to the Occupation Road is nearly finished, and preparations for another, in Gaol Lane, have been made within the last few days.—*Leicester Chronicle.*

Manchester and Birmingham Railway.—Congleton Viaduct.—The first stone of the celebrated viaduct at Congleton, on the line of the Manchester and Birmingham Railway, was laid with much ceremony on Wednesday the 26th September. Those of our readers who are interested in railway undertakings, know the magnitude of this work; but by those who do not, the following particulars will be read with interest. The viaduct is intended to run in a direction nearly north and south, and will cross the river Dane at a point about three chains below the extensive silk mill of Mr. Samuel Pearson. It will cross the Newcastle-road at a point about a chain to the west of the corner of Dane-street. In length, the viaduct will be 3078 feet, or nearly a mile, 31 feet in width, and 27 feet between the parapets; the span will be 60 feet, with 20 feet rise. There will be 42 arches, which are segments of circles. The greatest height from the river to the rails will be 98 feet 6 inches. The bases of the piers are intended to be of stone for about twelve feet in height above the ground; the imposts and parapets will also be of stone, and the rest of the structure of brick. The viaduct will contain about 61.000 cubic yards of brickwork, and about 586,000 cubic feet of stone work, and is expected to be completed in two years and a half. The contractors are, Messrs. John and Samuel Blakeley, of Manchester. The engineers in chief of the railway are Robert Stephenson and George Watson Buck, Esqrs., and W. Baker, Esq., a young gentleman of promising abilities, is the assistant engineer of the Congleton length —Mr. Buck stated that the viaduct would be the most gigantic structure ever attempted in this country—in this kingdom —or indeed in Europe, in modern times. It would be a thousand feet larger than the largest bridge of masonry in Europe, which was the *Pont du Saint Esprit*, over the Rhone. It would be more than three times the height of that bridge, and it would occupy six times its volume.

Hull and Selby Railway.—The rapid progress of the works at the Hull terminus during the last month or six weeks cannot fail to have arrested the attention of the most casual observer. At the principal front of the Hull station, on the West side of the Humber Dock, the lofty warehouses of the company, which are 270 feet in length by 45 feet in width, have received the frame work of the roof, and are now being covered in. The stone front of the company's offices has also attained the full height of the first story; when finished they will present an imposing appearance. The entire frontage towards the dock, including the entrances to the lines of tram-road, which will be placed on each side of the warehouses and the offices, will be about 210 feet. The tram-roads will cross the street on a level with the pavement, and extend quite up to the quay, where the waggons may be loaded, and the goods conveyed by this and other connecting railways to Leeds, Manchester, Liverpool, Birmingham, London, &c. The works at the Kingston-street entrance, coachbuilders', smiths', engineers', and turners' shops, offices of works, &c., are also rapidly assuming the appearance they are finally to bear; the engine-house and lofty chimney of the stationary engine are completed, the boilers are set, and the engine is nearly ready for work; it will be first employed in sawing the immense piles of Baltic timber, landed by Messrs. W. Beadle, Sykes, and Co., the agents to the contractors, an extensive house at Riga; of which nearly four thousand loads have already been delivered. This timber is intended for the basis of a portion of the permanent rails. The tanks for Kyanising the timber are upon the hydraulic principle and answer the purpose extremely well, the wood being completely saturated by this process. Mr. Walker, the engineer, has stated that it is done in a more effectual manner than any he has yet witnessed. Some idea of the extent of premises required for the station of a railway company may be formed by those who have never seen such buildings, when they are informed that the ground purchased by the company for this and other purposes adjoining Kingston-street, the Humber Dock side, &c., exceeds five acres, a considerable portion of which is now being covered with various needful edifices. The arrangements of these buildings, notwithstanding the large extent of ground which they will cover, are admirable for compactness and facilities of intercommunication. The ease with which passengers may enter and leave the carriages, and goods be loaded and unloaded from the carriage ways, being a couple of feet below the pavement immediately adjoining on each side, both in the warehouse and passengers shed, will also be a great convenience. At the Selby terminus, two sloop loads of castings were delivered last week for the iron bridge, which will be a splendid structure, and one of the largest, if not the largest, of the kind in the kingdom. It is expected to be put up in a few weeks. The castings have also been shipped for the Derwent bridge, which will be erected in about a month. The whole of the rails and chairs are contracted for, and the laying of the permanent way, which has been commenced between Hessle and Hull, will shortly be in progress throughout the line, which the contractors engage to complete by the 1st May, 1840. Fifty waggons, for goods, are contracted for, and the carriages of the first and second classes are nearly completed. The locomotive engines, which are being manufactured by Messrs. Fenton, Murray, and Wood, of Leeds, are in an advanced state of forwardness. We observe that the large culvert at the Lime-kiln-creek (about which so much has been said) is nearly completed. In fact, to whatever part of the works the eye is directed, activity and rapid progress are manifest, so that no doubt remains of the opening of the line next summer—we hope in the early part of it. A seventh call of 5*l.* per share has just been made; and it is gratifying to learn the readiness with which the previous calls have been met; of the sum required on loan, and for which the company have *not* advertised, we understand that only a very small portion, about 21,000*l.* remains to be taken up.—*Hull Advertiser.*

New Locomotive Engine.—Messrs. Peel, Williams, and Peel, of the Soho Iron Works, Ancoats, have recently turned their attention to the manufacture of locomotive engines for railroads; and on Wednesday trial was made of their first engine, on the Liverpool and Manchester line. The general form and disposition of the parts of this engine resemble those of the Liverpool and Manchester and Grand Junction Lines; the only difference being in the mode of working the valves. There are no eccentrics, but, in place of them, two spur wheels staked on to the crank axle, driving two other wheels of equal diameter placed immediately over them, and running in a frame supported by the crank axle, so as to preserve the distance between the centres constantly the same, and unaffected by the motion of the engine on its springs. The wheels last mentioned are attached to a short axle or shaft, carrying at each end a small crank arm, which drives a connecting rod attached to the valve spindle. There is likewise a very important and creditable improvement in the construction of the striking lever for reversing the motion, which we are unable to describe intelligibly without the aid of a drawing. The results of the experiments on Wednesday, during a trip from Manchester to Liverpool, with the nine A.M. first-class train, consisting of seven carriages, each weighing five tons, as reported by Mr. Edward Woods, the superintendent engineer, were most satisfactory. On the same day, the engine performed another experimental trip, from Liverpool to Manchester, with 25 loaded waggons, weighing in the gross, 133 tons 18 cwt. 2 qrs. Previous to this experiment, the "Soho" had been running a fortnight with passengers on the Liverpool and Manchester Line, and during that time, Mr. Woods informs us, "no failure has taken place, and the trains have usually been brought in *before their time.*"—*Manchester Courier.*

NEW CHURCHES, &c.

Staffordshire.—A new church is to be erected immediately, at Hill Top, in the parish of Westbromwich, Robert Ebbels, Architect.

Staffordshire.—The parish church of Wilbenhall is about to be very much enlarged, under the directions of Robert Ebbels, Architect.

Staffordshire.—The parish church of Wombourne is going to be repaired, restored, and greatly enlarged, from designs by Robert Ebbels, Architect.

Southwark.—A new church has been completed in Park-st It is a large and commodious structure, with a handsome bell tower 100 feet in height. The style of architecture is Gothic, and it is capable of accommodating 1,000 persons. One half the sittings are free. Adjoining the church is a range of lofty buildings intended for the new grammar school of St. Saviour's, corresponding with the architecture of the church. The old school-house opposite the ancient church of St. Saviour is to be rased to the ground; the site will be devoted to the enlargement of the Borough market, and will considerably improve the appearance of that locality. The benefits of a moral and religious education according to the tenets of the established church will be extended to a larger number of scholars than the old school-house could accommodate. The new church will be consecrated in a few days by the Bishop of Winchester. The site was presented by Messrs. Potts, the vinegar merchants. The church has been erected by the trustees of the late Mrs. Hyndman's bounty, at an expense of about 6,000*l.* The new school-house will cost about as much more, and will form an ornament to the district.—*Times.*

Yorkshire.—It gives us great pleasure to state, that Mr. J. Walker, the respected owner of the Sand-Hutton estate, near York, is now erecting a very neat and commodious chapel-of-ease at that place, which is in the parish of Bossall, and at a considerable distance from the parish church. The works are progressing rapidly, and under the direction of Mr. Salvin, of London, the architect will soon approach to completion.—*Doncaster Chronicle.*

Birmingham.—The ceremony of laying the foundation stone of the first of the ten churches proposed to be erected in Birmingham took place on Saturday the 5th ult., at the site granted by the Messrs. Robins, near Great Lister-street. The situation is admirably adapted for effecting the object intended by the originator and subscribers to the fund, being in the centre of a very large and increasing population. The committee have adopted the plan of Mr. Thomas, of Leamington, and the church will be of the early decorated gothic style of architecture, having a tower and spire of 125 feet in height; with lancet windows to the side walls, the windows to the tower and communion being finished with mullions and tracery heads. The roof will be of one span, with open framed principals, and pierced spandrils and corbels to the side walls. The structure is to be built of brick, the spire and moulded work being of Wheoley Castle stone; and the ground floor, when completed, is intended to contain six hundred sittings in pews of the first and second class, and two hundred free seats. The end gallery will likewise supply two hundred free sittings, making a total of one thousand sittings; and the contract stipulates that the whole shall be completed by the first of September 1840.—*Midland Counties Herald.*

Staffordshire.—At a vestry lately held at Leek it was agreed to elevate the front of the west gallery, so as to give a lighter appearance to the church generally, and to facilitate the labours of the preacher by affording a free circulation to the sound. The other alterations are rapidly advancing towards completion. Three handsome arches have been erected on each side of the body of the church. The gallery on the north side is finished, with the exception of painting; and the one on the south side is in a state of considerable forwardness. Altogether the work is of a very satisfactory kind, and when completed will afford to Leek a very elegant and convenient parish church. An increase of about three hundred sittings will be obtained, the whole expense of which will be sustained by the voluntary contributions of the inhabitants. In addition to the ancient free accommodation for the poor, which was very considerable, 137 more will be appropriated to their use in the new north gallery.

Old Windsor.—The corner-stone of a new district church for the parish of Old Windsor, Berks, was laid on Friday 27th ult., by her Royal Highness the Princess Augusta, in the presence of a highly respectable and numerous assemblage. After the usual ceremonies, the inscription was read by the architect, Mr. Ebbels, of Trysull, near Wolverhampton; it was as follows:—"The corner-stone of this church was laid by Her Royal Highness the Princess Augusta, on the 27th day of September, in the year of our Lord, 1839, and in the third year of the reign of Her Most Gracious Majesty Queen Victoria, Robert Ebbels, architect."

Ashbourne Church, in Derbyshire.—This fine old church is at present undergoing a very extensive internal beautifying and repairing. A public subscription has been raised, and the sum already obtained amounts to upwards of 2,000*l.* Ashbourne Church is one of the finest, oldest, and largest churches in Derbyshire, and it is well worth the repair which it is receiving.

Welch Church.—It is in contemplation to erect a Welch church in London for the especial use of the natives of the principality, to worship their Maker in their own language. We cordially concur in the object of the promoters of this excellent undertaking, and trust it will meet with the support of the Welch nobility and gentry throughout the kingdom.—*Cambrian.*

New Catholic Church at Stalybridge.—On Wednesday 26th Steptember, the Catholic church, dedicated to St. Peter, was consecrated. The edifice is built of stone, in the Gothic style, and cost upwards of 4,000*l.* in its erection.

PUBLIC BUILDINGS, &c.

Queen's College, Bath—This extensive structure, designed by J. Wilson, Esq., of Bath, is now in the course of erection on Claverton Down, a lofty and commanding eminence, from which it will overlook the city of Bath, and be seen in every direction. The Grand Terrace in front of the building is 800 feet in length by 60 feet in width, is intended for the carriage approach, there is also a smaller terrace 20 feet wide, on which the building will be elevated, this is to serve as a promenade for the use of the students and subscribers. The extent of the building is 600 feet long, and varying in width from 40 to 45 feet. It is of a uniform design in the Saxon style, having a grand principal entrance in the centre, consisting of a noble archway richly ornamented and surmounted by the appropriate arms of the college, and leading under the lofty tower which is 130 feet high, to the chapel extending to 80 feet behind the front. The wings on each side are terminated by embattled towers at the angles. The interior arrangements consist of a lecture theatre 50 by 60 feet, capable of holding 600 persons; a museum 100 feet by 40 feet, and a library of the same dimensions. The students apartments are arranged on each side of the long corridors, there are also apartments for the use of the professors, warden, and others connected with the establishment. The rooms are so arranged on the ground floor, that a view may be obtained from the principal lecture-room through the great hall, saloons, vestibule and corridors to the extent of upwards of 500 feet, to be illuminated by a rich stained-glass window at the termination. The height of the building varies from 35 to 50 feet, some portions of which are three stories high, the floors being concealed by the transverse mullions of the windows. It is estimated that the building will cost 30,000*l.*, which sum is to be raised by shares of 100*l.* each, and calculated to accommodate 215 students, with capabilities of extending the number should it be found requisite.

Mechanics' Institution, Bath, is now erecting at the corner of Charlotte-street and Queen-street, with a front elevation 70 feet in width by 40 feet in height, and 44 feet in depth, approached by a flight of steps leading into a large entrance vestibule with niches for four statues. The building will comprise a *souterrain* containing dwelling rooms for the librarian, a committee room, and five other rooms for the use of the various classes; the ground floor contains a library, reading room and a museum, together with the principal staircase; the upper floor is arranged to contain a large lecture room, capable of accommodating 600 persons, a picture gallery 65 feet in length, also two other rooms for philosophical apparatus, &c. The armorial bearings over the doorway, are those of the city of Bath, the façade is surmounted by a statue of Minerva. The front elevation and side front will be of Bath stone. The estimate cost of the building is 2400*l*., which the contractors have engaged to finish for that sum. Mr. James Wilson, of Bath, is the architect.

Stontgart.—Herr Zanth, architect of Stontgart, Honorary and Corresponding Member of the Royal Institute of British Architects, has recently commenced the erection of a very elegant, although small, theatre for the King of Wurtemberg at Cannstatt, near Stutgart. The constructions are already far advanced, and if the winter should be sufficiently mild to permit the continuation of the works, it is expected that the first piece will be played in the summer of next year. He has also nearly completed for the King a small conservatory for tropical plants, upon the system of the English buildings of that class.

Buildings at Munich.—The author of an article in No. 27 of the Foreign Quarterly predicted "that after a visit to Athens and Argigentum, Pœstrum and Pompeii, the student in architecture will finish his studies hereafter on the Glyptothek and Pinacothek of Klenze at Munich, and the Wachtgebäude and Museum at Berlin." Such is the opinion of an amateur (?) critic; let us now turn to the judgment of an intelligent foreign architect upon the very same subject:—"I remained nearly two weeks in the capital of Bavaria, and my opinion is very decidedly made up. Edifices, as vast as they are numerous, have been erected and are erecting in that city; but among the three arts which contribute to these various and important creations, architecture is far from holding the first rank. To painting must the first palm be ceded, then comes sculpture, and last of all, architecture. I cannot now develop all the reasons, nor examine in detail all the monuments which cover the surface of Munich, in support of my opinion; but I shall take up the task as soon as my professional occupations, which have accumulated during my month's absense, allow me the leisure to do so." B. A.

MISCELLANEA.

Waves of the Sea.—M. Aimé has presented a memoir to the French Academy of Sciences, in which he gives the results of his experiments on the depth to which the motion of waves extends, made in the Bay of Algiers, from December, 1838, to July, 1839, during the continuance of the heavy north and north-east winds which caused such a great swell in the bay. He concludes—1st, That the motion of the sea produced by the agitation of the waves may be sensible 40 yards in depth; 2dly, That the motion at the bottom is oscillatory; and 3dly, That the extent of this oscillation varies slowly from the bottom to the surface.

Northern Lights.—The northern lights were observed at Paris on the 3rd of September, at 10 o'clock in the evening. Also at Asti, in Piedmont, on the 4th of September, at one in the morning, and at Alexandria, in Italy, at ten o'clock in the evening.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 27TH SEPTEMBER TO 24TH OCTOBER, 1839.

JOSEPH CLINTON ROBERTSON, of Peterborough Court, Fleet-street, Patent Agent, for "*an improved method of manufacturing artificial marble.*" Communicated by a foreigner residing abroad.—Sealed, September 27; six months.

HENRY JAMES PIDDING, of Osnaburgh-street, Middlesex, artist, for "*improvements in collars for horses and other animals.*" Communicated by a foreigner residing abroad.—September 27; six months.

FRANCIS MACERONI, of Saint James's-square, Middlesex, gent., for "*improvements in steam boilers or generators.*"—September 27; six months.

THOMAS ROBINSON WILLIAMS, of Cheapside, gent., for "*certain improvements in the manufacture of flexible fibrous substances, or compositions, applicable to covering buildings, and other useful purposes, and also the machinery used therein.*"—February 28; six months.

WILLIAM HENRY BURKE, of Shoreditch, for "*improvements in the mode of constructing vessels for containing air, applicable to the purpose of raising sunken, or lifting floating bodies under or in water; and of fastening such vessels to chains or other machinery, or apparatus to be used for raising or lifting such bodies.*"—October 3; six months.

JOB CUTLER, of Lady-poole-lane, Sparbrook Warwick, for "*certain improved combinations of metals to be used for various purposes.*"—October 3; six months.

SAMUEL HALL, of Basford, Nottingham, engineer, for "*improvements in machinery for propelling.*"—October 7; six months.

FRANCIS GYBBON, Spillsbury, of Walsall, Staffordshire, chemist: MARIE FRANCOIS CATHERINE DOETZER CORBAUX, of Upper Norton-street, Middlesex, and ALEXANDER SAMUEL BYRNE, of Montague-square, gent., for "*improvements in paints or pigments, and vehicles, and in modes of applying paints, pigments and vehicles.*"—October 7; six months.

JOHN LOTHIAN of Edinburgh, geographer, for "*improvements in apparatus for measuring, or ascertaining weights, strains or pressure.*"—October 10; six months.

JOHN BARNETT HUMPHREYS, of Southampton, C. E., for "*certain improvements in shipping generally, and in steam vessels in particular, of some of these improvements being individually novel, and some the result of novel application, or combination of parts already known.*"—October 10; six months.

JAMES SMITH of Deanston Works, Killmadock, Perth, cotton-spinner, for "*a self-acting temple, applicable to looms for working fabrics, whether moved by hand or power.*"—October 10; six months.

JAMES SMITH, of Deanston Works, Killmadock, Perth, cotton spinner, for "*certain improvements applicable to canal navigation.*"—October 10; six months.

JOHN SWAIN WORTH, of Manchester, merchant, for "*improvements in rotatory engines to be worked by steam, and other fluids, such engines being also applicable for pumping water and other liquids.*"—October 10; six months.

DAVID HARCOURT of Birmingham, brass founder, for "*certain improvements in castors for furniture and other purposes.*"—October 10; six months.

ROBERT EDMUND MORRICE, of King William-street, London, gentleman, for "*improvements in the manufacture of boots and shoes and coverings for the legs.*" Communicated by a foreigner residing abroad.—October 17; six months.

JOHN DICKINSON, of Bedford-row, Holborn, Esq., for "*certain improvements in the manufacture of paper.*"—October 17; six months.

JOHN COOPE HADDING, of Bazing-place, Waterloo-road, civil engineer, and GEORGE HAWKES, of Gateshead, iron works, Durham, for "*certain improvements in the construction of wheels for carriages to be used on railways.*"—October 17; six months.

JAMES YATES, of the Effingham works, Rotherham, iron founder, for "*certain improvements in the construction of furnaces.*"—October 19; six months.

CHARLES ROBER, of Leadenhall-street, cloth manufacturer, for "*improvements in fixing colour in cloth.*"—October 19; two months.

WILLIAM NEWTON, of Chancery-lane, civil engineer, for "*certain improvements in machinery or apparatus for working or manufacturing screws.*" Communicated by a foreigner residing abroad.—October 24; six months.

JAMES SUTCLIFFE, of Henry-street, Limerick, builder, for "*certain improvements in machinery or apparatus for raising and forcing water, or other fluids, and increasing the power of water upon water-wheels and other machinery.*"—October 24; six months.

GEORGE GRAYDON, of Sloane-street, Chelsea, for "*certain improvements in instruments, for which letters patent were formerly granted to him, and which were called therein, 'A new Compass for Navigation and other Purposes,' parts of which improvements are applicable to instruments for measuring angles at sea or on shore, by aid of reflection or refraction, or of reflection combined with refraction, and part are applicable to magnetic compasses for ascertaining true bearings from celestial observations, and for comparing the same with the bearing of the magnetic needle contained in such compasses, whereby to determine and be enabled to allow for the deviation of such needle from the true meridian, whether by variation, local attraction, or other cause of error.*"—October 24; six months.

TO CORRESPONDENTS.

We are obliged to Major Turnbull, *of America, for the additional engravings of the Potomac acqueduct.*

Mr. Sheppard *has favoured us with an extensive* table of gradients, *which we shall publish next month. We are also obliged to him for information relative to the progress of works in Sussex, which we are necessitated to postpone until next month, which we hope he will excuse.*

Agreeably to the wish of several correspondents, we are having an extensive table calculated for setting out railway curves, *which we expect to be able to give next month.*

The next month's Journal will conclude the second volume, we have to request subscribers to complete their sets immediately.

We omitted to notice last month the receipt of D. C.'s *(a young mechanic) communication relative to Bunnett and Corpe's Concentric Engine, he will perceive that a similar communication was published, which had been previously received, which is the reason that we omitted his notice; however we shall be glad to hear from him respecting the latter part of his communication.*

As it is quite impossible for us to apply for information in regard to buildings we have either not heard of at all, or else do not know who are any of the parties employed upon them, we most earnestly request that professional gentlemen will have the kindness to apprize us of the buildings they are executing, even should they not care to favour us with any thing like a description of them. A Journal like ours ought to be a record of all that is going on in architecture throughout the kingdom; yet it is hopeless to expect that the utmost exertions on our part can render it such, if the only parties who are capable of supplying us with the intelligence requisite for that purpose, will not do so of their own accord. We cannot complain of having met with any backwardness in furnishing the information we have solicited, on the part of those to whom we have applied for it directly: still, for the reason first assigned, it is only in a very few cases that we know where and to whom we ought to address ourselves.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No. 11, Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, please to direct it to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

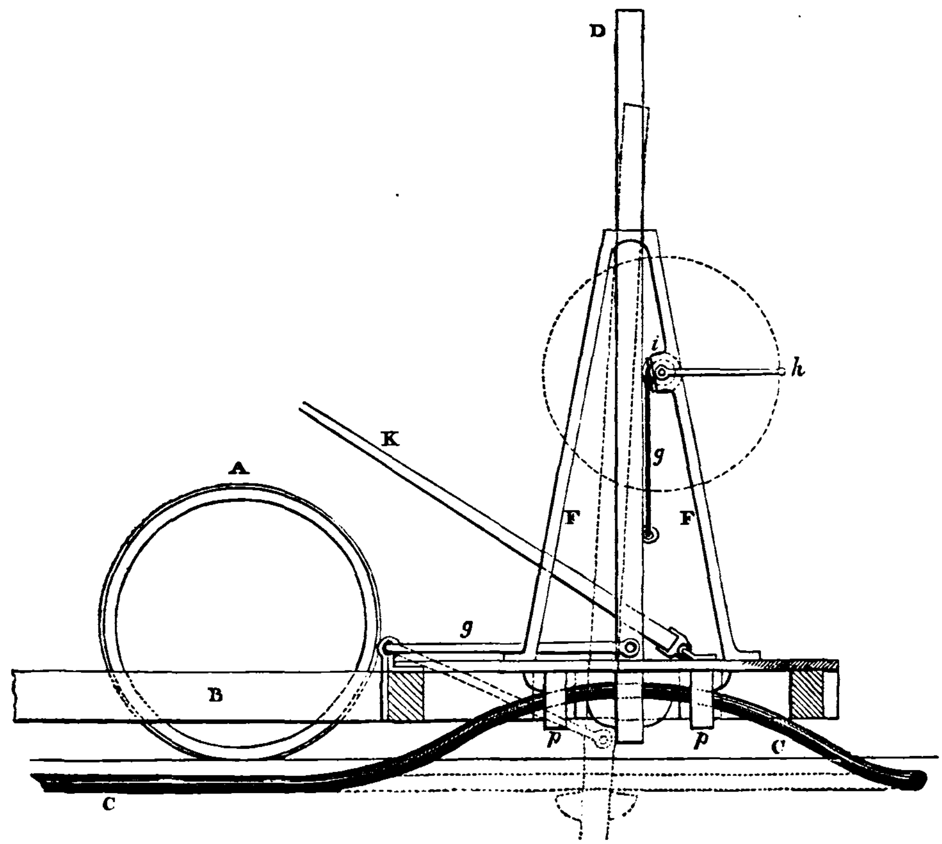
Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD, PRICE 17*s*.

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

GROUND-ROPE APPARATUS.

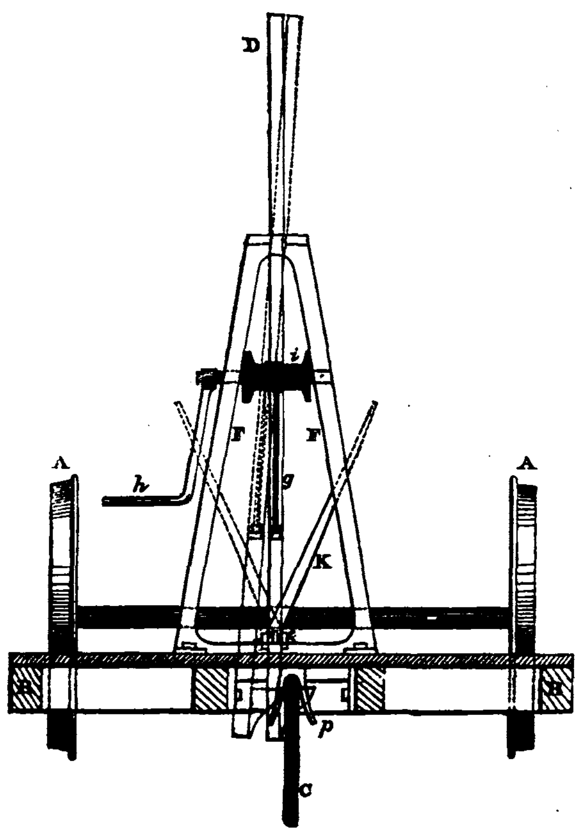
Fig. 1



Ground-rope Apparatus.

A machine or apparatus for connecting or disconnecting a train with a ground-rope whilst the rope is in motion. Figure 1 is a side view, and Figure 2 a front view. C is the cable or rope. A, the forewheels of the leading carriage, B, the framing of the carriage. A stage is fixed to the front of the carriage, upon which is erected the standard or frame *f f*, a vertical bar of iron D is connected with the train by the link *g*, and suspended to the frame by the chain *g'*, which coils round the barrel *i*; the lower part of the bar is formed into a kind of broad hook, the under side being formed like a latch, and the face rounded longitudinally, and hollowed to receive the rope; when the rope is detached, it occupies the position shown by the dotted lines, and the bar D, when about to hook up the rope, occupies the position shown by the dotted lines in Figure 1; then by turning the handle *h*, the bar is lifted up, and brings the rope with it, which is then tightly held or jammed, as in clams, between the broad hook of the bar, and the pieces *e* fixed to the framing; at first the rope slides through the clams and prevents concussion, but as the train gets into motion, the sliding is less and less, until the train attains the full velocity of the rope; a ratchet is placed upon the axle of the windlass, so as to hold up the bar, but in order instantaneously to disengage the rope, a bar K is provided, which works on a joint *l*, so that at any moment the bar D may be thrown on one side, as shown by the dotted lines in Figure 2, when the rope drops down, and the velocity of the train is checked by the drags or brake in the usual way; the fingers *p*, *p*, are placed in order that the rope may be prevented following the hook of the bar D, when the rope is required to be thrown down; the upper part of the standard F is formed rounding in such way as to allow full play to the upper end of the bar D.

Fig. 2.



Apparatus to take up a Carriage or Carriages whilst the train is at full speed.

Fig 3, Side View.

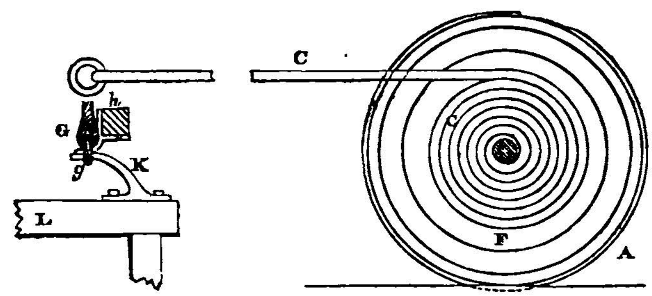
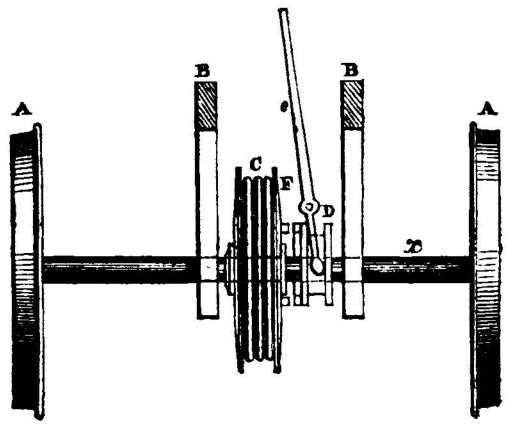


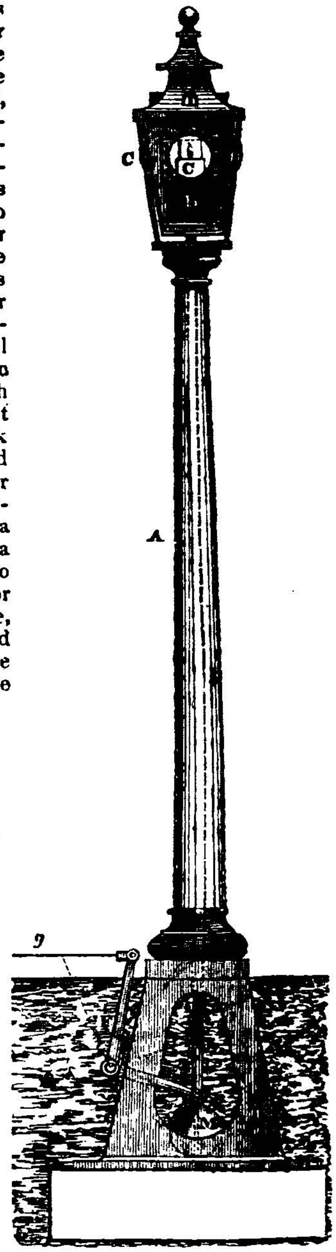
Fig. 4, Front View.



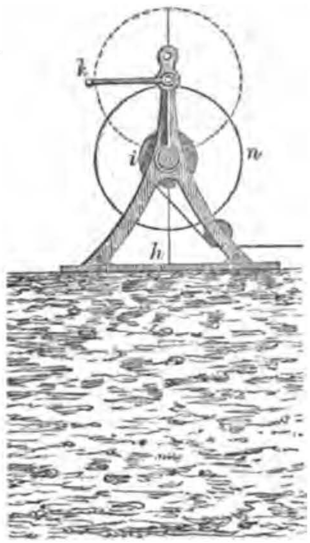
A machine or apparatus by which a carriage may be taken up and attached to a train, without stopping the train. Figure 3 is a side view and section, and figure 4 a front view. A, is the fore wheel of the carriage to be taken up, and x the axle; upon the axle is placed the sheave F, within which coils the rope C, the sheave runs loose upon the axle, and is thrown in and out of gear with it by the clutch D, worked by the lever e, the end of the rope is made fast to the sheave, and the rope coils over itself, the rope may be of any convenient length, about 100 yards I consider sufficient. B, B, are two supports depending from the framing of the carriage to support the axle more steadily. L, is the framing of the last carriage of the train, to the side of the framing is fixed the hook K, a post h, is placed at a proper distance, upon which is fixed the hook or bolt i, the ring g, fastened to the end of the rope c', is then hooked upon the bolt i; the hook k, of the passing carriage hooks into the ring and carries away the rope, which then drags the carriage to which the pulley is attached along with it; but the carriage is dragged after the train by a velocity so much slower than the train, as is due to the quantity of rope uncoiled for every revolution of the wheel A, for example, if the train passed over five yards, and the rope uncoiled four yards, the space passed over by the carriage at starting would be one yard or one-fifth the velocity of the train, but the velocity of the carriage is increasing as the coil of rope becomes less, and it moves slower than the train until all the rope is unwound, then afterwards the rope winds upon the axle, when the carriage then moves at a greater velocity than the train, and in the same proportion as the rope coils up when it at last overtakes the train, then when it has arrived close up to the last carriage, a bolt is fixed into the drag link, and the clutch is thrown out of gear, and the carriage is then united to the train the same as the rest. In this instance the sheave and apparatus is applied to the carriage, but it may likewise be applied to the engine or tender, and the best place to fix it would be outside the wheels, lengthening the shaft, and hanging the sheave upon it; and as regards the operation of taking on the coach, the link or ring i, of the rope will hook into the hook K, instead of the ring into the hook as before described; and the rope C will coil round the reverse way to that shown in the drawing, the carriage is of course placed in a siding, and it enters the line by a switch in the usual way.

An improvebd Machinery or Apparatus for making Signals.

Figure 5



The peculiarity of which consists in conveying the signal a mile or any convenient distance from the station, the object being that the engineer may pass the signal post, and have distance and time sufficient to stop the train before reaching the station or place for stopping; the machine for a light is shown in figure 5. A, is a lamp post. C, a lantern of any peculiar shape, with bull's-eyes on three sides, or it may be formed of glass like a street-lamp, or in any other manner. C, is the lamp with reflectors behind the light in the usual way. B, is a shade supported upon the vertical rod e, passing through the post and united by a joint at its lower end, with the bell-crank F, to which is likewise suspended the ball or weight M, to the other end of the crank F, a joint is attached, with which is connected a strong wire g, which is led like a bell-wire, by proper connections to the crab h, placed in a room of, or near, the station-house; the wire, or a chain or rope united to its end is fastened to the barrel i, of the crab h, which coils round the



barrel—then when a man turns round the handle k, by means of the pinion fixed on the handle shaft, and the barrel wheel denoted by the circle n; the barrel i is turned round, and the chain, or rope, or wire is coiled round the barrel, the wire drawn in, and the crank F made to occupy the place shown by the dotted line, when the vertical rod e, and shade B are raised, and the light concealed, the counterbalance M is employed to keep the connecting wire g always stretched; in places where gas is employed, a large gas burner may be substituted for the lamp, and the rod e, made to communicate with a stop cock, so that by raising or depressing the rod the gas may be turned on or off, then a small concealed jet of gas may be always burning so as to inflame the larger jet when the rod is raised by the apparatus, thus a powerful light may be used when needed, and when not required the gas may not be wasted. The apparatus as drawn is a night signal, or to be used when the weather is so dark that other signals cannot be seen; but for a day signal it is merely necessary to employ a post, so as to raise a vane or vanes like a telegraph, a spar for example fixed at the top of the lantern; when it is required to use the telegraph, a man may make the necessary and self-evident connexion between the rod e, and the limb of the telegraph, which limb being made with a bell-crank, when the rod e is raised may cause the telegraph limb to lie horizontally, and when the rod *e* is depressed to stand vertically, or the apparatus may be formed double so as to work both telegraph and the lamp at once, whether by day or night.

HYDROSTATIC CHAIR.

Fig. 6, Section.

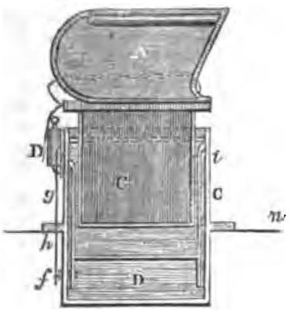
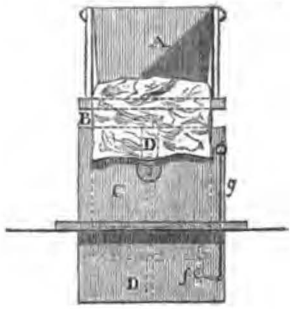


Fig. 7, Front View.



This apparatus consists of a seat to destroy the vibration of the railway carriages shown in figures 6 and 7, this consists of the outer case C, formed with a double bottom, dividing it into two parts, the upper in which the seat floats, and the under forming a receptacle for the superfluous water, the inner case or box. B, has a space all round it of about an inch clear, and the top of the outer case, and the bottom of the inner floating box is bound round with a loose hemp gasket or other suitable packing to prevent the sides of the cases from touching and to act as guides for the seat, the seat is raised by a person pumping up the water from the lower or waste box D, by means of the syringe D, the seat is lowered by the cock *f*, being opened by the wire or string *g*, and allowing the water to flow out into the waste box; the waste pipe *i*, is placed as high as it is proper the water should rise in the upper box without overflowing, so that the water returns by it to the waste box. The cases or boxes may be made of any suitable materials, but I consider sheet-iron the best. Figure 6 is a section and side view, and figure 7 a front view. A, is the seat formed in the same way as a chair or other seat; *h*, is the suction-pipe of the syringe, and the line *n* denotes the floor of the carriage.

WHEEL ADAPTED FOR THE COMMON ROAD OR RAILWAY.

Fig. 8, Side View.

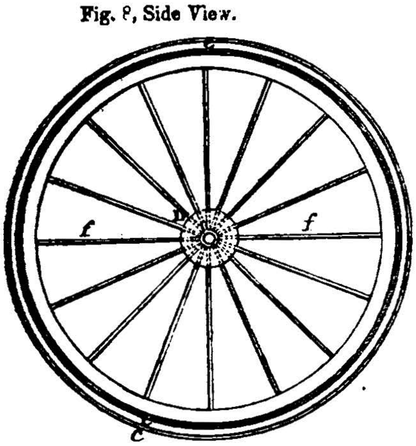
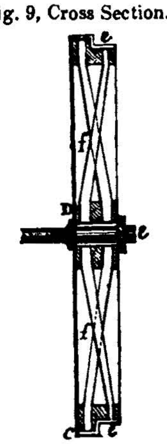


Fig. 9, Cross Section.



My next improved machinery and apparatus is a wheel adapted to run upon the common road or upon the rails of a railway.

Figure 8 is a side view, and figure 9 a cross section of the wheel, the wheel is formed as shown, as if the conical railway wheel were placed outside of the common wheel; if the wheel be formed of wood the felloes should be broad enough to take both tires, the outside tire may be the same as that used for a railway wheel, and the road tire the same as usual. I consider 1½ inch sufficient difference in the radius of the two wheels; the best mode to fix the spokes will be as shown, alternately to cross them; the nave would be best of cast iron in the usual way. The only part of the wheel which I claim as my invention being the form of the ring, any usual method may be used, and any material employed; the best mode to form the ring will be to make the wheel in the usual way and then shrink the railway tire *b*, *b*, upon it, then when this is turned in the lathe and the edge likewise, the road tire *c*, *c'*, may be shrunk on afterwards in the usual way; or the tire iron may be rolled to the entire shape, and the wheel put together upon the usual railway system. D is the nave, *e* the axle, and *f* the spokes.

TILGHMAN'S RAILWAY BAR.

The nature of the improvement consists in so forming the bar that there shall be a reduction of the height usually given to the ɪ rail between its head and the base on which it rests; thereby diminishing the leverage of the rail, while its strength and capability of being firmly secured to the cross-tie, are provided for by the addition of a rib directly under the centre of the base, which rib may be made plain, trapezoidal, or with a lower web.

To fasten the rail, the lower rib is inserted in the cross-ties, and wedged securely to its place, where it is supported conjointly upon the ordinary base, and the under part of the lower web. A chair, or flat plate of iron, is inserted immediately under the upper base or support, to receive which, notches are made in the ends of the bars, so that when two of them are put together, these notches form a mortice through which the chair is to be inserted. The chair is affixed to the cross ties by spikes or screws.

The Committee having tested the strength of the improved *trapezoidal* rail, weight 48 lbs. per yard, by the rules laid down by Professor Barlow in his account of "Experiments on the transverse strength and other properties of malleable iron, with reference to its uses for railway bars," feel satisfied it will sustain a weight of from six to seven tons without injury, (the supports being 33 inches apart,) or about 75 per cent. more than the most approved rail of similar weight now in use.

With reference to *leverage*, the improved rail is decidedly preferable to the ɪ rail, the distance between the upper surface and support being considerably less, and as its entire depth is greater than that of any other rail known to the Committee, (and may be increased at a slight expense, without changing the position of the main support or increasing the leverage,) it consequently follows, as the depth governs the deflexion, that the improved rail is much the most stiff and rigid.

In point of economy, the Committee are of opinion that the improved *trapezoidal* rail will be found less expensive than the ɪ rail. The plan suggested for connecting the bars, and attaching them to the sills, they conceive permanent and simple.—*Journal of the Franklin Institute.*

POINTING THE STONE WORK OF A CHURCH STEEPLE.

SIR—When I was building the Parsonage House at Waltham, Leicestershire, I had an opportunity of obtaining from the Register the following account for pointing, in 1652, the steeple or spire of the parish church, and which I have much pleasure in sending to your widely circulating journal, because it gives so minutely the materials formerly used, as well as the expence incurred, in that important but much neglected branch of work, "pointing."

"Paid the steeple pointer for pointing the steeple	3	10	0
Item for two days' work more		7	0
Item for smithy dust		4	2
Item for eggs		2	6
Item for nine strikes of lime		7	6
Item for two strikes of malt		7	4
Item spent when we paid the pointer		1	6
Item paid for a mare hired for the pointer			6
Item for the steeple pointer's man		1	0
Item for fetching the lime			6."

The Church, which is built of stone, stands on a very elevated situation, and is exposed to every wind that blows.

I am, Sir,
Your obedient servant,
CHARLES DYER.

36, *Guildford Street,*
Nov. 15th, 1839.

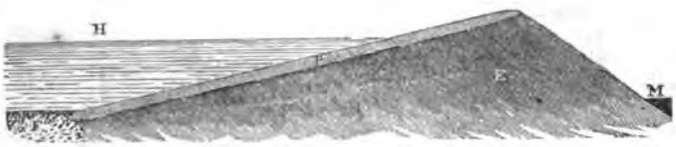
RAILWAY POINTS.—We have during the past week been shown the models of railway points or switches which appear to possess important advantages over any at present in use. The ingenious inventor is a mechanic now residing in this town, and who was for some time employed on the London and Birmingham Railway, where his attention was directed to the subject. As far as we are enabled to judge from the models, the invention will effect all that is desired; as, were the plan adopted, it appears that by no possibility could an accident occur in consequence of the negligence of the party to whose care the points were entrusted. We allude to the invention in the hope of drawing to it the attention of engineers and others engaged in the formation of railways; and we shall have pleasure in giving the address of the party suggesting the improvement to any gentleman who may apply to us for that purpose. It is to be hoped that the inventor, should his plan be found to possess the advantages he claims for it, will be rewarded for his ingenuity and perseverance.—*Midland Counties Herald.*

SEA BANK AT HOLBEACH.

Sir—I herewith enclose a description of a Sea Bank constructed in 1838 for the Messrs. Johnson and Sturton, of Holbeach, for the purpose of enclosing a quantity of sea marsh land.

The bank measured about two and a quarter miles long, and varied from 10 to 14 feet high above the surface of the marsh. There were various difficulties connected with the construction of this bank, on account of a bank having previously been made on the marsh; the principal part of which was unfortunately washed away in February 1836. In executing the new bank the material had to be carried over the old floor pits, and large creeks had formed themselves both at the back and front of the seat of the new bank in several places, varying from 8 to 12 feet deep below the surface of the marsh, and from 2 to 3 chains wide. The new bank in front of the most exposed situations, has slopes on the sea side from 5 to 7 feet horizontal to 1 foot perpendicular, and on the land side 2 feet horizontal to 1 foot perpendicular, with a top 3 feet above the height of the highest tide, from 2 to 4 feet wide at the junction angles of the slopes.

Section of Embankment.



H, Height of highest tide.
F. Foreland or cess,
P. Pudd'e.
E. Embankment, 13 feet high.

The counter bank has slopes of 4 feet horizontal to 1 foot perpendicular, and a top 2 feet wide, with land slopes of 1½ foot horizontal to 1 foot perpendicular.

In executing the work, it was let to the workmen in reaches, at per chain of 66 linear feet, measured along the top, including all labour in forming, puddling, scooping water from floor pits, breaking and spreading crocks, shifting materials, and securing the same from the tide's way; the men finding all shovels, plank hooks, tools, horses, carts, &c., required for excavating, and filling, and spreading, and puddling, the proprietors finding all planks, barrows, box horses, tressels, ropes, staples, &c., necessary for the same.

The whole of the earth deposited in the different parts of the bank, was well chopped, worked, and trodden together, and the best of the material was carefully reserved and laid on the front or sea slope of the bank, and well puddled or punned in the most workmanlike manner, and joined to the surface below; the face of the sea slope was sodded with the best green grass sods or flagging, varying from 3 to 4 inches thick, properly cut and joined together; and the land slope in some parts sodded, and the other parts sown with seed; in crossing the Creeks, facings of fascine work were applied according to circumstances, and some old vessels were sunk in the deepest parts, filled in with the best of the soil, and well puddled between; and in conducting the work, it was found necessary to encourage the warping up of the old floor pits, by introducing fascine jetty work, which greatly accelerated the deposit of the sea warp. The whole of the material used in the bank, was dug from the sea side, except where the men were filling up, and shutting out the sea at Creek openings, left for the draining of the marsh, where they were obliged to dig the earth from the parts that lay nearest to the work, whether at the back or front of the bank, so as to expedite the work, as this part of the operation required the greatest attention, or otherwise considerable damage would have arisen to the bank.

Since the bank has been completed, lines of fascines have been planted at the most exposed parts, having half their length let into the soil, and have been found very beneficial in breaking the force of the waves, protecting the surface of bank, and encouraging the deposit of the sea warp.

Stephen Lewin.

Witham Office, Boston, Lincolnshire.

NEW SYSTEM OF INLAND TRANSPORT.

An experiment has just been made on the Forth and Clyde Canal, in Scotland, which seems likely to be followed by very important consequences, in a scientific as well as commercial view, and to affect seriously the relative value of property in canals and railways. It is well known, that there is a system of canal navigation practised on some canals in Scotland, in which light iron vessels, capable of carrying from 60 to 100 passengers, are towed along by a couple of horses, at a rate of ten miles an hour; and this is effected by what is called riding on the wave. This new system of wave navigation has hitherto been limited in its use by the speed of horses, and been thrown back into comparative obscurity by the brilliant feats of the locomotive engine, whirling its ponderous burden along the iron railway with the speed of the winds. The experiment, however, to which we now allude, shows that the same mighty machine is capable of performing feats equally astonishing in water as land-carriage. *A locomotive engine, running along the banks of the canal, drew a boat, loaded with sixty or seventy passengers, at the rate of more than nineteen miles an hour!* and this speed was not exceeded, only because the engine is an old-fashioned coal-engine, whose maximum speed, without any load, does not exceed twenty miles an hour; so that there is every reason to infer that, with an engine of the usual construction employed on railways, thirty, forty, or fifty miles an hour will become as practicable on a canal as on a railway. Thus, the wave theory, which was formerly a beautiful speculation of science, becomes the basis of a new system of inland water transport, and abstract science receives new illustrations from the practical application of its principles. The experiments to which we refer, were performed in the presence of a number of men of science, and gentlemen interested in the improvement of canals and navigation, under the direction of Mr. Macneil.

.. .. The wave of the Forth and Clyde canal, from its great depth, travels at the rate of about eleven or twelve miles an hour, and that, consequently, in order to "ride on the wave," it would be necessary to draw the boat at fourteen or fifteen miles an hour—a speed hitherto impracticable, because above the available speed of horses; but it had been confidently predicted, that at these high velocities, the violent surges usual at velocities of eight or nine miles an hour would wholly disappear, and the vessel ride on a smooth undulating wave, exciting comparatively little commotion in the waters of the canal. Two of the experiments performed set this truth in a remarkable light—experiment No. 3 being performed with an ill-shaped passage-boat, which the engine had not power to drag "over the wave," and experiment No. 1, with a boat suited to higher velocities. Now, it happened as predicted, that the boat moved at a less velocity than that of the wave, raised a high and powerful wave at the bow, which overspread the banks of the canal, and threw up behind it a foaming and most injurious surge; while, on the other hand, the vessel which moved at the higher velocity rode smooth and even on the top of the placid and gentle wave, leaving behind it no commotion but the sudden collapse of the parted water. These experiments are as follow:—

Experiment 1.—A passage boat filled with passengers, drawn by the locomotive engine, passed over

Yards.		Seconds.	
110	in	12.4	Being a velocity of above nineteen miles an hour, *riding the wave*, with very slight commotion of the water.
220	..	24.5	
330	..	36.8	
440	..	49.2	
550	..	61.8	

Experiment 3.—A passage boat, containing passengers and baggage, but unsuited to high velocities, drawn by the locomotive engine, passed over

Yards.		Seconds.	
110	in	34.2	Being a velocity of about seven miles an hour only, with a large wave raised up at the bow and rolling over the bank, and an after surge tearing along the side, the boat being *behind the wave*.
220	..	65.0	
330	..	95.2	
440	..	127.8	
550	..	158.8	
660	..	190.8	
770	..	221.8	

Besides these experiments, there were others highly interesting in a practical view. A large fleet consisting of three schooners, three sloops, two canal traders, and one small boat, forming a gross weight of about 800 tons, were dragged along the canal simultaneously, with no other force than the simple adhesion of the wheel of the carriage to the surface of the rail. In another experiment, a train of five boats, capable of carrying 400 to 500 passengers, was taken along at the rate of fifteen miles an hour.—*Athenæum.*

THE FLEXIBLE WATER MAIN.

Fig. 1.
Section of the River Clyde.

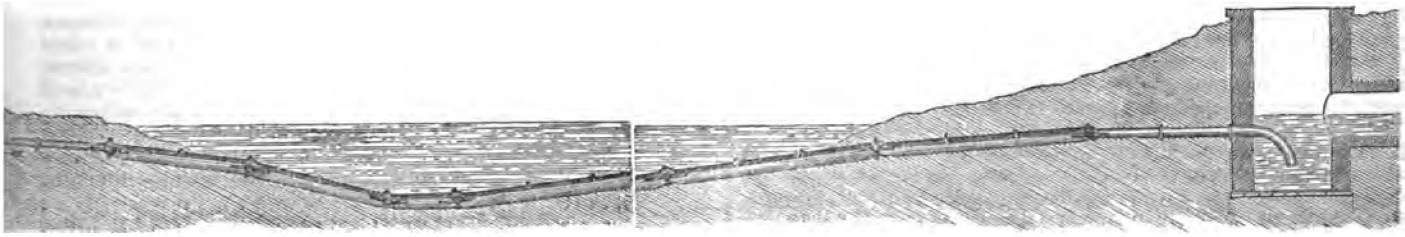


Fig. 2

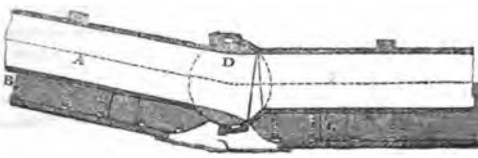


Fig. 3.

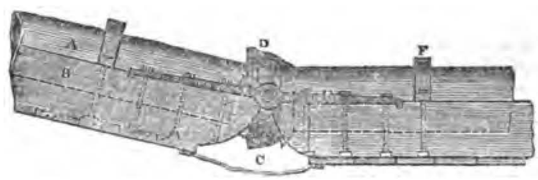


Fig. 4.

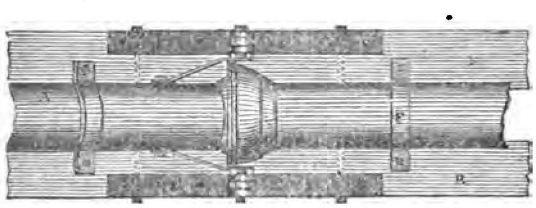


Fig. 5.

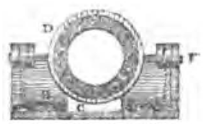
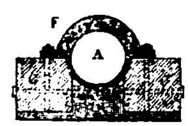


Fig. 6.



A, iron pipe. B, timber frame. C, canvass. D, joint. E, iron hinge. F, iron straps. G, bearers.

THE FLEXIBLE WATER MAIN,

Contrived by the late Mr. Watt, *for the Glasgow Water-work Company.* By John Robison, Esq., F.R.S.E.

(From the Edinburgh Philosophical Journal, Vol. III.)

The Glasgow Water-work Company derive their supply of water from a well and tunnel formed in a stratum of sand on the left bank of the Clyde, which affords a natural filter for the water of the river. As the city lies on the right bank, the conveyance of the filtered water across the stream was a problem of some difficulty. The fertile genius of Mr. Watt, however, enabled him to solve it.

He suggested that a flexible iron main should be drawn across the bed of the river, through which pumping engines on the north side should raise the water from the well on the south side. In executing this plan, the well and tunnel were dug in the sand near the water's edge. The well is 10 feet in diameter, and its bottom is 12 feet under the ordinary surface of the river; the feeding tunnel is 3 feet wide, and 6 feet high, and extends for a considerable distance into the sand-bank; the well has a wooden platform bottom: its sides, and those of the tunnel are built of granite, put together without mortar, and backed with gravel, to prevent the influx of sand. The south end of the suction pipe (or main) is turned down into the well to a sufficient depth. That part of it which lies in the bed of the river, is formed of pieces 9 feet long, (exclusive of joints,) and 15 inches interior diameter. Part of the joints are formed in the usual way, but others are something like what is called "ball and socket," or "universal joints." The whole is laid on strong frames made of parallel logs; these frames are joined by strong iron hinges, having their pivots in horizontal lines at right angles to the axes of the pipes, and passing through the centres of spheres, of which the zones of the sockets are portions. The flexible joints are at the extremities of the frames. This will be easily understood from the figures.

The frames and pipes were put together in succession on the south side of the river, and (the open or north end being plugged,) were hauled into and across the bed, in a trench prepared for them. The machinery for hauling them was of course on the north side; the operation was aided and directed by pontoons, &c. The moveable joints of the pipes, and hinges of the frames, allowed them to assume the form of the bed.

Upon the plugged end emerging from the water on the north side, it was immediately opened and connected with the main leading to the pumps, to secure it against accidents from floods. There is a contrivance for removing any sand which may accumulate in the pipe. That part which is under water is covered over with stones and gravel, to protect it from injury from passing vessels.

Fig. 1 is a section giving a general view of the relative situations of the well, and the main through the river leading to the pumps.

Fig. 2, a vertical section through the pipe at one of the flexible joints.

Fig. 3, a corresponding outside view.

Fig. 4, ditto plan.

Fig. 5, a cross section of stock-joint and hinge.

Fig. 6, ditto of the pipe and frame.

The demand for water having increased beyond expectation since 1810, (when this work was completed,) a second main of 18 inches diameter, similar in all other respects to the first, has been since added.

ANCIENT STATUES.—No. 3.

DICTIONARY OF TERMS.

Translated and rearranged from the French of the Count de Clairac, Knight of various Orders, Keeper of the First Division of the Royal Museum of Antiquities in the Louvre.

(Concluded from page 435.)

THOSE stones are called *antique* of which the quarries are exhausted, and which are now only to be found in ancient monuments. Among this great number of marbles and of other stones, there are very few which can be determined with certainty from the descriptions given by ancient authors. Most of these stones being only to be obtained from the monuments of Italy, we are often obliged to leave them their Italian names, the number of which, however, the dealers in antique stones have very much increased, by selling as stones of different kinds, specimens which are often only varieties presented by the same block of marble: The Italian edifices which are richest in marbles and other antique stones are, the churches and palaces of Rome, the cathedral of Pisa, St. Mark and some other churches at Venice, the cathedral of Ravenna, that at Florence, as well as the churches of Santa Croce and St. Lawrence in the same city. The palace of Caserta, the Royal Museum of Naples, and La Favorita, are decorated with a great variety of ancient marbles obtained from the excavations at Pompeii, Herculaneum, and Capri. The Royal Museum of the Louvre contains a great number of columns of the rarest and most beautiful ancient marbles, and which are not surpassed by any other collection.* Louis XIV. obtained from Barca, in Cyrenaica, a great quantity of beautiful antique marbles, which he used at Versailles and Trianon.

[We have inserted, among the following, the modern marbles mentioned by M. de Clairac; those are marked as modern, all the others are antique. Al. *Alabaster.* Bas. *Basalt.* Br. *Breccia.* Gr. *Granite.* M. *Marble.*]

AFRICAN BRECCIA. Black ground with spots of deep violet, or bright red and white veined with black. Very beautiful and very rare.

AFRICAN MARBLE. Purple, white and black.—FLOWERY. White, and purple and yellow.

ALABASTER, ORIENTAL. (*Alabastro*, Ital., *Albâtre*, Fr.) *Brown Veined*, wavy, half transparent; called in Italy, *pietra perruchina*, and *alabastro tarturacato.*—*Milk White.* not transparent.—*Transparent White.* Striped with milky and wavy bands.—*Tortoiseshell, tarturacola*, or brown veined. Weight of a foot cube, 181 lbs.

ALABASTER, COTOGNINO. Yellow.

ALABASTER, FLOWERY. White and reddish brown, ribbony or festoony.

ALEPPO BRECCIA. Yellowish green ground, with spots of violet, green, white, yellow mixed with red, veined with pale white. Very rare.

ALET BRECCIA, sometimes called ALEPPO. Modern. Yellow brown, red with gray spots. Found near Aix, in Provence.

ANTIQUE, GRAND. Breccia, black and white very pure, with great spots broken up by zigzag lines. Extremely rare.—LITTLE. With smaller spots, and the black approaching to gray. The quarries of these two breccias, which were supposed to be lost, have been found by M. Layerle Capel, at Aubert, in the department of the Arriege, France.

ARLECCHINO, BR. Resembles Seme Santo, but is of deeper colour.

AZURRO. Italian, the same as *Turchino*, a sky blue.

BARBAZAN BRECCIA. Modern. Formed of black, brown, and white fragments. Very good; much used at Toulouse. There are some fine columns of it in the Louvre. Found near Barbazan, Upper Garonne.

BASALT. *Black*, with large white crystals in the shape of pomegranates. It resembles a lava from Mount Albano. *Black*, with red granitic bands.—*Black grey*, mixed with small pomegranate crystals and little black spots.—*Blackish Grey*, with small white veins and scales.—*Deep Black*, with small shining black spots.—*Flowery Black*, marbled with white, and irregularly wavy. *Green* of very close grain. Another green with small white crystals, very rare. *Occidental* and *Oriental* of a dark gray with small white points. The Occidental is softer than the other. Weight of a foot cube, 210 lbs.

BEAUDEAN BRECCIA. Modern. A magnificent breccia quarried at Beaudean, in the Upper Garonne in France, in close yellow, brown and red fragments. According to M. de Clairac, this is the same as the Caroline Breccia.

BEIREDE MARBLE is a fine marble, with large flakes of dark red, clear red and yellow, sometimes resembling fine Sicily. It comes from the Pyrenees, and was worked by Louis XIV.

BIGIO, Italian for Gray, *vide* GRAY.

BLACK (*nero*, Ital.) ANTIQUE (*Nero Antico*). M. A most beautiful black, without any admixture, probably the marble of Lucullus. It appears that it is still found at Bergama, Carrara, Prato in Tuscany, and near Spa. The Italians call it improperly *paragone.* Weight of a foot cube, 182 lbs.—ANTIQUE SERPENTINE BLACK (*Serpentino nero antico*). *Vide* PORPHYRY and SERPENTINE. — MODERN BLACK. Very fine is obtained from Bergama, Spa, and the Pyrenees at Mount Majou, in the Upper Garonne.

BLUE (*Turchino*, Ital.).—ANTIQUE (*Turchino Antico*). Mar. Slatey grey, with fine and shiny grains. Another with white stripes and waved with slatey blue. *Piccolo Turchino Antico* has very fine grains, and narrower stripes. Weight of a foot cube, 188 lbs.—MODERN. Bright bluish grey, with bands of white or dark grey. Found at Genoa.

BRECCIA. *African, Alet, Barbazan, Beaudean*, see under their respective titles. *Antique, Yellow*, or *Gilt*, red ground, clear and deep yellow spots, veined with red and white. *Grand Antique, Partridge Eye, Peacock's Eye, Penne S. Martin, Persecchino, Polzeverra, Porta Santa, Porphyry, Red, Rose, Seme Santo, Tracagnina, Verde Antique*, see under their respective titles.—*Memphis.* Modern. A violet red, in little grey or white fragments. Quarried in Provence.—*Pall Lumacelle*, a beautiful pure black, irregularly strewed with white shells an inch and more in length, very rare.—*Verde de Paglioco*, or straw green, with greenish and yellow spots. *Verde Sanguino Antico.* Greenish grey, white, red and black spots.—*Violet.* There are several kinds, 1st, a dark violet ground, with large lilac and white spots. Of this superb kind is a beautiful table in the gallery of the Louvre. 2nd, the same colours with small spots. 3rd, with rose spots. Very rare. The *persecchino* may perhaps be taken as another variety. *Vide* also SILICIOUS BRECCIA.

BROCATELLE. A shelly marble; some are breccias, having the appearance of brocade.—GILT. Yellow spots, veined with red, and mixed with white shells. There is a kind of antique yellow, with red veins interspersed with white, which is like the brocatelle.—SPANISH. Modern. Beautiful yellow spots, well marked, bordered with red and violet, veined with white, and containing a few shells. Weight of a foot cube, 189 lbs.

CAMPAN MARBLE. Modern. Found in the valley of Campan, in the Pyrenees. Very beautiful, but not so fine now as when wrought by Louis XIV., some of the blocks of which time are still in the royal stores.—ISABELLA. A rose ground with some red stripes, covered with netty green veins, much crossed, and some white.—RED. A bright red ground, veined with green and white. GREEN.—Clear ground, veined with network of a dark green, some white veins cutting the others. Campan marble proper unites all these three varieties by very large stripes. These marbles are easily affected by exposure to the air. Weight of a foot cube, 190 lbs.

CARNATION. M. A kind of antique yellow approaching a rose colour.

CAROLINE. A modern breccia, exhibited at the Louvre in 1827, supposed by M. de Clairac to be Beaudean breccia, which see.

CARRARA MARBLE. These quarries were wrought about the time of Julius Cæsar, and in them have been found remains of unfinished bas reliefs. The white statuary marble is of a white inclining to blue, of fine and close grain, resembling loaf sugar; but crystals are often found in it which prevent the use of the chisel. The stripes and spots are greyish or greenish; when so striped it is named *Cipolmaccio*, that which is of coarser and harder grain, like salt, is called *Saligno.* Carrara does not take so fine a polish as Parian. It is of this marble that most statues are now made, although there are, in Italy and France, white marbles which approach it in beauty, and might be used in sculpture. Besides white marble, there are others at Carrara of different colours, and which form the upper part of the quarries. Those of Polvaccio almost exhausted, and of Serravezza, are the most celebrated. Weight of a foot cube, 189 lbs.

CASTRACANE. A Lumacelle, dark brown, rose, and with small circular shells of a bright yellow colour. Very rare.

CERVELLATA. M. Saveloy marble, red ground, white and green, with very fine interlaced white veins.

CINNAMON MARBLE. Yellow, something of an antique yellow.

CIPOLAZZO. Striated with white and violet.

CIPOLINACIO. A kind of Carrara marble, white with greyish or greenish spots and bands.

CIPOLINO. Onion marble. Dirty white, striated with large wavy bands, of green more or less dark, arising from talc. It is easily

* Enumeration of some of the articles:—Statues in porphyry, universal breccia and coloured marble, 6; columns 103, viz., porphyry 17, rose granite 24, grey granite 12, universal breccia 4, verd antique 10, Egyptian green 10, marbles, breccias, and oriental alabaster 26.—*Note of Translator.*

affected by air. It appears to be the same as the Carystian marble of the ancients. Statuary Cipolino, like the Pentelican, has narrow veins slightly tinted with green. Weight of a foot cube, 189 lbs.

CORALITIC MARBLE. Supposed to be GRECHETTO and PALOMBINO, which see. Some of the marble so called is like fine ivory.

COTOGNINO ALABASTER. Yellow.

COTONELLO. M. White and bright minium red.

DINAN MARBLE. Modern. Black, used for pavements. Weight of a foot cube, 189 lbs.

FLANDERS MARBLES. Modern. Such as those of St. Ann, gray and white, madreporic. Weight of a foot cube, 195 lbs.

FLOWERY MARBLE. White and red, with twisting spots.

GIALLO. The Italian for yellow, which see.

GRAND ANTIQUE. *Vide* ANTIQUE.

GRANITE (*granito*, Ital.). ORIENTAL. Black spots and white streaks.—*Black and white.* Transparent white ground, with a few opaque white spots; probably the *psaronion* of the ancients.—*Gray*, with black and white transparent spots, others milky and opaque. Weight of a foot cube, 189 lbs.—*Gray*, with little black spots.—*Green*, transparent white ground coloured with green, large oblong black spots.—*Red.* Red or rose, black or white spots, smaller or larger. Of this granite Pompey's pillar is made. Weight of a foot cube, 189 lbs.—*Rose.* With small rose, black and white spots. It seems to be the *Syenite* of the ancients, or perhaps their *Pyrrhopœcile*, and their *Thebaic marble.*—GRANITE OF THE VOSGES. Modern. A mixture of rose, gray, and black, resembling Egyptian rose granite. The *green* has grains of dark green, greenish white and black, very fine.—NANKIN GRANITE. Modern. A kind of Nankin marble, with small lenticular grains.

GRANITELLE, or fine grained granite. It seems that many of the granites which passed for oriental, were obtained from the Isle of Elba, the quarries of which have been worked from a very ancient period.

GRECHETTO. Greek marble. A fine white, very close grain, harder than other white marbles. Corallitic marble is supposed to have been like it.

GREEN (*Verde antico*). Br. A beautiful dark green, with spots of brighter green, pure white and fine black. The colours must be well marked. If the green be of a grayish cast, the stone is not so valuable, Sometimes the edges of the spots are tinged with green. This superb breccia came from Laconia and Thessalonica There is a marble which has a dark green ground, shaded with little bright green and black veins. It has a silky look, and is perhaps the *prasinum* of the aecients.—SUZA GREEN. *Vide* POLZEVERRA.—STRAW GREEN. *Vide* STRAW.—*Verde Sanguino Antico.* Br. Greenish grey, white, red and black spots.—EGYPTIAN GREEN. Modern. Red ground, veined with a dark and clear green, and white net work. Comes from the Genoese coast.—SEA GREEN from Polzeverra, which see.

GRAY ANTIQUE (Bigio Antico). M. A beautiful gray of a bluish pearl tinge. It seems that there were quarries of this at Lesbos.

GRIOTTE. Mar. Modern. Deep red ground, mixed with black and white spirals arising from shells. Worked at Caune, in the department of the Aude in France.—ITALIAN. So named, although it does not come from that country, is of a uniform blood red almost without veins. There are parts which resemble Antique Red, but which are better as they show no white spots. Another Griotte is veined with green. Weight of a foot cube, 189 lbs.

HYMETTUS MARBLE. Greyish white, striated, very hard, *vide* page 434 of this volume.

LANGUEDOC MARBLE, or of SAINTE BAUME. Modern. Fiery red, streaked with with white and grey, madreporic, with regular bands, turning together. Worked at Alais, in the department of the Gard, and at Portes, in that of the Herault, in France. The columns of the arch of the Carrousel and those of the Trianon are made of this marble. It is very much admired even at Carrara, where it is shown as a curiosity, as well as some columns of griotte of Canne, in a small church built during the last few years. Weight of a foot cube, 185 pounds.

LUMACELLE. These are formed of masses of shells, greyish brown, veins of a transparent white. Another with rose veins. Another of a beautiful yellow, with small black shells very close. *Pall Lumacelle. Vide* BRECCIA, *vide* also CASTRACANE.

LUNI MARBLE. Very fine, a milky white, very fine grains, more compact cement than that of ordinary Carrara; takes a fine polish.

MALPEAQUET MARBLE. Modern. A vinous pale red, waved with grey. These very common marbles are most used at Paris.

NANKIN MARBLE. Modern. A shelly marble, ground a rosy or yellowish nankin, with white and bluish spots. Found in 1808 at Mansionx, Upper Garonne, France. When in good condition, they are good and do not spot. One kind is called Nankin Granite, which see.

NERO ANTICO. Italian for Antique Black, which see.

PAGLIOCCO. Italian for Straw colour, which see.

PALOMBINO. Dove marble. A milk white, very fine cement, resembling creamy milk or ivory, without transparency. Supposed to be the Coralitic marble of the ancients.

PARAGONE. A name sometimes given to Antique Black or Nero Antico. Paragone is properly the touchstone basalt.

PARIAN MARBLE. A milk white, sometimes greyish, opaque, its tissue is of grains smaller or larger, which determines two or three varieties; it takes a fine polish; its contexture makes it harder to work than fine Carrara. Weight of a foot cube, 196 lbs.

PARTRIDGE EYE. Br. Black and red, spotted with white.

PAVONAZZO. Italian for Violet, which see.

PEACOCK'S EYE. Br. Red, white and yellow.

PECORELLO. Red and white spots, mixed with white circles.

PENNE ST. MARTIN. Br. Modern. Yellow, white and grey, very fine. Quarried at St. Beat, Upper Garonne in the Pyrenees, worked by the Romans, and also at present. From this quarry columns 40 or 50 feet high may be obtained.

PENTELICAN MARBLE. A yellowish white, close grained, having other striæ or greenish layers which cause it to peel off in the air. Much used by the ancients.

PERSECCHINO. Peach blossom Breccia. Very fine with large white, red and rose spots. There is a variety with small spots.

PIETRA FRUCTICULOSA. A silicious breccia or pudding stone, composed of round yellow and red pebbles, mixed with black dendrites.

PIETRA SANTA. M. Whitish and rosy yellow, with very small white veins and very compact.

POLZEVERRA. Br. Suza Green. Resembles Antique Green or Verde Antique, but is not so fine nor so much esteemed. There is a modern Sea Green Polzeverra, with a deep dark green ground, with wavy bands and network of a clear green, mixed with white filaments.

PORPHYRY. *Alabanda*, deep brownish red, liver colour, oblong green spots.—*Black.* There is also a black marble of this name. Black ground with white spots.—*Serpentino nero antico, vide* SERPENTINE.—*Breccia Porphyry.* This porphyry is very fine, and unites in itself almost all the kinds scattered over a brownish red ground. —*Brownish Black Ground.* Greenish spots.—*Green.* Greenish ground, mixed with white and black.—*Deep Green Ground.* Oblong clear green spots.—*Deep Green.* White spots.—*Deep Green Ground.* Black spots.—*Clear Green Ground.* Yellowish with black spots.—*Green*, properly so called, deep blackish green ground, sometimes quite clear, white, oblong, irregular spots. The ancients called *ophites* some of these porphyries with a green or black ground.—*Very Deep Green.* Like jasper, oblong white spots larger than those of black porphyry, and smaller than those of black serpentine.—*Deep Green Ground.* A kind of jasper, with round oblong white spots.—*Very deep Green Ground.* Large white irregular spots.—*Flowery Green.* Deep green with small irregular white spots, interlaced like worms.—*Red Ground.* Small and oblong, covered with black and white spots. Perhaps the *leptosephes* of the ancients.—*Thebaid*, red ground, with yellow spots. Weight of a foot cube of green porphyry, 230 lbs. Red porphyry, 196 lbs.

PORPORINO. Italian for purple.

PORTA SANTA. A marble breccia, so named, because used for a gate of St. Peter's at Rome.—FLOWERED PORTA SANTA is white or grey, bluish, with purplish spots.—PORTA SANTA NOT FLOWERED is a lreca red and white.

PORTO VENERE, or ANTIQUE PORTOR. M. Black, veined with yellow. The colours should be well marked.—MODERN. M. Black, veined with yellow and a little white. From Carrara in Italy, and from St. Maximin, near Toulon, in France.

PURICHIELLO. Red and white.

PURPLE.—*Porporino*, Italian.

RED. *Rosso Antico.* M. That of a fine quality should be of a deep red bullock's blood colour, uniform, without black or white veins; the grain is very fine and very close, and takes a fine polish. In the cement can be seen extremely small white points; when they are larger and like sand they injure the Antique Red, and render it difficult to work. It is not very hard, but uses the tools like a whetstone for which purpose the ancients used it; it is very rarely found in large pieces, and is supposed to have been brought from Egypt. ANNELATO, red spotted with white.—BRECCIA ANTIQUE RED. Deep red with clear spots.

REZZIATO. A kind of yellow marble with white net work.

ROSE, ANTIQUE ROSE BRECCIA. Clear red ground with little spots of rose and black, others white. Very rare.

ROSSO ANTICO, *vide* RED.

SAINTE BEAUME, *vide* LANGUEDOC.

SALIGNO. A kind of white Carrara marble, so called because it is of a coarse hard grain, like salt.

SAVELOY MARBLE, *vide* CERVELLATA.

SEME SANTO, or VIRGIN BRECCIA. Very small red, chocolate, brown, bluish, white and yellowish angulous fragments. It is very rare, and is found in small fragments at Pompeii.—SEME SANTO DE SETTE BASI formed of fragments of seven colours.

SERPENTINE. A Porphyry. This stone is sometimes called Ophite. Green ground, with small yellow or yellowish spots in long squares and in crosses. There is some with a brown black ground and white spots.—SERPENTINO NERO ANTICO. Black ground, large oblong black spots.

SERPENTELLO, SERPETRELLO and SERPARELLO. M. White, with little tortuous red rays or streaks.

SERRANCOLIN. M. Modern. Straight bands and in great fragments, bluish grey, rosy, deep red and yellowish. Extracted from the Pyrenees, the same block of this fine marble often presents great varieties.

SETTE BASI. M. White veined with red, and mixed with several other colours.—SEME SANTO DE SETTE BASI. Br. formed of fragments of seven colours.

SILICIOUS BRECCIA. *Universal or Egyptian Breccia.* A mixture of pebbles, porphyry and granite of all colours, particularly green, yellow and reddish. This fine breccia extremely hard, is very rare. *Pietra Fructiculosa*, which see.

STATUARY MARBLE. *Marmore Statuario Antico* of the Italians resembles Parian, but it is translucent, and has some relation to the phengite of the ancients.—*White Statuary.* Modern. An immense quantity in very large blocks, and of very good quality is found in the mountains of Rapp, at the gate of St. Beat, on the Garonne, some leagues from St. Gaudens, in the Upper Garonne. It has large grains like some kinds of Parian. The first quality of a mild white may be easily worked any way. In the exhibition at the Louvre in 1827, were some statues of it very well executed. That of Henry IV. when a child, by M. Bosio, is of second rate St. Beat marble This beautiful marble used by some of the French sculptors, was discovered by M. Layerle Capel, one of the principal proprietors of marble quarries in the Pyrenees, and who has found out most of the new quaries. The statuary marble of Sost, five leagues from St. Beat, in the valley of Barrousse, is a very fine white, and very fine grain, but it is subject to a number of threads, which prevents its being wrought in large blocks. Much harder than that of St. Beat, it is dry, brittle, scales off, and often contains rock crystals, which make it hard to work, There are other statuary marbles in the south of France, even in the department of the Loire, but they are not worked. The white marble of Loubie Soubiran in the department of the Lower Pyrenees, near Gave, is of a greyish white, and fine grain, works well, but is in layers, and peels off.

STRAW GREEN BRECCIA. *Verde de Pagliocco.* Br. Straw green with greenish and yellow spots.—STRAW YELLOW. Mar. A very clear antique yellow.

SYENITE. Rose Oriental Granite seems to be the Syenite of the ancients. It has little spots of rose, white and black.

TARTARUCATO. A kind of brown veined, undulated half transparent alabaster, so called because it is like tortoiseshell.

TRACAGNINA. Br. The same as Arlecchino, a kind of Seme Santo but of darker colours.

TURCHINO. Italian for Blue, which see.

UNIVERSAL BRECCIA. *Vide* BRECCIA EGYPTIAN.

VENTURINO. M. Red and white.

VERDE ANTICO. Italian for Green, which see.

VIOLET. (*Pavonazzo*, Italian.) Mar. White with violet spots and veins. Perhaps the Synnadic marble of the ancients.

VIRGIN BRECCIA. *Vide* SEME SANTO.

VOLTERRA MARBLE. Gypseous. Milk white colour, transparent, very soft, may be scratched with the nail, and does not effervesce with nitric acid. Specific weight of a pound cube, 154 lbs.

VOLTRI GREEN MARBLE. Modern. Like Egyptian Green, but shells off in the open air.

WEIGHTS. M. Brard, in his *Traite des Pierres Precieuses*, gives the following as the specific weight of a cubic foot of various stones.

	lbs.		lbs.
Volcanic Basalt	210	St. Anne's marble	195
Verde Antico Porphyry	203	Giallo Antico marble	191
Breccia marble of the Tarentuise	200	Campan marble	190
Rosso Antico, Egyptian Porphyry	196	Red Egyptian Granite, or Pompey's column	189
White Parian marble	193	Ancient Grey Granite	189
		Black Dinan Marble	189

	lbs.		lbs.
Spanish Brelloet ca	189	St. Baume Marble	185
White Carrara Marble	189	Nero Antico Marble	182
Griotte Marble	189	Calcareous Alabaster	181
Cipolino Antico	189	Gypseous Alabasters	154
Turquino Marble	188		

These weights give 197·4 as the mean weight of a cubic foot of porphyry, granite and basalt, and 189·33 for that of marbles.

YELLOW. *Giallo Antico.* Antique Yellow. Mar. A fine yellow, of uniform colour, with a few slight violet veins. There is some quite clear. That called *Carnation* has a rosy hue. Antique Yellow is one of the rarest marbles, and is supposed to have come from Macedonia, there are several varieties of it, and it was much used by the Emperor Adrian in his magnificent villa.—BRECCIA YELLOW, of clear colour, spotted with deep yellow.—STRAW YELLOW (*Pagliocco*). Very clear. —RINGED YELLOW (*Annellato*). Yellow and black circles.—YELLOW and BLACK, with large spots.—YELLOW, with net work (*reszialo*).— YELLOW with red veins, interspersed with black, a sort of brocatelle. Weight of a foot cube, 191 lbs.

COMPETITION DESIGNS.

Sir—Towards the close of last year, an advertisement was published in several country papers, addressed "To Architects," for a new Athenæum at Sunderland, and the plans directed to be sent to the chairman on the 20th February last, a young architect, who was a candidate, applied for information, composed and completed a design and estimate, and transmitted them to the party: in the May following, not having any tidings of his design, he wrote to the party, on hearing that a *builder* was the successful candidate, who was proceeding with the working plans and specification; after waiting a few days he received an answer, of which the following is a copy:—

"To J.B.C., Architect.

In consequence of the committee of the Sunderland Athenæum requiring the architect whose plan was selected, to satisfy them that it could be effected for 3000*l*., they have thought it best to retain thy plan along with two others, until they know the result.

I am, respectfully,
For EDWARD BACKHOUSE,
E. BACKHOUSE, Jun."

Leeds.

Now it appears by notice in the papers, that the first stone is to be laid immediately, and yet, for some purpose or other, the plans are retained, and very possibly the two others—yes, retained nine months to *satisfy a committee;* some years ago I was a candidate for a public building in the same neighbourhood, and had my plans returned within *three* months, and during the last month I had an opportunity for the first time of inspecting the building erected after the design, therefore selected, and could scarcely imagine, that it was the institution competed for; if, as in the opinion of the *publisher* of a *Guide to Modern Athens*, London street architecture is very inferior, I wonder at what rate of discount this building would stand; in another case I had my plans soiled and torn after four months' retention, which so disgusted me, that I have never since ventured on a public competition, although I had been successful in several former instances. For a public building in Leeds some years back, five architects were applied to, and *paid* for their plans, though the result in that case was not satisfactory, as none of the competitors were employed, but canvassing and jobbing were resorted to, and a worse design than any of the five was taken, furnished by a stranger, by way of *easing party spirit:* the committee *measured* all the rooms, passages, holes and corners, entresols, &c., *added all the lengths together*, and *all the breadths*, and thereby give some *acres* of floorboarding! It was a most irregular, filled an irregular piece of ground, and was supposed to give quantity rather than quality. In this Sunderland case, for which the young architect competed, there appears something so very indecorous, that it ought to be recorded among the many instances of modern *deference, paid to architects*, of these days of the *march of intellect.* Apologising for this trespass on your time, I beg to subscribe myself,

Your very faithful servant,
DIONYSIUS.

CANDIDUS'S NOTE-BOOK.
FASCICULUS XI.

I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please.

I. And I may surely blow upon one of the newspaper gentry, even at the risk of being blown up by some of them in return. "Covent Garden Theatre," says the oracle of the Sunday Times, "is a much finer edifice than Drury Lane, having been designed after the 'Temple of Diana at Athens'"! Still, it is possible that he meant the Parthenon all the while, Diana having the reputation of being as good a *Parthene* as Pallas Athene herself, notwithstanding the bit of poetical scandal about "chaste Dian" and Master Endymion. But if the erudite newspaper critic imagines, that Covent Garden Theatre bears any resemblance in its design, either to the Parthenon at Athens, or the temple of Diana at Ephesus, or Diana anywhere else, he is gifted with a very powerful imagination indeed. After all, the chief wonder is, not that a newspaper writer should blunder after that egregious fashion, even in this march-of-intellect age, but that the enlightened public should be so much in the dark as to swallow blunders which a school-boy could correct. It is greatly to be feared that, without libelling that very respectable personage the "Public," we may give it credit for a vast amount of ignorance on almost every thing connected with architecture, for on scarcely any other subject do we hear so much nonsense and absurdity uttered so fearlessly and with such impunity.

II. If our designers of shop-fronts do not display so much invention as they might do, they certainly have not that excuse for not indulging in it, which their *betters* avail themselves of; because they may experimentalize without risk of incurring reproach on the score of licentiousness. Hardly worth while is it to be correct, where correctness is attended with no merit of any kind; and most assuredly a miniature facsimile of some ancient example from Stuart, applied as an order to the frontispiece of a shop, can produce no effect in itself, whereas an original composition for the same purpose would at all events be less stale; and if clever and tasteful into the bargain, would have value as a specimen, and might, should it be found worthy of such distinction, become a model for something of the kind upon a larger and more satisfactory scale. Whatever else we choose to impute it to, our excessive shyness of any attempt at originality, cannot be attributed to our aversion to novelty, because, in our eagerness for it, we take a sudden jump from one favourite style to another diametrically opposite to it, and make no scruple of adopting without hesitation, the most preposterous architectural fashions, provided only we have due authority for them. While to innovate upon either Grecian or Gothic, no matter in what way or with what intention, would be reprobated as little less than sacrilegious, we may, without the least offence, abandon both for the Elizabethan, or any other tasteless and mongrel fashion, provided that we then also adhere strictly to precedent, and not sacrifice one iota of its bad taste and deformity. Should any one, instead of closely following some one of the various examples of Grecian Ionic capitals, venture to compose something different, yet with kindred feeling and spirit, he would greatly *discompose* all his brethren, to whose astonishment at his presumption and rashness there would be no end. Yet should it so please him, he might copy the poorest—or, we might say the best, for almost the best are poor enough, in all conscience—of the Roman and Italian specimens of the same kind, without incurring censure. His taste, indeed, might not be applauded by every one; but his orthodoxy could be questioned by no one. And truly, let the taste so shown be as bad as it may, he is not chargeable with it—it is none of his invention; he has taken it just as he found it, which is, surely, a very fair and reasonable excuse, and therefore I wonder that it should never be made use of.

III. Of what use, I should like to know, have been such works as Piranesi's Magnificenza di Roma, since, for any ideas they appear to have furnished, they might as well have been flung into the sea, or committed to the flames. Though we there meet with much to convince us that there was infinitely more variety in ancient Roman architecture than existing monuments of it show, we have not cared to turn it to any account, but have continued to plod on with the old and limited stock of ideas, endeavouring to reduce all that appertains to detail, to as few forms and as mechanical a system as possible, instead of studying to enrich the language of the art, by adding to its synonymous expressions, in order to avoid the perpetual and wearisome repetition of the same forms on every occasion.

IV. That the design for the Royal Exchange which obtained the first premium is not to be executed, is the most satisfactory circumstance in all the proceedings of the competition; nevertheless, it is by no means very satisfactory and intelligible in itself, how such very marked distinction came to be made in favour of that particular design. Neither the report of the three architects appointed by the committee, nor that of the committee itself, affords us the slightest information, nor helps us even to a conjecture. Surely the reasons for such preference ought to have been most explicitly stated by the first-mentioned, if merely in justice to themselves, because at present they seem to have been guided only by caprice—certainly not by taste, for in that respect, No. 36 was far from pre-eminent It might possibly fulfil the conditions—such as they were—imposed by the committee, more exactly than any other design did. As to that, I cannot speak, for, thanks to the manner in which the exhibition was managed, and the hurry with which it was closed, it was impossible to study either that or any other design sufficiently to judge of it in all its bearings, unless attention had been confined to a single set of drawings. But it seems to me that, wanting one great pre-requisite, namely, originality and grandeur, it wanted what was most of all essential. Minor defects as to arrangement and accommodation might be overcome, got rid of by after study; but where the original idea is poor, the general taste defective, the case is without remedy. Where there exists want of conception at first, it can be supplied by no revision or correction, by nothing short of abandoning the first scheme and beginning entirely afresh. It does not appear to me the wisest way, either in this or any other competition, to attach any merit to a mere literal compliance with the terms of the instructions issued. The great point is to obtain an idea worthy of being adopted, a satisfactory ground-work and basis of a design, leaving the author of it to correct those particulars in which it may be considered defective or objectionable. If understood beforehand, there would not be the slightest unfairness in this, because the successful competitor would have earned for himself a privilege that would else have fallen to the lot of another. By this means we should have a chance of obtaining very superior buildings to what we now do; because opportunity would then be afforded for thoroughly revising and correcting the whole, and perfecting it in every respect, Not to allow this to be done, is not to allow an architect to bestow all the study upon his design that he may be capable and willing to do; but to confine him to what, though shown in finished drawings, may be little more than a first sketch of his ideas for the subject, which he would be able very greatly to improve upon, were he allowed to make such alterations as a mature re-consideration of it might suggest.

ON THE PRIMING OF LOCOMOTIVE BOILERS.

Experiments on the quantity of water in the liquid state, mechanically carried over with the steam during the working of locomotives; by M. De Pambour.

There exists in locomotives, and perhaps more or less in all other steam engines, a loss which has not hitherto been measured, and which is nevertheless very important. It consists in a very considerable quantity of water in the liquid state mechanically mixed with the steam, and carried over with it into the cylinders. To account for the production of this effect it is sufficient to observe the enormous volumes of water which are continually carried away by the wind, and held in suspension in the air in the form of clouds. Since also the steam formed in the boiler of a high pressure engine has a much greater density than the air, and instead of touching only the surface of the liquid, it is evolved in the very midst of the water, it is not surprising that it should be able to draw along with it in its motion a considerable mass of water, and this effect must be produced during the whole time the engine is in action.

This loss must be much greater in locomotives than in other steam engines, on account of the continual shocks which they receive in their motion, and of the slight elevation of the orifice of the steam pipe above the level of the water, of the small capacity of the steam chest, and lastly on account of the enormous rapidity with which the steam is evolved from the water in the boiler. In order to obtain an evaluation of the quantity of water thus carried over with the steam, we placed the engines submitted to experiment on inclined planes, under such circumstances that the pressure of the steam in the cylinder was sensibly equal to that in the boiler, and we then compared their actual speed with that which they would have attained, if the whole of the water expended by the engine had been really transformed into steam. This calculation is very easy: as we know by observation the velocity of the engine, we have the number of revolutions of the wheel, and consequently the number of times the cylinders are filled with steam in an hour; and as we also know the elastic force of this steam, we can deduce from it the corresponding quantity of water. Comparing then this quantity of water which is effective with the total quantity expended by the boiler, we find the quantity which has passed over with the steam in the liquid form. In this calculation we take account of the quantity of steam required to fill the waste space at each end of the cylinder, called the *clearance*, and also of the reduction of vaporization caused by the slowness of the motion in ascending inclined planes, and of the loss by the safety valves. For this purpose we make use of the results furnished by special experiments, whence we deduce that, by reason of the action of the blast pipe, the vaporization of locomotives varies as the fourth root of their velocity, and that the loss through the safety valves in ascending planes amounts on an average to 0·12 of the total vaporization.

The results of our experiments are contained in the following table. It should be remarked that if, in any one of these experiments we have erred in admitting the pressure in the cylinder to have been the same as in the boiler, it will follow that the quantity of water which passed over in the liquid state with the steam in that experiment was more considerable than our determination makes it. We are therefore sure that our results are not exaggerated.

It should also be remarked that the loss here observed cannot be attributed to a partial condensation of the steam in the steam pipes and cylinders, since these are placed in the boiler itself and in the smoke-box, where they are constantly in contact with the flame, which renders this supposition inadmissible.

TABLE.

Experiments on the quantity of water carried over with the steam in the liquid state into the cylinders of locomotives.

Name of the engine.	Diameter of the cylinder.	Stroke of the piston.	Diameter of the wheel.	Total pressure in the boiler.	Speed of the engine in miles per hour.	Total vaporization per hour in the boiler. Mean during the experiment.	Total vaporization per hour in the boiler. During the ascent, after deducting the loss through the valves.	Effective vaporization.	Ratio of the effective to the total vaporization after deducting the loss through the valves.
	inches.	inches.	feet.	lbs. per sq. in.	miles.	cubic feet.	cubic feet.	cubic feet.	
Star	14	12	5	64·3	8·57	68·79	53·12	29·53	0·56
„	„	„	„	65·3	6·26	68·79	49·11	21·87	0·45
Vesta	11·125	16	„	69·7	14·11	65·00	48·53	44·05	0·91
Fury	11	„	„	80·2	6·31	54·45	36·06	21·90	0·61
Leeds	„	„	„	63·2	10·00	68·82	49·73	27·92	0·56
Vulcan	„	„	„	72·2	11·42	60·60	44·77	35·91	0·80
Atlas	12	„	„	69·7	8·00	43·81	37·44	29·06	0·78
„	„	„	„	65·7	7·50	48·21	35·36	25·78	0·73
								Mean..........	0·68

From these experiments we learn that the quantity of water in the liquid state carried over with the steam into the cylinders of locomotives amounts on an average to 0·32 of the total vaporization of the boiler, reckoned after deducting the loss through the safety valves.

This determination suits the mean of the engines we submitted to experiment, but we shall observe that the quantity of water which passes over without being vaporized must necessarily vary in different engines, since it depends on the particular construction of the boiler, and especially on the capacity of the steam chest. If this is very small, no more, for example, than 10 times the capacity of the cylinder, a tenth part of the steam already formed will pass into the cylinder at each stroke of the piston, and thus the density of the remaining steam will be suddenly reduced to nine-tenths of what it was previously. This great change of density will immediately draw from the liquid a new quantity of steam to supply the deficiency; but it is evident that this new quantity of steam will be evolved from the liquid with so much the greater violence, and will consequently carry with it so much the more of the liquid, as the medium into which it is precipitated is more rarefied. If then the steam chest were made to contain 100 cylinders full, instead of 10, as the difference of density produced at each stroke would be only 0·01, the quantity of water carried over with the steam would be so much less. Also, if the end of the steam pipe is very little elevated above the level of the water in the boiler, or if it is very large, the water will be more easily carried as far as the entrance of the pipe, and will be admitted into it in greater abundance.

The quantity of water carried along with the steam must therefore vary according to the construction of the boilers. But it is also influenced by circumstances independent of it, such as the intensity of the fire and the dirtiness of the water: the intensity of the fire, because it produces in the boiler a more or less violent current of steam in the boiler for the quantity of water which it contains, and the dirtiness of the water, in consequence of the scum which it forms on the surface.

The carrying over of water with the steam is produced, as we see, without the appearance of any external sign, because the water mixed with the steam is dissipated in the air with it. But there are moments when this effect is so violent, that it manifests itself externally in the form of an abundant fall of rain from the top of the funnel. The engine is then said to *prime;* and this takes place especially when the boiler is too full, because then the steam chest is by so much reduced in capacity, and the level of the water at the same time approaches nearer to the entrance of the steam pipe.

The extent of the loss which was the subject of the preceding experiments, explains how it is that some boilers expend water so rapidly that it is impossible to keep them full, even at a very moderate speed, and how it sometimes happens that, by merely changing the steam dome, a reduction of nearly 25 per cent. of the expense of fuel has been produced.

(We regret to find that we cannot put much confidence in the results of the preceding experiments for several reasons: in the first place, M. de Pambour appears to have made no allowance for leakages arising from defects in the pipes and joints, so common in locomotive boilers; secondly, it seems highly probable that the loss through the safety valves was very different in the various engines submitted to experiment, in which case a considerable error might be committed by estimating it in all the experiments at 0·12 of the total amount of steam generated. In the same manner the mean, 0·68, of the results in the table can have no value whatever, being the average of ratios varying from 0·45 to 0·91; which shows that the difference of circumstances in the various experiments was such as to occasion an essential difference in the results.—*Editor C. E. and A. Journal.*)

Effects of Lightning on Ship's Masts.—M. Sellier has reported to the Academy of Sciences in favour of Captain Arrowsmith's plan, as superior to the application of conductors. Captain Arrowsmith's system is to paint the masts, yards, and trucks of the top masts and flagstaffs with black, and on the approach of a storm to strike the small white sails. M. Arago dissented from these conclusions.

Antiquities.—In digging under the foundation of an old house in Catherine-street, Exeter, last week, twelve old flat bottles or flagons, evidently of the period of the 15th century, several small vessels of earthenware, a curious cup or tankard, and the seal of the Court nay family were discovered. This seal is of very large dimensions, bearing the arms of Courtenay and Talbot emblazoned together, and the legend. *Anne Courtenay Comitissæ Domina Sigillum*, the Lady who owned it being the wife of the 4th Earl of Devon, and died about 1440.—*Bristol Mercury.*

ON THE ELASTIC FORCE OF STEAM.

Observations of M. Arago *on a Memoir by* Mr. Farey, *on the elastic force of Steam, published in the first volume of the "Transactions of the Institution of Civil Engineers."*

(From the correspondence of the Academie des Siences, *at Paris.)*

In presenting to the Academy the first volume of the *Transactions* of a society whose labours may be expected to exercise a beneficial influence on the progress of the art of the engineer, M. Arago expresses his regret at having found therein a memoir by Mr. Farey, which certainly does not deserve a place in so useful a collection. This memoir is a bitter and unfounded criticism on a work of M.M. Dulong and Arago, undertaken by order of the Academy, and honoured with its approbation. M. Dulong had knowledge of Mr. Farey's memoir a short time before his death; he was very much grieved, and proposed to refute it. What my illustrious friend was unable to do, said M. Arago, I shall now attempt. The task will, however, not be difficult; it will suffice to compare the following quotations from the two works:—

"The principal object of the present communication," says Mr. Farey, "is to show the coincidence between Mr. Southern's scale *(for the elastic force of steam corresponding to different degrees of the thermometer,)* and that of a new series of experiments made in Paris in 1829, by a Committee of the Academy of Sciences."

"Another object of the communication is to put on record, in the papers of the Institution, a memorial of the fair claim of our countryman, Mr. Southern, to the merit of priority in accurate determination of this law, in opposition to the *unfounded assertion* of the French author (M. Dulong) who has just published the new experiments, according to which *the previous determinations in England were erroneous.* Mr. Southern's determination is not mentioned in this sweeping condemnation. * * *

" * * At four atmospheres Mr. Southern found the temperature 293·9 degrees, and the academicians 293·7. This last is not an accidental coincidence, but an adoption of Mr. Southern's scale, through Mr. Tredgold, *though not acknowledged as such.*"

"In adopting this formula from Mr. Tredgold, (who quotes Mr. Southern's experiments, and takes them as his basis,) the French academicians could not have been ignorant of Mr. Southern's determinations, nor of their accuracy * * *

"*Under these circumstances, it was not candid that all mention of Mr. Southern's determinations should have been suppressed.* * *

" * * It is to be remarked that the elasticities were measured by the French academicians by the compression of air included in a manometer, and not by a direct measure of a column of mercury, or a loaded safety valve; whereas Mr. Southern used both those means, and employed very correct thermometers, and therefore his scale is of as much authenticity as that of the French. * *

" * * As there is no certainty in the exactitude of either temperatures or elasticities when so great as 438 degrees and 24 atmospheres, it is not advisable to adopt a new law of progression for the sake of reconciling differences of 2½ degrees from uncertain observations."

The imputations of Mr. Farey, said M. Arago after having made the above quotations, are categorical and numerous. In order to refute them, I shall content myself with quoting several passages from the memoir criticized.

The author makes M. Dulong assert that the English determinations, previous to the experiments which he made with M. Arago, *were inexact.* The following is the passage in the Report to the Academy to which Mr. Farey alludes:—

"La science ne possédait que des mésures assez discordantes *audessous de huit atmosphères*, et pour des pressions plus fortes, absolument aucun résultat d'expériences directes."*

Now in this passage there is no mention either of English, French, or German. It is merely stated that the results of the known experiments were *discordant*, and that it was difficult to choose; and this is an incontestable truth.

The great crime of the French Academicians, in the eyes of Mr. Farey, is to have suppressed all mention of Mr. Southern's determinations. It is in this that they have been wanting in candour.

To show how we have suppressed all mention, and how we have been wanting in candour; the following is a passage of the Memoir. The reader will hardly believe his eyes:—

"*Les determinations seules de Southern et de Taylor* offrent avec celles-ci (les déterminations Françaises), une conformité d'autant plus frappante qu'elles ont été fournies par un mode d'observation totalement différent. A l'époque où nous avons *calculé* la table insérée au rapport provisoire cité plus haut, nous les considerions déjà comme les plus vraisemblables; aussi ne trouvera-t-on entre cette table et celle que nous allons donner, que des différences presqu'insignificantes, dans la partie de l'échelle qui leur est commune."—*(Mém. de l'Acad. de Sciences*, t. x, p, 222.)*

This is not all. Mr. Southern has been quoted, not only for his experiments, but also for a simple formula of interpolation, which the following extract will prove:—

M. Young parait être le premier qui ait employé le mode d'interpolation, qui consiste à représenter les forces élastiques de la vapeur, par une certaine puissance de la temperature augmentée d'un nombre constant. M. Young avait trouvé que l'exposant 7 satisfaisait aux expériences connues a l'époque de la publication de son ouvrage. M. Creighton prit l'exposant 6, qui lui parut mieux s'accorder avec les résultats du Dr. Ure. Mr. Southern adopta le nombre 5·13, qu'il détermina sans doute par têtonnement. *Mr. Tredgold* rétablit l'exposant de Creighton, en changeant le coefficient, &c.—*(Mém. de l'Acad.* t. x, p. 230.) †

It is unpleasant to have always to answer by formal denials; but is it my fault? Mr. Farey says that for four atmospheres we took Mr. Southern's determination, *without acknowledging it.* This is not the fact; our observations embrace the interval between one and 24 atmospheres, it was therefore unnecessary for us to borrow anything from any other author; but, as our observations did not correspond to round numbers of atmospheres, we could not do otherwise, in constructing the table, than make the interpolation by means of the formula which gave the nearest approximation to our results. This formula was Mr. Tredgold's. M. Dulong stated thus much, and he had nothing more to *acknowledge.*

Once in the vein of detraction, Mr. Farey has not confined himself to the historical part of the Report. The experiments of the Commission, examined in their details, appear to him defective. And is it not true that MM. Dulong and Arago did indeed make use of a manometer?

But what would have become of this pretended difficulty, if Mr. Farey had added that the manometer was graduated directly, by mercurial columns which attained a height of 20 metres (nearly 66 feet)? Can the English critic have mistaken the object of the Academicians? The reader may judge by the following extract from page 196 of the Memoir:

"(La Commission) s'est déterminée à recourir au moyen le plus pénible, mais aussi le plus exact, la mésure directe de la colonne de mercure capable de faire équilibre á l'élasticité de la vapeur!" ‡

Mr. Farey prefers the determinations of Mr. Southern to those of M.M. Dulong and Arago, which he is certainly entitled to do as far as regards the numbers comprised between 0 and 8 atmospheres; but beyond this he must, *nolens volens*, refer to the French measures, since our critic's compatriots have not determined any elastic force above eight atmospheres. M. Arago remarked that the difficulties and extreme danger of the experiments commence at 10 atmospheres, and that the Commission carried theirs as far as 24.

Mr. Farey prefers the English determinations, because Mr. Southern employed *very exact thermometers.* What then? Can it be supposed that a Commission, prosecuting its researches under the auspices of the Academy, a Commission which counted among its members, which had for reporter one of the two authors of the excellent memoir, now become classic, *On the communication of Heat*, can it be supposed that such a Commission should not have used *very exact thermometers?* Such doubts, when they are gratuitous, when they are not founded on

* Science possessed but discordant measures *below eight atmospheres*, and for greater elasticities absolutely no result of direct experiment.

* *The determinations of Southern and Taylor alone* shew a conformity with these (the French determinations) by so much the more striking, as they were furnished by a totally different mode of observation. At the time when we *calculated* the table which was inserted in the provisional report quoted above, we already considered them as the most probable; and the differences between that table and the one we are about to give, will be found to be very inconsiderable in the part of the scale which is common to both.

† Mr. Young appears to have been the first who made use of the method of interpolation, which consists in representing the elastic force of steam by a certain power of the temperature augmented by a constant number. Mr. Young had found that the index 7 made the results coincide with the experiments which were known at the time his work was published. Mr. Creighton took the index 6, which seemed to him to agree better with Dr. Ure's results. Mr. Southern adopted the number 5·13, which he no doubt determined by *tâtonnement.* Mr. Tredgold resumed Creighton's index, and changed the coefficient, &c.

‡ (The Commission) resolved to have recourse to the most laborious, but at the same time the most exact method; the direct measure of the column of mercury capable of supporting the pressure of the steam!

any discussion of the experiments of the Commission of the Academy, could not be designated here as they deserve. We shall therefore content ourselves with confidently submitting the preceding facts and reflections to every impartial man, and especially to the chief part of the members of the honourable *Institution of Civil Engineers of Great Britain.*

COUNTER REMARKS.

Sir—It appears to me that the "Catholic" whose letter you have inserted at page 439, is a bit of a Jesuit, since, if he is really of opinion that nothing at all approaching to religious controversy ought to be mixed up with architectural topics, he should have reprimanded his brother Catholic, who first set the example, and thereby rendered counter remarks almost unavoidable on the part of others. Yet though there was nothing improper in Mr. Welby Pugin's sneering at and calumniating the Protestant church, it is now highly so, forsooth, in Mr. Habershon, or any one else, to make any remarks to the disadvantage of the Romish church! The plain meaning of which is, that it was all very fair for Protestants to be bullied by Mr. Pugin, but if they presume to open their mouths in return, then an architectural publication "is not a fit vehicle for religious controversy." How particularly modest and consistent!

Pray, has either Mr. Pugin or the "Catholic," seen a publication by Dr. Gruneisen that has recently been published in Germany, under the title of "De Protestantismo Artibus haud Infesto"? It would be worth their attention, and also that of the Protestants themselves of this country, more especially our church commissioners, for the writer proves very satisfactorily that the early Reformers were by no means hostile to the admission of painting and other decoration in churches; in proof of which he quotes some very strong passages from the writings of Zuinglius and Calvin. And, indeed, if we tolerate illustrated and pictorial bibles, it does seem rather absurd to affect to be scandalized at similar subjects being represented on the walls of churches, or to consider painting almost as an alliance with Popery, as if pictures and no pictures constituted the essential difference between the church of Rome and that of England.

So much for the "Catholic," and "religious controversy." Let me now comment upon the paragraph signed B.A. page 446, the writer of which seems to be of opinion that the recent buildings at Munich have been praised far beyond their due, and who is therefore not likely to approve of the article headed "Architecture of Munich." However much in the right he may be in the estimate he has formed of the buildings themselves, he is very much in the wrong if he supposes that the reviewer in the Foreign Quarterly is the person who has chiefly extolled them beyond their merits. To be convinced of this, he has only to look into the second volume of Count Raczynski's splendid work, "Histoire de l'Art Moderne en Allemagne," to discover that other persons besides reviewers have the temerity to admire what such men as Klenze, as Gärtner, and Ohlmüller have done at Munich. Of the Gothic church by the last-mentioned the Count speaks in terms of unqualified admiration, and he professes to be charmed by the singular yet captivating style of Gärtner;—and to judge from some specimens of detail given in the work, the last justly merits all the commendation bestowed upon him. I very much question whether any of our architects have the ability to compose, or the courage afterwards to execute, such an original composition as a capital there shown, from the new Library at Munich. In regard to Klenze, the Count is somewhat more measured in his praise, for he objects to his taste in many instances, but he brings forwards Schinckel's testimony in favour of the Pinacotheca; and that testimony certainly says a very great deal indeed, because there is no class of men who are less addicted to the foible of exaggerating the merits of each other's works, than architects; at any rate, in this country they cannot be accused of evincing much cordial admiration of their rivals.

Nemo.

Terrestrial Magnetism.—M. E. Capucci, Director of the Observatory at Naples, has reported that he has determined, by observations with Gambey's instruments, that after the eruption of Vesuvius on the 1st of January last, that *the dip of the needle suddenly diminished half a degree at least.*

Fossil Remains.—M. Duval has presented to the Academy of Sciences some fossil remains of mammifers found in an osseous breccia in a mountain called the *Marbriere*, near Grasse, in the department of the Var. This breccia is found five miles from the sea-shore, and about 500 yards above its level, in calcareous marbles forming the upper layer of the chalk of that district.

BRITISH MUSEUM.—No. IV.

(*From the Times.*)

The Ægina Marbles.

In the Phigalian room of the British Museum, against the southern wall, a pediment has recently been erected, corresponding with that opposite, which contains 11 of the casts from the Ægina statues, an account of which some time since appeared in this Journal.* On this we are about to describe are placed five more, which were brought from the ruins of the same temple of Jupiter Panhelleneus, in the island of Ægina. These five statues were all that were found belonging to the eastern front sufficiently in a state of preservation to assure of their original destination and design; and it is the more to be lamented, as that was the principal façade of the edifice, and contained the great entrance into the soros of the temple. This front was by far the most magnificent in its decorations, the esplanade before it extending 100, while that of the western was but 50 feet; the statues also on this tympanum were more numerous, there being originally on this 14 figures, and but 11 on the other; they are also both in style and sculpture far superior, and appear as the work of the master, the others in comparison as those of the scholars; the superiority of conception and manner is apparent, the forms are more muscular and robust, the veins and muscles more displayed, an imitation of a maturer nature. It is remarkable that they occupy less space than those of the western pediment. At the first opening of the ruins 25 statues were discovered, besides the four female figures belonging to the Acroteria. To the artist the canon of proportion and the system of anatomical expression observable throughout the whole may be regarded as the models whence was derived that still bolder style of conception which afterwards distinguished the sculptors and made the perfection of the Athenian school; what the works of Ghulandia were to Raphael these were to Phidias. The surprise of the common observer may be excited when he contemplates these figures, however disadvantageous the circumstances under which he views them. Perhaps he cannot call to mind, in the capital of his country, however civilization and the arts may have advanced, any sculptures of the 19th century which appear equally imposing; the more so, when he reflects that the history of their origin is buried in the darkness of 2,400 years. Long after this period Lysippus held as a principle of the ideal, which has in later times been too generally followed, to make men as they seem to be, not as they really are. In this group there is not, as seen in the opposite one, any figure immediately under the centre of the tympan, that of Minerva, which was found, and which, no doubt, had occupied it, being thought too much broken to be placed. The one nearest is the figure of a warrior, who appears as having fallen wounded to the ground. He is supporting himself on the right arm, endeavouring to rise. The hand no doubt held a sword, as the rivets of bronze still remaining indicate. On the left arm is a shield held close to the body, the hand enclasping the *telamon*, or holder. The countenance, contrary to the one in a similar position on the opposite pediment, seems calmly to regard, and to mark the moment to resist, with any chance of success, an advancing enemy who is rushing forward to seize his spoils. Whether this statue is rightly placed, we think will admit of doubt. The figure rushing forward could not have inflicted the wound by which he has been disabled, and it seems more probable that an arrow, which an archer at the extreme of the pediment has just discharged, has been the cause of his wound, and that it should, instead of being on the ground, have been placed as if in the act of falling. In the attitude of the attacking warrior a desire is shown to give the greatest interest to the action; the position of the right leg seems calculated to give movement to the figure as seen from below: behind the fallen an unarmed figure is stooping forward, apparently to raise him; but this statue would seem rather to belong to the other pediment, where a hollow is found in the pedestal on which the goddess Minerva stands, which appears to have been made to allow room for its advance. Among the statues found, but broken, was one which stood nearly over the body of the wounded hero to defend him against the advancing enemy before mentioned. Near the archer is another combatant on the ground; the countenance of this figure is aged, the beard most minutely sculptured; it is of a square form and descends to the breast; on the lip are long mustachios. It is by far the most aged of either group, and appears to be a chief of consequence; he is raising himself on his shield; the expression of the face is very fine, it has a smile on it, though evidently in pain. The archer is a Phrygian, and his body is protected by leathern armour; as he has no shield allowed, he is holding the bow, which is small and of the Indian shape, in the left hand with the arm outstretched; the bow-string has been drawn to the ear, the arrow seems just to have sped, and the exultation of the countenance shows it has taken effect. Three of these figures have that sort of helmet which defends the face by a guard descending over the nose, and the back by the length of the *lophos* or crest, or horse-hair, *crista;* the shields are massy and large, they are the Argive *aspis, enkuklos,* circular shields, and the handles are nicely framed. The inside of all of them were painted in red colour, and within a circle of the exterior a blue colour was seen, on which was depicted, without doubt, the symbol adopted by the hero, for on a fragment of one of those belonging to this front was in relief a part of a female figure. The remaining figures belonging to this tympanum, the fragments of which were found, were principally archers.

These statues offer the only illustration now extant of the armour of the heroic ages. The bodies of all the figures of this pediment, with the exception of the archer who is encased in leather armour, are uncovered. The great minuteness of execution in the details corresponds with the exactness with which Æschylus, Homer, and the earlier writers of the heroic age have preserved in their descriptions; in the whole of these statues this is observable in every tie and fastening; it would appear that the whole had undergone the strictest scrutiny, as in each those parts which, from their position on the building, could not have been seen, are found equally exact; in every particular they are the same as those which are traced on the vases of the most Archaic style, where they are delineated in black on a red ground, as is seen in the Museum collection. The two female figures on the apex of the pediment are clothed; the drapery falls in thick folds around the figure: in their hands they hold the pomegranate flower; the feet are on a small plinth; they are the *Elpis* of the Greeks, the goddess of hope, so well known in museums and on coins, and their situation here is peculiarly appropriate, as presiding over an undecided combat. It does not appear that any of the figures on either pediment had any support to fix them in position but the cornice where they came in contact with it; they must all have been easily removable; and perhaps it may not be unreasonable to suppose, that on particular festivals they were so disposed as to represent the actions then in celebration, to recall to the imagination of the votaries the reason for those sacrifices then offered to the god who presided over the temple; this would account why almost all the celebrated groups of antiquity which have decorated the façades of their sacred edifices, among which may be reckoned those of the Parthenon, the Sicilian Adrimetum, and the Ægina, are so completely finished, and shows how, what would otherwise seem a waste both of talent and labour, was brought to account.

It is much to be regretted that the pediments which have been erected to receive these statues have been, from want of space, not completed to the extremity of the angles; in consequence, the statues contained on both lose much of their effect; the idea of a shelf cannot be got rid of, neither is there sufficient depth allowed for the figures, which ought to be seen in shadow. A considerable expense appears to have been incurred in the erection of this abortion; had it been placed in a situation where there was sufficient space, which, if this room does not afford, is to be found in the vestibule at the end of the Egyptian gallery, the object might have been attained; the columns belonging to the pediment should have been added, and they would much have improved the bare walls of that portion of the building; and this creation being entirely unconnected with the halls which contain the remnants of the Elgin marbles, such a situation could not have been deemed heterodox to their remains. Had an exact representation of the façade of the temple to which these sculptures belonged been erected, which might easily have been done, as all the parts were known and measured, and the additional expense would have been but trifling, it would have given to those who have no opportunity to view the remains of antiquity abroad, a far more comprehensive idea of their grandeur and beauty than either dilapidated statues or engraved plates can offer. The inherent good taste of the public, who see with sorrow the architectural monstrosities which are dignified with the name of public buildings, would have regarded with pleasure the repose of a Grecian edifice adorned with its sculptures, the greater part in an entire state of preservation, and those which time had dilapidated, as restored by the hands of Thorwaldsen, a *fac simile* of antiquity; the lions' heads which adorned the ends of the marble tiles might then have been replaced, the griffons or chimeras which were found, restored to their positions, and the whole of the figures and architraves coloured exactly as their remains point out; the eye of the spectator, wearied with the sight of nameless monsters, on passing the doors at the end of the Egyptian hall, would have viewed with admiration the reality of an edifice, seen in the same perfection as if an interval of three and twenty centuries had been recalled.

The Phigalian Marbles.

In this saloon are the celebrated bas reliefs found at Mount Cobylus, near the ancient city of Phigalia, in Arcadia. They represent the battles of the Greeks and Amazons, and those of Theseus and the Lapithæ against the Centaurs. According to Pausanias, they were the work of Ictinus, contemporary of Phidias. The grandeur of conception displayed in their composition, the variety of attitude and action shown, is not surpassed by those in the Elgin saloon, though their execution may be inferior. A more particular notice of them than is found in the synopsis of the Museum may not be unacceptable. The combat of the Greeks and Amazons occupies 12 slabs of marble, and that of the Centaurs 11. Both the history of the Amazons and the battle here represented are obscure. The origin of the name is derived from two words, "*Ama*," or "*Ma*," which in all old languages signifies "mother,"—its ubiquity is proof of its antiquity—and the ancient name of the sun, as found in the Temple of Heliopolis, in Egypt, is "*On*," "*Ton*," or "*Zoan*"; but that any nation of Amazons, in the vulgar acceptation of the word, ever existed, is more than problematical. Faber says that those nations who worshipped the female principle of the world, such as the Iberians, the Cimmerians, the Mootæ, the Atalantians of Mauritania, and the Ionians, were Amazons, and a celebrated invasion of Attica by them is mentioned. We are told that Eumolphus, an Egyptian, was the leader; and Pausanias mentions an Attic victory or trophy, called an Amazonium, erected to their manes; according to Arrian, the Queen of the Amazons, on the borders of the Caspian Sea, sent ambassadors with defiance to Alexander. In the time of Pompey they were still supposed to exist, and Dion Cassius says, that in the Mithridatic war buskins and boots were found by the Roman soldiers, undoubtedly Amazonian. The worship of the male and female deities in Greece caused peace between the sects, and the origin of their quarrel and their name was forgotten in Europe. In Asia, the Persians and the Jews seem still to have formed an exception; Cambyses in his invasion destroyed in Egypt every thing connected with the female worship, he overturned the sphinxes, but he left the obelisks untouched.

The scene of the combat depicted on these tablets is drawn with great force and spirit; some of the Amazons have long tunics, others short vestments, only reaching to the knee; one on horseback has trousers and loose sleeves reaching to the wrist; on the head of some is the Archaic helmet, and those without have the hair fastened in a knot on the top; they all but one wear boots which reach to the knees, their robes are fastened with a zone, some have two belts crossed between the breasts; their arms are swords, and the double-headed Scythian battle-axe, as also spears, bows and arrows; none of these last are preserved, they being probably of bronze, as the holes remain, and added afterwards, as was the custom with ancient sculpture; the shields are small, and of the lunar form, opening at top. The Athenian warriors have cloaks or tunics fastened round the neck, and tightened about the waist by a belt; it reaches no lower than the knee; the right arm is bare. In one group a fierce warrior has seized a mounted Amazon by the hair; he is dragging her from the horse, which is rearing; the action of the female figure is very fine; she firmly maintains her seat, till relieved by another, who, with uplifted axe, and shield to protect her from the flying arrows, shall have brained her antagonist. The 18th slab has five figures and two horses; in one the horse has fallen, and an Athenian warrior has his right hand fixed on the throat of the Amazon, while, with the other hand, he has grasped her foot, and drags her, who seems to have lost all recollection, from the horse's back. The position of the centre figure is very fine. He is within the guard of the shield of the Amazon, and is striking a deadly blow with his hand, in which has been a sword. In another group an Athenian has fallen; he rests on his left hand, and extends his right in supplication to the female warriors who surround him, and is in the act of surrendering, while behind him an Amazon is striking him with her battle axe. In the sculptures of the Lapithæ and Centaurs all the warriors, with the exception of Theseus, are armed with swords, who, as an imitator of Hercules, has a club. The shields are large and circular; they have a broad border round the circumference, and resemble those of the Ephibi of Athens. Of the helmets there are four kinds—one which fits the head closely without either crest or vizor, another with a crest, and one with guards for the ears, and a fourth with a pointed vizor. In one of the sculptures Theseus is seen attacking a Centaur; he has the head of the monster under his left arm, and with the right, which probably held a club of bronze, as the hole remains, he is destroying him. He appears to have arrived just in time to save Hippodomania, whom the Centaur has disrobed, and who is clinging to the statue of Diana. From the tiara behind, and the lion's skin, this figure is supposed to be Theseus; the Centaur is Eurytion; a female figure is also seen pleading on her behalf, and in the distance a goddess is hastening in a car, drawn by stags, to the rescue; this probably is Diana, as the temple was dedicated to Apollo.

TABLE OF GRADIENTS, BY ROBERT SHEPPARD.

Feet. Per Mile.	Inclination. 1 in.	Inches. Per chain.	Feet Per chain.	Feet Per Mile.	Inclination. 1 in.	Inches Per chain.	Feet Per chain·	Feet Per Mile.	Inclination 1 in.	Inches Per chain.	Feet Per chain.
1·	5280·	·15	·0125	59·	89·492	8·85	·7375	97·	54·433	14·55	1·2125
2·	2640·	·30	·025	59·326	89·	8·899	·7416	97·778	54·	14·667	1·2222
3·	1760·	·45	·0375	60·	88·	9·	·75	98·	53·877	14·70	1·225
4·	1320·	·60	·05	60·69	87·	9·103	·7586	99·	53·333	14·85	1·2375
5·	1056·	·75	·0625	61·	86·557	9·15	·7625	99·623	53·	14·944	1·2453
6·	880·	·90	·075	61·395	86·	9·209	·7674	100·	52·8	15·	1·25
7·	754·286	1·05	·0875	62·	85·161	9·30	·775	101·538	52·	15·23	1·2692
8·	660·	1·20	·1	62·118	85·	9 3176	·7765	103·529	51·	15·529	1·2941
9·	586·667.	1·35	·1125	62·857	84·	9·428	·7857	105·6	50·	15·84	1·32
10·	528·	1·50	·125	63·	83·81	9·45	·7875	107·755	49·	16·163	1·3469
11:	480·	1·65	·1375	63·614	83·	9·542	·7952	110·	48·	16·5	1·375
12·	440·	1·80	·15	64·	82·5	9·60	·8	112·34	47·	16·851	1·4043
13·	406·154	1·95	·1625	64·39	82·	9·659	·8049	114·783	46·	17·217	1·4348
14·	377·143	2·10	·175	65·	81·231	9·75	·8125	117·333	45·	17·60	1·4667
15·	352·	2·25	·1875	65·185	81·	9·778	·8148	120·	44·	18·	1·5
16·	330·	2·40	·2	66·	80·	9·90	·825	122·791	43·	18·419	1·5349
17·	310·588	2·55	·2125	66·835	79·	10·025	·8354	125·714	42·	18·857	1·5714
18·	293·333	2·70	·225	67·	78·806	10·05	·8375	128·78	41·	19·317	1·6098
19·	277·895	2·85	·2375	67·692	78·	10·154	·8462	132·	40·	19·80	1·65
20·	264·	3·	·25	68·	77·647	10·20	·85	135·385	39·	20·308	1·6923
21·	251·429	3·15	·2625	68·571	77·	10·285	·8571	138·947	38·	20·842	1·7368
22·	240·	3·30	·275	69·	76·522	10·35	·8625	142·703	37·	21·406	1·7838
23·	229·565	3·45	·2875	69·474	76·	10·421	·8684	146·667	36·	22·	1·8333
24·	220·	3·60	·3	70·	75·429	10·50	·875	150·857	35·	22·6286	1·8857
25·	211·2	3·75	·3125	70·4	75·	10·56	·88	155·294	34·	23·294	1·9412
26·	208·077	3·90	·325	71·	74·366	10·65	·8875	160·	33·	24·	2·
27·	195·556	4·05	·3375	71·351	74·	10·703	·8919	165·	32·	24·75	2·0625
28·	188·571	4·20	·35	72·	73·333	10·80	·9	170·323	31·	25·548	2·129
29·	182·069	4·35	·3625	72·329	73·	10·849	·9041	176·	30·	26·40	2·2
30·	176·	4·50	·375	73·	72·329	10·95	·9125	182·069	29·	27·31	2·2759
31·	170·323	4·65	·3875	73·333	72·	11·	·9167	188·571	28·	28·285	2·3571
32·	165·	4·80	·4	74·	71·351	11·10	·925	195·556	27·	29·333	2·4444
33·	160·	4·95	·4125	74·366	71·	11·155	·9296	203·077	26·	30·462	2·5385
34·	155·294	5·10	·425	75·	70·4	11·25	·9375	211·200	25·	31·68	2·64
35·	150·857	5·25	·4375	75·429	70·	11·3143	·9429	220·	24·	33·	2·75
36·	146·667	5·40	·45	76·	69·474	11·40	·95	229·565	23·	34·435	2·8696
37·	142·703	5·55	·4625	76·522	69·	11·478	·9565	240·	22·	36·	3·
38·	138·947	5·70	·475	77·	68·571	11·55	·9625	251·429	21·	37·714	3·1429
39·	135·385	5·85	·4875	77·647	68·	11·647	·9706	264·	20·	39·60	3·3
40·	132·	6·	·5	78·	67·692	11·70	·975	277·895	19·	41·6842	3·4737
41·	128·78	6·15	·5125	78·806	67·	11·821	·9851	293·333	18·	44·	3·6667
42·	125·714	6·30	·525	79·	66·835	11·85	·9875	310·588	17·	46·589	3·8824
43·	122·791	6·45	·5375	80·	66·	12·	1·	330·	16·	49·50	4·125
44·	120·	6·60	·55	81·	65·185	12·15	1·0125	352·	15·	52·8	4·4
45·	117·333	6·75	·5625	81·231	65·	12·1846	1·0154	377·143	14·	56·571	4·7143
46·	114·783	6·90	·575	82·	64·39	12·30	1·025	406·154	13·	60·923	5·0769
47·	112·34	7·05	·5875	82·5	64·	12·375	1·0313	440·	12·	66·	5·5
48·	110·	7·20	·6	83·	63·614	12·45	1·0375	480·	11·	72·	6·
49·	107·755	7·35	·6125	83·81	63·	12·571	1·0476	528·	10·	79·20	6·6
50·	105·6	7·50	·625	84·	62·857	12·60	1·05	586·667	9·	88·	7·3333
51·	103·529	7·65	·6375	85·	62·118	12·75	1·0625	660·	8·	99·	8·25
52·	101·538	7·80	·65	85·161	62·	12·774	1·0645	754·286	7·	113·1429	9·4286
52·8	100·	7·92	·66	86·	61·395	12·90	1·075	880·	6·	132·	11·
53·	99·623	7·95	·6625	86·557	61·	12·984	1·082	1056·	5·	158·40	13·2
53·333	99·	8·	·6667	87·	60·69	13·05	1·0875	1320·	4·	198·	16·5
53·877	98·	8·982	·6735	88·	60·	13·20	1·1	1760·	3·	264·	22·
54·	27·778	8·10	·6750	89·	59·326	13·35	1·1125	2640·	2·	396·	33·
54·433	97·	8·165	·6804	89·492	59·	13·424	1·1187	3017·143	1·75	452·5714	37·7143
55·	96·	8·25	·6875	90·	58·667	13·50	1·125	3520·	1·5	528·	44·
55·579	95·	8·3368	·6947	91·	58·022	13·65	1·1375	4224·	1·25	633·6	52·8
56·	94·286	8·40	·7	91·034	58·	13·655	1·1379	5280·	1·	722·	66·
56·17	94·	8·425	·7021	92·	57·391	13·80	1·15	7040·	·75	1056·	88·
56·774	93·	8·516	·7097	92·632	57·	13·895	1·1579	7920·	·667	1188·	99·
57·	92·632	8·55	·7125	93·	56·774	13·95	1·1625	10560·	·5	2584·	132·
57·391	92·	8·609	·7174	94·	56·17	14·10	1·175	15840·	·333	3376·	198·
58·	91·034	8·70	·725	94·286	56·	14·143	1·1786	21120·	·25	3168·	264·
58·022	91·	8·703	·7253	95·	55·579	14·25	1·1875	31680·	·167	4752·	396·
58·667	90·	8·80	·7333	96·	55·	14·40	1·2				

A slight inspection of the table will render any explanation of it unnecessary. The table may be considerably extended, by merely shifting the decimal points.

EXAMPLE.

Feet per Mile.	Inclination 1 in.	Inches per chain.	Feet per chain
55·	96·	8·25	·6875
550·	9·6	82·5	6·875
·5·5	960·	·825	·06875

THE FINE ARTS OF GREECE, DURING THE AGE OF PERICLES. BY FREDERICK J. FRANCIS.

[It affords us much pleasure to draw the attention of our Architectural readers to a well written essay on the Fine Arts of Greece, during the Age of Pericles, by Mr. Francis, a young and aspiring architect; who, if we may judge by his writings, promises to be an ornament to his profession. We have given below a lengthened extract from the essay, which was read before several Literary Institutions, and gave great satisfaction.]

In Architecture, the Acropolis was, undoubtedly, the proudest triumph of Grecian skill. It consisted of a lofty rock, standing in its unapproachable majesty above surrounding buildings, and adorned profusely with every variety of temple and sacred edifice, both votive and monumental, rich in the hues of the most brilliant polychromy, and glittering in all the brightness of Pentelican and Parian marbles.

So splendid, indeed, was its architectural adornment, that it was termed the "City of the Gods," and appeared as though it were one vast offering to the divinity. "It was the peerless gem of Greece—the glory and pride of art—the wonder and envy of the world;" enriched with temples incomparably more beautiful than those the Persians had demolished, and decorated with those spoils and trophies, which had marked the progress of the Grecian arms.

We pass by, without particular observation, solely for the sake of brevity, and in no degree from their being unworthy of notice, the various public edifices erected without the Cecropian citadel; such, for instance, as the hexastyle temple of Theseus—the famed Dionysiac theatre—the Stoa—the Gymnasium—the Choragic monument of Lysicrates—and that magnificent decastyle, peripteral, and perhaps, hypæthral temple, dedicated to the worship of the Olympian Jove at Elis; and wish you to look more particularly at the unequalled grandeur of the Acropolis itself, which, towering above the homes and habitations of private citizens, raised far above surrounding buildings, defended on all sides by deep and precipitous rocks, and inaccessible only through the gorgeous Propylæa, which formed its western entrance, was the one sacred spot which all the resources of art had been exhausted to beautify, and in whose decoration the most costly treasures were lavished and expended.

It would, of course, be impossible in this necessarily limited detail, to describe with any minuteness all the many temples and sacred monumental emblems with which the summit of the Acropolis was covered; or the stately and majestic sculptures, which adorned their pediments, decorated their friezes, or in the form of colossal statues, were placed in their interiors as objects of worship and adoration.

Still, from the beauteous, though shattered and crumbling remains of the Propylæa, and the Parthenon—the first, beyond all doubt, the greatest production in civil architecture of which ancient Greece could boast, the latter, equally unrivalled as a sacred edifice, dedicated to the goddess Minerva, as the tutelary goddess of Athens, and standing in the centre of the citadel an object of supreme and commanding beauty—from these two buildings, which mark distinctly the architecture of the Periclean age, may be inferred an accurate idea of the perfection which this branch of the Fine Arts had then attained.

The Propylæa, so called from its forming the vestibule to the grand entrances which led to the citadel, was erected on the western, and, indeed, the only accessible approach. The entire building occupied the whole space, which formed the natural entrance to the summit of the rock, nearly 170 feet, 60 feet being occupied by the centre, the rest taken up by the wings, which belonged to the building; and was thus at once, a source of strength, a means of defence, and a vast ornamental fortification.

The Propylæum, or great vestibule, presented a front of six elegantly proportioned, and massive fluted Doric columns, leading to another beautiful vestibule, nearly 50 feet in depth, the roof of which being sustained by six Ionic columns in a double row, divided the inner vestibule into three aisles or compartments; while the ceiling was laid upon marble beams, and adorned with some of the noblest monuments of art. The wings of the building projected 30 feet in advance on either side, showing a front elevation of a plain wall with hieroglyphics in the frieze; and by their simple and undecorated finish, must have given to the whole edifice the effect and proportion of simple, unpretending, and yet pure and classic beauty. This incomparable structure was erected entirely of Pentelican marble, and the effect which it had in the days of its unmutilated grandeur must have been majestic and impressive in the extreme.

Not only did it glitter in all the whiteness of the marble of Mount Pentelicum, but its interior glowed with all the varied hues and shades of colouring, and all the minuteness of sculptural detail. The cloudless skies of Attica, and the unruffled serenity of her climate, permitted a species of adornment, which, in a murky district like our own, would soon be disfigured and destroyed: and it gave to the works of the Grecian artists that peculiar charm which we, at any rate, can never hope to emulate or equal.

Within the spacious courts of these proud and commanding vestibules, were enshrined many noble examples of the perfection which the sister arts of painting and sculpture had then reached. The left wing was decorated with paintings by Polygnotus, whereon were represented, with all the powers of artistic genius, the ever memorable and stirring events connected with the Trojan war; and, at intervals, throughout the whole edifice, were placed, in striking and appropriate localities, groups of equestrian statues, designed with all the originality, and executed with all the perfection, which especially belonged to that age and people.

The Propylæa, in short, was the glory and pride of the Athenians—famed throughout all the surrounding states of Greece; nay, it became so celebrated, that even the national enemies of Greece paid homage to its magnificence; for, when in the assembly of the Thebans, Epaminondas desired to convey to his audience the importance of transferring the glory of Athens to Thebes, he made reference to the Propylæa alone, as if in that structure there were concentrated all that was glorious and magnificent in art, and said, "Oh! men of Thebes, you must uproot the Propylæa of the Acropolis, and plant them in front of the Cadmean capital!"

Passing this splendid structure, entering the citadel, and ascending several steps, we come to the sacred and revered temple of the Parthenon, dedicated to the virgin goddess, and, undoubtedly, the noblest monument of architectural genius the world has ever seen.

It stands upon the summit, and in the centre of the Acropolis, elevated considerably above the Propylæa and the adjacent buildings, and executed in the purest marble the country could produce. You are all, doubtless, well acquainted with its simple, yet expressive form, its classic harmony of proportion, its unbroken outlines, its massive and majestic grandeur.

It is termed a peripteral and hypæthral temple, that is to say, it is perfectly surrounded with columns, and contains an interior cella, exposed to the external air.

As far as it is possible for this branch of art to embody the true sublime, and we know that it is capable of doing so in no mean degree, has been accomplished by the peripteral parallelogrammatic temple of the Greeks. Such was the sacred Parthenon. In length it measured more than 200, in breadth about 100 feet; containing, at each end, a lofty and commanding portico of eight fluted Doric columns in a double row, 35 feet in height; and having, likewise, a colonnade of similar proportions along each side, to preserve the harmony and unity of the design. Even now, in the ruined and mutilated condition to which it has been, by the wreck of time and the ruthless hand of invasion, reduced, it is peculiarly calculated to rouse in the mind of the beholder, feelings of sublimity and awe.

What, then, must it have been in the palmy days of its original and pristine grandeur? perfect and unspoiled, and decorated both within and without, by some of the most splendid productions of art, sculpture and painting lending their aid to heighten that undefined and yet irresistible charm which belongs to the majestic unity of its form, and the classic simplicity of its unbroken outline?

The Parthenon was, in short, the *chef d'œuvre* of Grecian art, unequalled, as a monument of architectural skill, either in ancient or modern time. "Its dimensions," remarks an anonymous writer, "were sufficiently large to produce an impression of grandeur and sublimity, which was not disturbed by any obtrusive division of parts; and, whether viewed at a small or a great distance, there was nothing to divert the mind of the spectator from contemplating the unity, as well as the majesty, of mass and outline, circumstances which form the first and most remarkable characteristic of every Greek temple erected during the purer ages of Grecian taste and genius."

Scarcely inferior to these, though less pretending, were the Ionic temples of Erectheus, and Minerva Polias, the renowned Odeon, the little temple of Victory without wings, and others; all remarkable for that characteristic simplicity, that proper relation of parts to a whole, that harmonious proportion and unadorned beauty, which form the distinguishing features of Grecian architecture.

Never was there a people who understood so completely, and retained with such exactitude, the elements of simple beauty in this department of the Fine Arts, as the ancient inhabitants of Greece. In the mouldering relics of their immortal productions, their sacred temples, fanes, monuments, and theatres, there is nothing of that ornate and finished elegance so peculiar to the Roman style; nothing of the tasteful splendours of Moorish architecture, as developed in the fascinating outlines and gorgeous decorations of the ancient palace of the Alhambra; nothing of that glittering grace and exquisiteness of detail exhibited both in British and continental cathedrals; still less, any of those fantastic and superabundant adornments which distinguish the Palladian, the Elizabethan, and the Tudorian styles; and yet, devoid of all these adventitious embellishments, destitute of all or any of these factitious aids, the sacred Architecture of Greece stands forth in all the consummate perfection of its harmonious beauty, compelling the respect and admiration of all succeeding ages.

Yes!—to this day, their magnificent temples still remain unrivalled, though in ruins—unequalled, though in desolation—standing alone, in the unapproachable majesty of simple and classic dignity, the acknowledged models of all that is perfect and expressive in Art.

Nor was SCULPTURE backward in the rapid strides made by the Fine Arts at this period. The Acropolis, with its hundred temples dedicated to the gods—with its multitude of sanctuaries and monumental structures—contained also hundreds of statues, representing, for the most part, those persons to whom the temples were inscribed.

The range of Grecian Polytheism was most wide and extensive. Every temple had its fit and appropriate deity—every niche—every recess—every cell, its proper occupant: and whether, it were the lofty Propylæa—the revered temple of the Parthenon—the Erectheium—the cell of Pandrosus—the magnificent temple dedicated to the Olympian Jove at Elis—or that sacred edifice at Eleusis, within whose walls were performed those celebrated religious mysteries and sacrificial rites, regarded by the Athenian people with the utmost solemnity and veneration; whether we look at each, or all of these, we shall find that they united to the beauty of external form and architectural grace, all that additional charm which creations of sculpture could convey, wrapped as they were, in the expressive elegance of exalted art, and the consummate perfection of ideal beauty.

Among the celebrated sculptors of the Periclean Age, PHIDIAS, without doubt, must be reckoned the greatest and the most illustrious. During the administration of Pericles, he had the uncontrolled command and supervision of all the public works of Athens; and by the exercise of superior genius—profound and varied knowledge—and peculiar stedfastness of purpose, was a great instrument in carrying the arts to the perfection they then attained.

Progressing far beyond the rude and homely style of Dædalus and his successors, in him, it was first seen, how wondrous are the powers of sculpture, under the hand of commanding genius, in the personification of the creations of poetry. To him first belonged the power of producing deep and lasting emotions of sublimity and beauty by the expressive and the finely moulded marble; and, in fact, in the almost breathing forms of his inimitable creations—

"Are exprest
All that ideal beauty ever bless'd
The mind with, in its most unearthly mood;
When each conception was a heavenly guest,
A ray of immortality: and stood,
Star-like, around, until they gathered to a God."

"The superior genius of Phidias," says Mr. Flaxman, the late lamented Professor of Sculpture, in the Royal Academy, "in addition to his knowledge of painting, which he practised previous to sculpture, gave a grandeur to his compositions—a grace to his groups—a softness to flesh, and flow to draperies unknown to his predecessors: the character of whose figures was stiff, rather than dignified: their forms turgid—the folds of their drapery, parallel, poor, and resembling geometrical lines, rather than the simple but ever-varying appearances of nature. The discoveries of cotemporary philosophers on mental and personal perfection, assisted him in selecting and combining ideas, which stamped his works with the sublime and beautiful of Homer's verse."*

Among the many works which sprung from the hand of this extraordinary man, there are two, which, to this day remain unrivalled. Had they been the only two he had ever executed;—had the extent, the capacity, the *calibre* of his genius, depended solely upon them,—still, they are so magnificent in themselves: so absolutely perfect as a work of art as alone to warrant our ranking him far above all ancient or modern sculptors.

I allude to the colossal statue of Jupiter Olympius at Elis, and that of the goddess Minerva, in the sacred temple of the Parthenon: the former, upwards of sixty, and the latter, forty feet in height: both of which are regarded (the former especially) as among the wonders of the world, and will never fail to excite the praise and astonishment of future ages till all appreciation of the beautiful, the expressive, and the sublime—shall have departed from amongst mankind.

It is in the representation of the Attic divinities—more particularly the deities of Homer's verse, that we mark, in an especial manner, the commanding genius of the Grecian artists. The religion of Greece, not indigenous but exotic; springing originally from Egypt, but at the same time purified, idealized, and essentially changed by its transmission, was in all respects, a *sensuous* worship: sources of the sublime were sought for in objects of sense and sight, and through the material and the visible, were the mass of the people led to perceive, and taught to adore, the unseen and the spiritual. The Egyptian theology was *emblematic*: the sublime was attempted by the personification of monsters in external form; and in proportion as there was reached, what was falsely deemed, the height of sublimity, was there an equally proportionate recession made from the attainment and the embodying of the expressively beautiful.

But as civilization advanced, and the Ionian character became fully developed; it was justly considered that the really beautiful and sublime was most easily attained by that department and species of sculpture, which delineated the human form in all the perfection of its ideal beauty, and physical excellence. In the personification, therefore, of their Homeric divinities (for, as you are aware, they existed in the metres of the poet, long before they were embodied in the material excellence of sculpture) this rule is followed, and in the general, strictly adhered to: and consequently the statues of Phidias, Praxiteles, and their contemporaries, possess this peculiar charm, that they stand out the most expressive personification of the essential characteristics of humanity: the most perfect exponents of the very passions which agitate—the thoughts which controul—and the will that governs the minds of men. They are not forms which convey to us no mental impression, which rouse no hidden emotions, or which call into action none of the sympathies of our nature; but they are forms which speak to us in all the silent eloquence of expressive beauty,—linked intimately in their outward proportions with the peculiarities of our own physical, moral, and intellectual structures, and conveying to us most clear and tangible ideas of all the varied evolutions of intelligence, of mind, and will.

Thus, in the Jupiter Olympius of Phidias, to which I have already referred, there was developed in all the expressiveness which material forms could bestow, the power of absolute *will*, subjected to no controul, and accustomed to wield the sceptre of undivided command.

Conscious however, as he is of being in the possession of this undisputed authority, "The father of the gods and men," is here represented by the unrivalled hand of Phidias, as relaxing in some measure the sternness of his character, and from his regal throne awarding with one hand the chaplet of victory to the Olympian conquerors, while, with his other, he grasps the royal sceptre, and round his ample brows there circles the sacred olive wreath.

Immediately before the throne, forming indeed one magnificent group, were various emblematic representations of the fabulous adventures of the heroic age: containing among others, the destruction of Niobe's children, the labours of Hercules, and the garden of Hesperides: while, on the base, might be seen the battles of Theseus with the Amazons: and, on the pedestal, an assembly of the gods—the sun and moon in their cars, and the birth of Venus.

Such was this master piece of Phidian genius and skill. And it would be impossible for imagination to conceive a more splendid personification of that—

"Olympian Jove,
Who rolls his thunders o'er the vaulted skies."

Sitting, as he might be supposed to do, upon that hill of dread Olympus, which—

"Shrouds
Its hundred heads in heaven, and props the cloud."

and giving to the august assembly—

"The nod that ratifies the will divine
The faithful, fixed, irrevocable sign."

The artist has happily combined the benignant expression of benevolence with the awful majesty of the Homeric god, as delineated in the following passage:—

"He spoke; and awful bends his sable brows
Shakes his ambrosial curls, and gives the nod
The stamp of fate, and sanction of the god:
High heaven, with trembling, the dread signal took
And all Olympus to the centre shook."

But it is not only in this magnificent conception of the genius of Phidias, that we mark the pervading expressiveness and consummate beauty of form to which I have alluded. In all the statues and groups executed in that age, from those of Phidias, which emanated in the Periclean, to those of Praxiteles, which were produced near the Alexandrian era, we perceive the shades and the varieties of the

* Flaxman's Lectures on Sculpture.

human character and passions shadowed out in all the realization of ideal beauty; the idealism of poetry, transposed into the materialism of sculpture.

Thus, in the colossal statue of the goddess Minerva, situate within the sacred inclosure of the Parthenon, we recognize "the martial, blue-eyed maid" depicted in Homer. Pre-eminent wisdom, high martial energy, and the celestial beauty of a virgin goddess, accompanied and guarded by the sternest and severest virtue, are the chief characteristics of this noble production,—executed in ivory and gold, by the masterly hand of Phidias, and inferior only to the Jupiter Olympius, as a work of art.

Then again, in the Apollo Belvidere, there is embodied the indwelling energy of an indignant god. The "Lord of the unerring bow" is represented shooting with his arrows the great serpent Python. You all know the attitude of this exquisite statue.

> "The shaft hath just been shot; the arrow bright
> With an immortal's vengeance, in his eye
> And nostril, beautiful disdain; and might
> And majesty, flash their full lightnings by;
> Developing in that one glance, the Deity."

In the Juno, we see that imperial dignity and matronly grace, which belong to her station as Queen of Heaven, and wife of Jove: in the Bacchus, all the self-sufficiency of the most luxurious ease: in the Venus, the Cnidian Venus especially, all the softened and tender graces of the most attractive loveliness: and in fact, the whole range of the Grecian divinities stand out the emblems and exponents of the several attributes of humanity, heightened and perfected by that extraordinary appreciation of simple and expressive beauty in which the Greeks so eminently excelled.

But such being the acknowledged characteristics of the sculpture of this period, it may be asked how it was that the Grecian artists obtained so thorough and intimate an acquaintance with the human form, in all the varieties of its full developement, and physical excellence.

It may be asked, how it was that they, above all other nations, maintained that harmony, fitness and proportion, which endowed their creations with all the force of expression, and made them the almost breathing symbols of intelligence and will.

To this we answer, that the Greek sculptors possessed advantages altogether peculiar to the nation of which they formed a part:—as it has been well observed, "they not only derived the highest advantages from a religion which disposed men to embody all the charms of nature in definite forms, and from a cast of mind requiring for enjoyment the distinctness of beauty rather than the visionary and the dim; but had all the benefit of studying the human frame, in its most perfect freeness, elegance and grace. Not only were the Greeks beautiful by nature, but the course of their lives, even from earliest infancy, was calculated to improve the form. The public exercises gave, in addition to the polished manner, and elevated attitude of a citizen of the most glorious state on earth, something of the wild and airy grace of an Indian bounding in the chase, or of a stag delicately pacing through his native forests."† These public games, indeed, gave a singular and decided impulse to the progress of Grecian sculpture. The Gymnasia, or schools in which the candidates for distinction at the Olympian games were trained, was the constant resort of men of rank and talent: at these places, and in the Olympian contests themselves, the combatants, for the sake of greater ease and elasticity, exhibited without the usual accompaniments of dress.

By these means, the Grecian artists would become accustomed to the contemplation of the human form, in all its changing attitudes and expressions: and intimately conversant with the varying evolutions of the muscles, joints, and sinews of the frame, whether in the stillness of repose, or the vigour of action.

By dwelling for instance on the athletic proportions of a brawny wrestler,—his firm compactness of frame—his well-knit joints—his largely developed muscular masses: there would be afforded to the observant sculptor the model from which he might create a Theseus or a Hercules, or any other of the fabled demi-gods of the heroic age; in which his aim would be to make physical strength and power the leading and distinguishing characteristics.

Or again, by musing on the light and agile forms of the unrobed victors of the race, their supple and elastic limbs, their rounded joints, and general elegance of shape, the artist might obtain his original, for the swift-footed Mercury, or the more matured and majestic Apollo.

Or once more: by gazing on the forms of the Grecian maidens, when—according to their national customs, they danced perfectly unveiled before assembled thousands at their celebrated festivals—Praxiteles might have caught that ray of inspiration which subsequently expanded itself into the finished graces of the Cnidian Venus: and who can doubt that Phryne in rising from the bath, exposed to the eyes of all Greece, at the celebration of the Eleusinian games first suggested to the artist the beauteous form of the Venus Anadyomene. In short, in almost every solemnity and religious rite—in every public game and athletic combat, in the Olympian—the Panathenaic festivals and others—in all these various ways full opportunity was afforded to the Grecian artists, to become thoroughly acquainted with the diversified characteristics and varying expressions of the human figure: and hence, in a great measure, the secret of that unrivalled perfection to which sculpture attained in Greece. To this we may add, that they possessed so exquisite a sense of the beautiful—so just and profound an appreciation of what was really the perfection of shape and figure—that they were not contented with copying exactly, even from the admirable models continually presented to their minds—they never represented Nature as they found her embodied in any one form—but they sought after an IDEAL perfection more complete than is to be found in any *one*—even the fairest and the noblest of Nature's works: —they derived portions from the many—adopting every recognized and admitted excellence—and rejecting every acknowledged and palpable defect; and grouping and combining those features alone in each, which reached the standard of that perfect IDEAL to which it was their proudest ambition to attain.

* Encyclopædia Metropolitana, vol. 1, p. 305.

ON THE EFFECT OF CLIMATE ON YORKSHIRE PAVING.

Report communicated by Colonel FENSHAWE, *Royal Engineers.*

(From the Papers of the Corps of Royal Engineers.)

A report having been received from the Mauritius that the Yorkshire stone coping which had been supplied for that station was either of a bad description, or not calculated to withstand the great power of the sun in that climate, a considerable portion of it having blistered and peeled, references were consequently made to other tropical stations and to Bermuda, where stone of this nature had been used.

From Barbadoes the reply was that the experience of that command had in no case shown that solar heat has had the effect of blistering or peeling Yorkshire paving, and that the defect complained of was more attributable to the quality of the stone than to the climate.

The Jamaica Report stated that on examination of the Yorkshire flag-stone measuring 14 inches wide and 3 inches thick, used in coping the wall that surrounds the barracks at Up-Port camp, being about 2,000 yards in length, and having been laid ten years, some few stones were found partially honey-combed to the depth of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch, which is attributed to the bad quality of the stones rather than to the effect of the climate,—the deteriorated flags having been in all probability obtained from the upper beds of the quarry, the greater part being to all appearance perfectly sound and showing no indication of blistering or peeling.

The Bahama Report stated that upon a careful examination of the Yorkshire stone used for flooring and pavement in situations exposed to the heat of the sun, it was not perceived to have blistered or peeled, or to have been otherwise affected beyond what might be expected from common wear and tear.

The Bermuda Report stated that in many instances Yorkshire stone exposed to the weather has not suffered sensibly from such exposure, whilst in others it has been blistered and peeled off in laminæ from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in thickness.

A quantity not set, and so exposed from four to five years, has undergone no sensible change, which is likewise the case with that on the top of the tower in the main ditch, laid about eight years since.

Exposed to the alternate action of the sea and sun at the landing places in the dock-yard at Ireland Island, the Yorkshire flagging had failed.

Yorkshire flagging is of very different qualities. The best is found in the lower part of the quarry; that from the upper part is usually composed of several laminæ, disposed to spilt, and will in all probability fail. But there seems no reason to doubt, from the above experience, that by a proper selection of quarry, or of stone at the quarries, the Yorkshire flagging will be found to withstand the effects of a tropical climate.

ENCROACHMENTS AND RECESSIONS OF THE SEA.

(From the Cinque Ports' Chronicle.)

A correspondent having, a considerable time past, mooted the hitherto, we believe, unanswered question as to the causes which produce encroachments and recessions of the sea, upon a line of coast having nearly the same geographical bearing, and especially as regards the south-eastern coast of England: we have delayed attempting the solution of the problem on our own part, in the hope that some of our correspondents would anticipate our labours by directing their attention to the subject.

The correspondent to whom we have alluded, very justly observes that the traveller along our shores is somewhat puzzled to find a town or village once washed by the sea, now standing two or three miles inland; and other localities, within the space of a few miles, which were once at a remove from the ocean, now diminishing, by the daily encroachments of the billows.

Commencing with Beachy Head, we have at once an instance of the latter, as formerly, springing from the base of the cliff were seven perpendicular rocks, denominated the Seven Charles'; these, in

"The incessant war of wave and rock,"

have, for the most part, been undermined and washed away by their indefatigable adversaries—the winds and the waves. Continuing our progress eastward, we find not only considerable tracts of land or sward, formed upon a sub-stratum of beach, extending from the headland towards St. Leonards, a distance of about eighteen miles; but about midway between these towns, we have undeniable evidence of the extent of the recession of the sea, in the fact, that the hill or cliff upon which Pevensey Castle stands, is said to have been washed by the sea, while its perpendicular distance from the present high water mark is about two miles. Bexhill, further eastward, may also be pointed out as having been subject to a similar, though less extensive, alteration of locality. The question hence arises—can a physical cause be assigned for the remarkable changes under consideration? We are aware of the risk we run of incurring the charge of presumption in attempting to solve that which, as far as our reading has extended, we believe, has never been attempted by geographers or geologists; but years of attentive consideration to this subject has so thoroughly convinced us of the simplicity of the law which produces the alterations in the aspect of our coasts generally, and especially of the south-eastern, with which we are most familiar, that, as none of our philosophical readers have come forward to explain a subject of considerable interest to residents and frequenters of our shores, we shall proceed with all deference to lay our opinions before the public; being at the same time open to conviction, and perfectly willing to insert in our columns any observations either against or in corroboration of the view we take of the subject.

The simple law, then, which we regard as the origin of the changes in the aspect of our coast, is *the tendency of the sea to preserve its parallel* under the influence of the prevailing wind and current. The tendency of water to find its level is universally known, and that of keeping its parallel is as unquestionable, though less obvious to common observers. Were the coasts and shores washed by the ocean composed of the same geological substances, as, for instance, sand or clay, the phenomena of the geographical changes under consideration would not occur; but it is otherwise: our coasts being diversified with ridges of rocks, and with plains level with or below high water mark. In the former case, the action of the waters of the channel would be similar to the uniform waste of sand raised as embankments on each side of a sloping trough, along the centre of which water was made gradually to flow; but in the latter case, which actually obtains, the comparison is only maintained by supposing a number of stones or hard masses were irregularly thrown into the trough, which would occasion an interruption to the equable flow of water, and have the effect of throwing the waters, diverted from their parallelism, into serpentine courses, causing inroads upon the sand or yielding substance at the sides, in proportion to the obstructions which they met with from the hard projecting masses. Such, then, we believe to have been the case, when the shores we inhabit were separated by the effects of earthquake, or otherwise, from the opposite coast of France. The waters of the channel, impelled by the prevailing currents from the Atlantic and the south-westerly winds, found their parallelism obstructed by the rugged inequalities of the channel, occasioned by the intervention of mountainous ridges. This had the effect of throwing the waters upon the lowlands and coast composed of sand or vegetable earth, in the same proportion as the waters were obstructed in their onward flow by the causes alluded to; and which inroads will always be found to have occurred on the side of the obstructing mass *opposed* to the prevailing momentum. From this consideration we should naturally infer that, in the early years of creation, or of the formation of new marine channels, the coast scenery must have been even more diversified and romantic than it now is. In speaking of the equal ratio between the obstruction of water in its current, and the incursion which it makes in consequence of that interruption, we need not merely in corroboration refer to the simple fact that, wherever there is a headland, there is a bay, on the side opposed to the prevailing power of water; but it is worthy of note, that under ordinary circumstances of a geological character, the proportions between the perpendicular extents of promontories and their bays are distinctly and unequivocally marked. By way of illustrating our subject, we will return to Beachy-head in confirmation of our theory, that changes in the face of the coast are occasioned by the efforts of the ocean to obtain its parallelism. By comparing ancient maps of the coast with modern ones, the extent of the alterations effected upon the south-eastern coast will be more readily perceived. We have already shown that the face of Beachy-head has, within the memory of man, suffered considerably from being undermined and washed away by the sea: and could we have beheld it as it was in the times of the Romans, we doubt not we should have seen it stretching out much further into the sea than it now does, and the waters, obstructed in their course by its huge mass, sweeping round its eastern base, forming a deep and ample port (probably the *Anderida* of the Romans), and the bay spreading its waters over the level, till it washed the hills upon which Pevensy and Bexhill were built.* But why has the sea receded, remains still to be answered. We answer, simply by the gradual removal of the causes which occasioned its irruptions; in other words, the liquid element has, in its incessant warfare, reduced the opposition occasioned by projecting masses of cliffs; these have been undermined, the superstrata hurled from their heights, and after, perhaps, temporarily increasing the obstruction, and causing a greater influx of water upon the plains, which must be regarded as exceptions of the general law of equalization which our coast is sustaining, these procumbent masses of chalk or stone have been battered *en detail* by the merciless billows, reduced to fragments, and swept by the maddening tempests into the deep, or from the locality in which nature had originally deposited them. The headlands being thus diminished, and causing less reaction of the sea, deposit after deposit of beach is made in the bays, which increase in the same proportion as the neighbouring headlands wear away. In the course of a few years a green sward covers the beach, and unless interrupted by some extraordinary circumstance, tending to infringe upon the watery world, the work of decreasing the excrescencies, and filling up the indentations of the coast, is carried continually on by the aqueous element.

In concluding our observations upon this interesting problem, we shall proceed to illustrate the solution, "That the mutations to which our coast is subject, proceed from the tendency of the waters of the channel to find their parallel," by further reference to the past and present state of the coast. Resuming our examples to the eastward of Bexhill, we find that the cliff upon which the Galleyhill station-house is erected, is fast consuming away by the continual assaults of the sea; and, in accordance with the law which we have pointed out, the waters which were formerly obstructed by this interposing headland, and thereby intruded with augmented force upon the level to the eastward, so as in former times to render Bulverhithe a small tributary port to Hastings, and to form a bay from that point to Bopeep: the waters, we repeat, in the same proportion as they have effected their parallelism, have also left deposits of beach in the bay, which they originally formed. The curvature of this neighbourhood is now trifling, and in a few years hence its parallelism with the S.W. will be perfectly effected by the prevailing current from that quarter.

By the consumption of the St. Leonards, the Cuckoo hill, and the Castle cliffs, the valleys at the Priory, and between the West and East hills, were forsaken by the sea; in proof of which, we need only state, that in removing the Priory bridge, and in digging the foundation of Mr. Jackson's house, at the end of High-street, nothing, we believe, but beach was discovered—an unanswerable evidence of the sea having formerly entered the mouth of each valley. We have no doubt that Hastings, the Danish pirate, selected our locality as his occasional rendezvous, from the circumstance of the East and West hills or cliffs, which projected in the sea, forming excellent spots for the formation of his camps: and between which, at the mouth of the valley, he could take refuge with his fleet of galleys, perfectly sheltered from every adverse wind.

The cliffs, immediately to the eastward of Hastings, are continually

* If the proportions between the headland and the bay be equal, as we have assumed, by measuring the distance from the present high water mark to the most inland extremity where beach can be discovered, we shall be able to ascertain, with tolerable accuracy, the distance which the promontory formerly extended.

wasting, from the cause to which we have alluded; and as a further corroboration of our opinion, we may mention that, about the first spring tide after the completion of the large groyne, the sea, obstructed by the beach which the erection had caused, was thrown with such additional impetus upon the coast to the eastward, as not only to sweep the beach away, and to bare in an unusual manner the rocks, but also to undermine and throw down many tons of a projecting part of the cliff to the eastward.*

The cliffs, extending from Hastings to Cliff's End, a distance of six miles, formerly stretched much further to seaward, and by obstructing the parallelism of the current, caused it to excavate a bay in the valley to the eastward, proportioned to the extensiveness and perpendicular obstruction of the cliffs adverted to. As recently as the reign of Queen Elizabeth, the sea appears to have flowed as high as the town of Winchelsea, and to have insulated the cliff upon which that of Rye is posited. Our opinion in this case is further confirmed by old maps attached to Camden's Britannia, which represent the towns now mentioned as almost insular. The destruction of *Old* Winchelsea, which is buried in the sands to the south of Camber castle, may easily be explained upon the theory of the equalizing tendency of the channel currents, which it has been our object to establish and to illustrate. It would be easy to multiply examples, and it was rather a remarkable coincidence that, in our last number, there were two paragraphs from distant parts of the coast relating to encroachments of the sea—one respecting the neighbourhood of Penzance, confirmatory of our principle; and another stating that, as the accumulation of beach at Dungeness point augmented, the undermining of the Martello towers near Hythe, in the bay to the eastward, by the sea, proceeded, with a probability of many acres of land being speedily swallowed up by the element.

Without further examples we trust we have not only assigned a satisfactory reason for the encroachments and recessions of the sea, and at the same time, by an easy deduction, hinted at the means whereby land may, by the construction of groynes, be recovered to the westward, or, if necessary, excavated on the side opposed to the prevailing current by the action of the waves, but have also shown that no extensive infringement of the coast by the waters need be apprehended; and that the irregularity of the ebb and flow of the tide for centuries past, has been less in proportion than the disturbance of water in a vessel when carried by the steadiest hand, thereby demonstrating the omnipotence of the divine and sublime injunction—"Hitherto shalt thou come, but no further; and here shall thy proud waves be staid."

ENGRAVINGS IN RELIEF FROM COPPERPLATES BY MEANS OF VOLTAIC ELECTRICITY.

We lately published M. Jacobi's letter to Mr. Faraday, in which he described his attempts to copy in relief engraved copperplates, by means of voltaic electricity. We have since received a communication from Mr. Thomas Spencer, of Liverpool, from which it appears, that that gentleman has for some time been independently engaged on the same subject; and that he has not only succeeded in doing all that M. Jacobi has done, but has successfully overcome those difficulties which arrested the progress of the latter. It is unnecessary here to enter on the question of priority between these gentlemen. To Mr. Spencer much credit is certainly due for having investigated, and successfully carried out, an application of voltaic electricity, the value of which can hardly be questioned. The objects which Mr. Spencer says he proposed to effect, were the following:—"To engrave in relief upon a plate of copper—to deposit a voltaic copperplate, having the lines in relief—to obtain a fac-simile of a medal, reverse or obverse, or of a bronze cast—to obtain a voltaic impression from plaster or clay—and to multiply the number of already engraved copperplates." The results which he has obtained are very beautiful; and some copies of medals which he has forwarded to us are remarkably sharp and distinct, particularly the letters, which have all the appearance of having been struck by a die. Without entering into a detail of the steps by which Mr. Spencer brought his process to perfection, many of which are interesting, as showing how slight a cause may modify the result, we shall at once give a description of his process. Take a plate of copper, such as is used by an engraver; solder a piece of copper wire to the back part of it, and then give it a coat of wax—this is best done by heating the plate as well as the wax—then write or draw the design on the wax with a black lead pencil or a point. The wax must now be cut through with a graver or steel point, taking special care that the copper is thorough exposed in every line. The shape of the tool or graver employed must be such that the line made are not V-shaped, but as nearly as possible with parallel sides. The plate should next be immersed in dilute nitric acid—say three parts water to one acid: it will at once be seen whether it is strong enough, by the green colour of the solution and the bubbles of nitrous gas evolved from the copper Let the plate remain in it long enough for the exposed lines to get slightly corroded, so that any minute portions of wax which might remain may be removed. The plate thus prepared is then placed in a trough separated into two divisions by a porous partition of plaster of Paris or earthernware—the one division being filled with a saturated solution of sulphate of copper, and the other with a saline or acid solution. The plate to be engraved is placed in the division containing the solution of the sulphate of copper, and a plate of zinc of equal size is placed in the other division. A metallic connexion is then made between the copper and zinc plates, by means of the copper wire soldered to the former; and the voltaic circle is thus completed. The apparatus is then left for some days. As the zinc dissolves, metallic copper is precipitated from the solution of the sulphate on the copper plate, wherever the varnish has been removed by the engraving tool. After the voltaic copper has been deposited in the lines engraved in the wax, the surface of it will be found to be more or less rough, according to the quickness of the action. To remedy this, rub the surface with a piece of smooth flag or pumice-stone with water. Then heat the plate, and wash off the wax ground with spirits of turpentine and a brush. The plate is now ready to be printed from at an ordinary press. In this process, care must be taken that the surface of the copper in the lines be perfectly clean, as otherwise the deposited copper will not adhere with any force, but is easily detached when the wax is removed. It is in order to ensure this perfect cleanness of the copper, that it is immersed in dilute nitric acid. Another cause of imperfect adhesion of the deposited copper, which Mr. Spencer has pointed out, is the presence of a minute portion of some other metal, such as lead, which, by being precipitated before the copper, forms a thin film, which prevents the adhesion of subsequently deposited copper. This circumstance may, however, be turned to advantage in some of the other applications of Mr. Spencer's process, where it is desirable to prevent the adhesion of the deposited copper. In copying a coin or medal, Mr. Spencer describes two methods: the one is by depositing voltaic copper on the surface of the medal, and thus forming a mould, from which fac-similes of the original medal may readily be obtained by precipitating copper into it. The other is even more expeditious. Two pieces of clean milled sheet lead are taken, and the medal being placed between them, the whole is subjected to pressure in a screw press, and a complete mould of both sides is thus formed in the lead, showing the most delicate lines perfect (in reverse.) Twenty, or even a hundred of these, may be so formed on a sheet of lead, and the copper deposited by the voltaic process with the greatest facility. Those portions of the surface of the lead which are between the moulds, may be varnished to prevent the deposition of the lead, or a whole sheet of voltaic copper having been deposited, the medals may afterwar s be cut out. When copper is to be deposited on a copper mould or medal,care must be taken to prevent the metal deposited adhering. This Mr. Spencer effects by heating the medal, and rubbing a small portion of wax over it. This wax is then wiped off, a sufficient portion always remaining to prevent adhesion. Enough has been said to enable any one to repeat and follow up Mr. Spencer's interesting experiments. The variations, modifications, and adaptations of them are endless, and many new ones will naturaly suggest themselves to every scientific reader.—*Athenæum.*

Transferring Impressions of Old Prints.—One of the most ingenious inventions we have witnessed for many a day is a process invented by Mr. Joseph Dixon, for transferring impressions to stone. The discovery was made some seven or eight years since, and, by its means, new and exact impressions of the leaves of old books, bank bills, engravings, &c., may be obtained in an incredibly brief space of time. The celerity and exactness of the work are truly remarkable. A bank bill was transferred by Mr. Dixon, in presence of the officers of a bank, with so much fidelity and precision that the very signers of the bill could not tell the difference between the copies and the original. It is due to Mr. Dixon to state, that he has obtained a patent for the process by which bank bills can be protected from his own invention, should it ever fall into the hands of rogues. The importance of this discovery is in nowise inferior to that of the Daguerreotype, of which we have heard so much within the last year.—*New York Mirror*—[We gave a description of a similar invention, by two Frenchmen, in the Journal for August last, page 308. Editor C. E. and A. Journal.]

How to Stop a Runaway Horse.—Mr. Thomas, of St. James's-street, has just perfected an invention, the object of which is to stop the progress of horses which have taken fright. The apparatus is thus described by Mr. Thomas himself:—"On the nave of the wheel is fixed a small gun-metal wheel; in front of the axle runs a steel spindle, with a small cog attached; over the spindle is a cylinder, and to which a check-string is affixed. The moment it is put in action the spindle advances, and the cog revolves gradually round the gun-metal wheel, which is fixed on the nave, carrying with it reins leading from the horse's head, composed of cat-gut, or of patent cord, covered with leather. As the wheel revolves, the cylinder, which is about an inch in diameter, is gathering up the reins, until the horse is brought to a stand-still; when, by letting loose the check-string, the horse's head is immediately free." Mr. Thomas has very appropriately named his most valuable invention a "Carriage Safety, or Traveller's Life Preserver."—*Waterford Paper.* [We believe this to be a similar invention to one patented by a gentleman of the name of Cook, and applied to several carriages, and to a Brighton stage coach, about 10 or 12 years ago; at that time orders were received for the apparatus at a shop in Long Acre.—Ed. C. E. & A. Jour.]

* Lieut.-Col. Williams, in his scientific paper on "The Laws which govern the course of the Shingle on the S E. coast, and Hints upon Rye and Dover Harbours," notices the general tendency of groynes to collect the beach on the western, and to clear it away on the opposite side, owing to the prevailing current from the south-east.

REVIEWS.

Theory of the Steam Engine. By COMTE DE PAMBOUR. London: John Weale, 1839.

(SECOND NOTICE.)

IN our September number we noticed this work, and made some remarks on the first chapter, in which the author criticises the ordinary mode of calculating the effect of steam-engines, and exposes the principles of his own theory. We then assented to these principles generally, but at the same time expressed our opinion, that it would not be very easy to apply them practically, for want of proper means of ascertaining with accuracy the data on which the calculations are grounded, and showed that the same results might be arrived at, by a method similar to the ordinary one, with much greater facility than by the Count's method.

The second chapter treats of the laws which govern the mechanical action of the steam. In the first section of this chapter the author justly observes that the formulæ which he uses to calculate the temperature of steam at its maximum density under different pressures, have the inconvenience of suiting only a limited part of the scale of temperatures. At the time when the work was written no formulæ had been discovered, to express the relation existing between the temperature and elastic force of steam, which would suit the whole scale, even as far as it had been ascertained by experiment; but in the June number of this Journal a formula was proposed by Mr. Mornay, which, though in one part of the scale it does not accord so well with experiment as Tredgold's rule, follows the natural law much more nearly in general, and can therefore be used in investigating the action of steam when its elastic force varies, as in the case of expansive engines; particularly as the original elastic force and density of the steam need not be calculated by the proposed formula, but may be ascertained directly or taken from tables constructed so as to accord more exactly with experiment.

M. de Pambour proposes the two following formulæ, to express the relation which exists between the elastic force and relative volume of steam, of the maximum density for its temperature:

Formula for *condensing engines* of various systems;

$$\mu = \frac{10000}{\cdot 4227 + \cdot 00258p}.$$

Formula for *non-condensing engines;*

$$\mu = \frac{10000}{1\cdot 421 + \cdot 0023p}.$$

In these formulæ μ represents the relative volume, and p the elastic force in pounds per square foot.

The application of these formulæ is attended with a serious inconvenience in some cases, namely, when the steam enters the cylinder of an engine at a high pressure, and is there caused to expand to a very low one. In this case the second formula would suit at the commencement of the stroke, after a certain portion of which it would cease to be applicable; and, unless the action of the steam were divided into two parts, and the effect of each calculated by the respective formula (which would double the length of the calculation), we should be obliged to content ourselves with a less accurate result than in purely high pressure, or low pressure engines. But the formulæ adopted by M. de Pambour do not agree so well as Mr. Mornay's with the results obtained by means of the ordinary formulæ from the table of elasticities constructed so as to accord with experiment, even in those portions of the scale for which they were severally intended. The relative volume of steam of five pounds pressure is (according to the table, page 83) 4624, and the volume calculated by the formula for condensing engines is found to be 4386; Mr. Mornay's formula gives 4600. At 10 lbs. pressure the volume is, by the same table, 2427; calculated by the formula for condensing engines it is 2417, and by Mr. Mornay's formula, 2424. At 20 lbs. the volume is 1280; M. de Pambour's formula for condensing engines gives 1273, that for non-condensing engines, 1243, and Mr. Mornay's, 1281. At 60 lbs. the volume is 467; the formula for condensing engines gives 440, that for non-condensing engines 470, and Mr. Mornay's formula 469. At 90 lbs. the volume is 323, the formula for non-condensing engines gives 320, and Mr. Mornay's formula 324.

The two expressions of the relative volume of steam adopted by M. de Pambour, page 80, were no doubt chosen on account of the facility which they afford in calculating the mean pressure on the piston, when the steam is used expansively; but they do not agree, that is, they are not identical with the general equation, page 75. The former are of the form

$$\mu = \frac{1}{n + qp},$$

and the latter

$$\mu = r\,\frac{1 + s\,(t - 32)}{p}.$$

Eliminating μ between these two equations, we obtain

$$p = \frac{nr\,[1 + s\,(t-32)]}{1 - qr\,[1 + s\,(t-32)]},$$

which differs in form from all the equations previously adopted, page 68, to calculate the elastic force of the steam in terms of its temperature.

In the third chapter the author develops more fully the theory, of which the outline was given in the first chapter. Here the different problems regarding the effects of steam-engines are very clearly and systematically stated, with reference to three cases which occur in the working of an engine. These are: that in which it works at a given rate of expansion, and with any load or velocity *whatever;* that in which it works at a given expansion, and with the load or velocity proper to produce its *maximum useful effect with that expansion;* and lastly, that in which, the expansion having been previously regulated for the most favourable working of the steam in that engine, it is loaded with the most favourable load for that expansion, which consequently produces the *absolute maximum useful effect* for that engine. The four problems proposed and solved by the author consist in finding the Velocity, the Load, the Evaporation, and the Useful Effect of the engine. The chapter is divided into three Articles, each of which is devoted to one of the three above mentioned cases.

The first problem, *to find the velocity of the piston under a given load,* is treated in the second section of the first Article. The author here appears by the following passage to suppose the elastic force of the steam in the cylinder not to vary so long as the influx of the steam lasts.

"Let P be the total pressure of the steam in the boiler, and P′ the pressure the same steam will have on arriving in the cylinder, a pressure which will always be less than P, except in a particular case, which we shall treat of shortly. The steam then will enter the cylinder at the pressure P′, and will continue to flow in with that pressure and to produce a corresponding effect, till the communication between the boiler and the cylinder is intercepted."

That this is not rigorously the fact is evident, on account of the varying velocity of the piston; and even though M. de Pambour may have ascertained that these variations are not worth taking account of, it would have been much more satisfactory, if he had mentioned the circumstance, and shewn that the results are not materially affected by omitting to take them into consideration. At the commencement of the stroke of the piston, when it has no velocity, the steam must have the same elastic force in the cylinder as in the adjoining passages; but when the piston has acquired a considerable velocity, as at the middle of the stroke (particularly in locomotive engines, where the velocity of the piston is excessive), the steam will not flow from the steam-pipe into the cylinder sufficiently fast to follow the piston in its motion, without a certain excess of pressure on the side of the steam in the pipe, which we do not believe to be a negligeable quantity. In a locomotive engine, for example, with wheels of five feet diameter, and 18 inches length of stroke, running at a speed of 30 miles an hour, with an effective pressure of 65½ lbs. on the square inch, we should estimate the difference of pressure between the steam-pipe and the cylinder at one-third of a pound at least on the square inch. We believe this difference to increase *nearly* in the ratio of the square of the velocity of the piston, all other circumstances remaining the same, on which supposition it would amount, at a speed of 40 miles an hour, to about three-fifths of a pound per square inch. If this be true, it will materially affect the calculation of the effect of expansive engines, where the steam is cut off at *one-half* of the stroke, as the effect during the expansion is determined by the density of the steam in the cylinder at the instant of cutting off. It is evident, in the same manner, that the earlier the steam is cut off, the less the difference of pressure will be, since the velocity of the piston is then less considerable; if cut off at one-sixth, for example, when the other circumstances are the same as in the above case of the locomotive engine running at 30 miles an hour, we believe the loss of pressure would be about two-elevenths of a pound. This is, of course, but a rough estimate of the difference of pressure arising from the variations in the velocity of the piston; but perhaps M. de Pambour will give the subject some consideration before the publication of a second edition of his work.

On the supposition of the invariability of the pressure, the author finds the following general relation between the different data of the problem,

$$a(l'+c)\left(\frac{n}{q}+P'\right)\left\{\frac{l'}{l'+c}+\log\frac{l+c}{l'+c}\right\}-\frac{n}{q}\,al=\mathrm{R}al, \qquad \text{(A.)}$$

in which P is the pressure of the steam on the piston, before the communication with the boiler is intercepted, and R the mean resistance on the piston. This equation is then transformed into another, independent of P′, by supposing the evaporation of the engine, or rather its effective evaporation, to be known. This new equation is,

$$v=\frac{\mathrm{S}}{a}\cdot\ \frac{1}{n+q\mathrm{R}}\left\{\frac{l'}{l'+c}+\log.\frac{l+c}{l'+c}\right\} \qquad \text{(1.)}$$

where S is the volume of water evaporated per minute, and transmitted to the cylinder in the form of steam, l the length of the stroke, l' the length of the portion traversed by the piston at the moment the steam is cut off, c the clearance at each end of the cylinder, that is, the length of a portion of the cylinder whose capacity is equal to that of the waste space beyond that traversed by the piston, which is necessarily filled with steam at each stroke.

In order to make use of this equation, it is evident that we must know, not only the quantity of water actually evaporated, but also the quantity lost through the safety valve, or by any other means.

The quantity R, which is the total resisting pressure on the unit of surface of the piston, is afterwards decomposed into three parts, namely, the resistance arising from the motion of the load, which the author calls r; that arising from the friction of the engine, which is expressed by $(f+\delta r)$, calling f the friction of the engine unloaded, and δ the augmentation of that friction per unit of the load r; and the pressure on the opposite side of the piston, which is represented by p, and is equal to the pressure of the atmosphere in high pressure engines, and to the pressure of condensation in condensing engines. Thus,

$$\mathrm{R}=(1+\delta)\,r+p+f.$$

Substituting this value for R, and the expression k for

$$\frac{l'}{l'+c}+\log.\frac{l+c}{l'+c},$$

the equation (1) becomes

$$v=\frac{\mathrm{S}}{a}\cdot\ \frac{k}{n+q\,[(1+\delta)r+p+f]} \qquad \text{(1.)}$$

In the calculations relative to locomotive engines, three terms more are to be introduced into the expression of the resistance; the first to express the resistance of the air against the train, which, increasing as the square of the velocity, could not be neglected without error; the second to express the resistance offered by the engine itself in the transport of its own weight on the rails; and the third to take account of the resistance caused by the blast-pipe.

The above general equation appears to be very complete, and, provided we are furnished with the means of ascertaining the quantity of water which actually passes through the engine in the form of steam, as well as the amount of the various parts of the resistance, and provided also the constant values of n and q do not cause too great an error practically, we have no hesitation in saying that it will be found of great utility in proportioning engines and boilers to the work required to be done.

RIVER OUZE OUTFALL IMPROVEMENT.

This improvement promises to be the prelude to others, and is of great national importance, the success of which will lead to similar improvements in other parts of the coast of England, thereby adding many thousand acres of rich fertile land to the kingdom; in our own judgment we have no doubt of its success, if it be not marred by parish squabbles and the grasping appetite for pecuniary compensation by adjacent landed proprietors.

We have before us an elaborate report relative to the above improvement, by Sir John Rennie, accompanied by plans; it ought to be read by all landed proprietors connected with property on the sea coast. We regret that we cannot find space for the whole of the report, however, we will give a lengthened extract of the most interesting part of it.

The plan for obtaining this most desirable result consists in deepening the Outfalls of the Ouze, the Nene, the Witham and the Welland, by correcting and straightening their channels, confining them between substantial and well-formed banks, carrying all of them into deep water, and there uniting the whole in one general grand channel in the centre of the Great Wash (as shown upon the accompanying plan); a work which, although of considerable magnitude, yet presents no difficulties in the execution which cannot be readily overcome by the provision of adequate means. The natural consequence of these measures will be the closing of all the present minor channels and shoal water of the Wash, which are now fed and kept open chiefly by the rivers above mentioned, the circulation of the tide, and the agitation produced by the wind over such an extensive surface, which prevents the alluvial soil held in suspension by the waters from subsiding, so that it is again carried back to sea. As soon, however, as the present channels are diverted, and other artificial means resorted to to check the currents and waves, and assist the accumulation of warp, then the whole of this extensive space will become still water, and the silt and warp which is held in suspension, amounting to a large proportion, will be deposited, and thus in a comparatively few years will raise the sub-soil sufficiently high, when it will be converted into good land, and may be wholly embanked from the tide. By pursuing the above system of operations regularly and judiciously, the soil will accumulate according as the subjacent space is removed from the action of the waves and currents, and thus the acquisition of land will be progressive, and contribute to the expense of acquiring the remainder, until the whole quantity be completed; indeed about 90,000 acres are now bare at low water, and a large portion of this, viz., about 10,000 acres, are fit to be taken in. By way of illustration, it is only necessary to observe, that a portion of the old channel of the Ouze, containing 800 acres, which was deserted by the Eau Brink Cut, has been warped up, by the course of nature alone, 25 feet, in five or six years, and the whole 800 acres is now under cultivation and worth from 30*l.* to 70*l.* an acre; 1,300 acres were embanked from the Nene Wash eight years since, and let for nearly 2*l.* per acre; since that period the warping of the remainder, containing between 4,000 and 5,000 acres, has been very rapid, amounting to in parts 14 feet perpendicular, by the mere operations of nature alone; this has been further increased by the addition of some slight works within the last two months, and the whole of this will be ready to be taken in in about two years from the present time, and will be much more valuable than the 1,300 acres above mentioned; and if the system now adopted of assisting the accumulation of soil had been commenced earlier, I have no doubt but that the whole of the Nene Wash might have been under cultivation by this time; above 3,000 acres, I understand, have been taken in also along the shores of the Welland and Witham, and the northern side of the Great Wash. These it should be observed are mere detached, isolated operations carried into effect without any general plan and system, and are necessarily neither so efficient or economical as when carried on upon a great uniform and well-combined scale; still, however, they have been very profitable, and have well repaid those who undertook them. The Outfall of the Ouze is the first and principal operation, and by correcting its course and channel three miles may be saved; and an additional fall of nearly 6 feet may be gained in the low-water line between Lynn and the Thief Beacon, 12 miles below the town. There are three lines by which the new channel may be carried; first, by taking it through the inclosed lands belonging to the late Lord William Bentinck; secondly, by straightening and confining it by jetties rather more seaward than No. 1 into deep water; and, thirdly, by carrying it through the Peter Black Sand by jetties along the Norfolk shore into deep water in that direction. The first Plan is, upon the whole, shorter by one mile than the Plan, No. 2, and by the first Plan an additional fall of one foot would be gained in the current; it would also be more certain of execution, more easily maintained when completed, and sooner accomplished, although rather more expensive in the outset.

The Plan, No. 2, would be rather longer, more uncertain, and not so good when completed.

The Plan, No. 3, is objectionable, in consequence of the great length of shoal water, viz. 11 miles, through which the work would have to be carried before it would arrive at deep water; and there would be a greater difficulty in preserving it when made, in consequence of the extensive tract of shifting sands which accumulate along the shore.

The expense of Plan, No. 1, would amount to the sum of 250,000*l.*, and the other two rather less.

The Outfall of the river Nene being 5 feet 8 inches lower than that of the Ouze, with the exception of being advanced, is now in such a perfect state, that much more fall cannot be expected; by prolonging it downwards, however, into deep water, so as to unite with the Ouze, the whole of the intervening space of land, amounting to several thousand acres, would be gained in a short time.

The Welland and Witham Outfalls, particularly the former, are now in a very defective state; they may however be completed either by carrying them direct across the Clays into Clayhole, or by the Maccaroni or South Channel, to join the Nene and the Ouze. The advantage of the former plan is, that the distance to deep water is considerably shorter, and, in consequence, it would be sooner effected; and custom has hitherto pointed out Boston Deeps as the natural entrance or roadstead both for the Welland and the Witham. On the other hand, looking forward to one general grand plan, and the prospect of maintaining the general Outfall open, there can be little doubt but that the greater the body or mass of fresh and tidal waters that can be brought into one channel the better, and the greater the certainty of its being able to maintain itself open.

In order to effect this enlarged view of the subject, the junction of the Witham, the Welland, the Nene and the Ouze into one common Outfall in the centre of the Great Wash, appears the best and most certain plan: moreover, presuming that the Witham and the Welland be carried separately into

Clayhole Channel, the Nene into Lynn Well and the Ouze along the Norfolk shore, there would be a far greater quantity of retaining embankments to make; the channels, by being separate, would not be able to maintain themselves open so well; the land gained would be divided into several separate islands, which would render it more difficult of access, and consequently reduce its value, whilst the expense of acquiring it would be greater; and, lastly, the boundaries of the counties of Lincoln and Norfolk would be disturbed.

Presuming that the four rivers in question be turned into one common Outfall in the centre of the Wash (as shown in the Plan), and the other requisite measures carried on, there would most probably be gained, in comparatively a few years, 150,000 acres of land. This, if taken at 40*l.* an acre (and a great proportion of that acquired lately on the old channel of the Ouze is now worth a great deal more), would be worth 6,000,000*l.*, and, after deducting 12*l.* per acre for the expense of obtaining the greater portion, and 15*l.* per acre for that portion lying nearest to the open ocean, would amount to the sum of 2,000,000*l.*, leaving a clear gain of 4,000,000*l.*; perhaps an additional quantity may be obtained hereafter, although it is unnecessary to say more at present, because the other when carried into effect will alone form a sufficient remuneration.

In addition to this profitable result, the following may be added:—

First,—The complete *natural* drainage and consequent improvement in the salubrity of the whole district of low lands draining by the Ouze, the Nene, the Welland and the Witham, and into the Wash, amounting to about 900,000 acres, 160,000 of which, as above mentioned, are in a very defective state and comparatively valueless.

Secondly,—The navigation of all the rivers would be so improved as to occasion no inconsiderable reduction in the charges for freight; there would be a great saving in the pilot and harbour dues; the deepened channels would admit vessels of much larger tonnage; and the ports of Lynn, Boston, Spalding and Wisbech would, in consequence, be rendered much more available for all the purposes of trade and merchandize.

Thirdly,—The shipping interests in general would derive great benefit in stormy weather, during the most prevalent winds, from having an opportunity of entering a roadstead equal in security to any on the eastern coast of England.

Fourthly,—There would be one uniform efficient system of barrier banks round the Great Wash, which would relieve the present proprietors from a very heavy continual tax, amounting at times to 20*s.* and 30*s.* per acre, and at the same time guarantee them against all danger of inundation.

LOCOMOTIVE EXCAVATOR.

M. Gervais, a manufacturer of Caen, and a member of the Superior Council of Commerce, has lately presented to the Academy of Sciences a small model of a locomotive excavator (Terassier Locomoteur). This machine may be usefully employed in the excavation of canals and formation of railroads; but from the want of strength in its construction, it seems at present suitable only to an alluvial soil. A force of steam of from two to three horse-power is required to work it; it clears a space eight feet (2 m. 50) wide, and 2 feet 3 inches (0 m. 70) deep, and advances 1 foot 3 inches (0 m. 38) a minute. Thus, in twenty-four hours it completes 1800 feet (547 m. 20) in length; having cleared out 3250 cubic feet (1000 cubic metres) of earth, which is levelled as regularly on each bank as it could be done by the hands of men. The expense in twenty-four hours cannot exceed 40 francs. The clearing of a cubic metre of earth, therefore, costs about 4 centimes. If we compare this with the price usually paid, the advantage of the invention is evident; but this is nothing in comparison with the advantages which we may expect to derive from the great saving of manual labour, and from the rapid increase of works so beneficial to the industry of the country.

The inventors's first idea was to employ men in levelling all occasional elevations beyond fifteen inches (0 m. 40), but it was found less expensive to employ the machine used in cutting railroads. His plan proceeds on the same principle. The same frame which carries the locomotive, is arranged so that tools, attached to it, can work upwards from the surface of the earth, instead of downwards, and thus remove these elevations. A space is levelled equal in width to the working of the locomotive excavator, and then rails are laid down to preserve the direction and the level. The locomotive follows, excavating and throwing out the earth either on one or both of the banks, and forming an inclined plane, on each side, of forty-five degrees. If a canal is required to be sixteen feet (five metres) deep, or deeper, and cannot be excavated at once, there is attached to the machine behind, an axletree, and cast-iron wheels with large felloes, by which means, as fast as the first cutting is finished, lines are traced on which to place the rails for the second, and so as to preserve the original level. A machine capable of working twenty-feet, wide, and eight feet deep, excavates sixteen cubic feet of earth in a minute.

In railroads, the process would be nearly the same as in canals, except that the inclined plane on the sides need be only of fifteen degrees, and the earth might be carried away in carts wherever it was wanted. This machine is calculated for light and sandy soils; and is so constructed, that, should it encounter any obstacle, it may be stopped in a moment to prevent accidents. Thus, any rocky substance, if small, can be lifted up; if large, can be broken to pieces by the workmen, and carried away on the frame of the machine, after removing the tools, which can then be replaced, and the work continued.

It would be difficult to give a more particular detail without the aid of the plan, which the inventor has transmitted to the academy for the use of the committee, who, as well as ourselves, have seen the machine at work. Whatever their decision may be, it seems to us that the only question now, is the application of steam to the excavation of canals and railroads. The employment of this machine on a large scale, must be attended with great advantages, whether we consider the difficulty of collecting a considerable number of workmen on one spot. the increased rapidity of the work, or the improved salubrity of low grounds by the draining of marshes, and the removal of miasma and its consequent diseases. And these great advantages, if the machine of M. Gervais can really be employed on a large scale, are to be obtained at a remarkably small expense. Taking the model, which we have seen at work, as our data, if we calculate on a 3-horse power steam-engine, and on a consumption of 15 kilogrammes (30 lbs.) of coal per hour, we shall find, after deducting 30 per cent. interest for the outlay, and making every allowance for repairs, and loss of time when the machine is not at work, that it can excavate 957 cubic metres of earth at a cost of 48 francs 50 cents; whereas we now pay for excavating the same quantity, 478 francs 50 cents. In short, the invention of M. Gervais bids fair to make a great revolution in the mode of excavation, and we look forward with a degree of impatience for the decision of the committee of the academy.—*Inventor's Advocate.*

BUTE DOCKS, CARDIFF.

In our last number we gave the particulars of the opening of these docks. The construction of which was entrusted to Mr. Cubitt, of London, as engineer in chief. and to Mr. Turnbull, as the resident engineer. The following particulars are from a statement furnished by the engineers:—

"The river Taff, which falls into the sea at the port of Cardiff, forms a principal outlet for the mining districts, with which Glamorganshire abounds; the produce of these mines has hitherto found its way to market through the Glamorganshire Canal, but its sea lock, constructed about 40 years ago, has long been found inadequate to the demands for increased accommodation, consequent upon the extraordinary increase of trade since the canal was opened, some idea of which may be formed from the fact, that according to the Canal Company's Report, 123,234 tons of iron, and 226,671 tons of coal passed down in 1837—making a total of 349,905 tons, or about 1,000 tons per day.

"The Marquis of Bute possessing lands in the neighbourhood of Cardiff, and especially an extensive tract called Cardiff Moors, where docks, wharfs, and warehouses, might be constructed to any extent, and a convenient outlet made into the well-known safe roadstead, protected by the headland of Penarth, obtained in 1830, an act for constructing a new harbour, to be called 'The Bute Ship Canal,' and has completed this great work at his individual expense.

"The principal advantages of the undertaking are as follow:—A straight open channel N.N.E. and S.S.W. about three-quarters of a mile in length from Cardiff roads to the new sea-gates, which are 45 feet wide, with a depth of 17 feet water at neap, and 32 feet at spring tide. On passing the sea-gate, vessels enter a capacious basin, having an area of about an acre and a half, called the outer basin, calculated to accommodate vessels of great burden and steamers; the main entrance lock is situated at the north end of this outer basin, 152 feet long, and 36 feet wide, sufficient for ships of 600 tons.

"Beyond the lock is the inner basin, which constitutes the grand feature of this work. It extends in a continuous line from the lock to near the town of Cardiff, 1450 yards long, and 200 feet wide, an area of nearly 20 acres of water, capable of accommodating in perfect safety from 300 to 400 ships of all classes. Quays are built on each side for more than two-thirds of its length, finished with strong granite coping, comprising nearly 6,000 feet, or more than a mile of wharfs, with ample space for warehouses, exclusive of the wharfs at the outer basin. To keep the channel free of deposit, a feeder from the river Taff supplies a reservoir 15 acres in extent, adjoining the basin. This reservoir can be discharged at low water by means of powerful sluices with cast-iron pipes five feet in diameter, and by 10 sluices at the sea-gates, so as to deliver at the rate of 100,000 tons of water per hour.

"The feeder was commenced in 1854, the first stone of the docks laid on the 16th of March, 1837, and the last coping-stone laid on the 25th of May, 1839.

"Some doubts existed whether sufficient water could be supplied to keep the channel clear, but experience has already shown that the daily discharge is more than adequate to the removal of the daily deposit, and in fact, a considerable portion of the entrance was cleared by loosening the clay and mud, so as to be carried out by the power of the sluices."

Some idea of the vastness of this undertaking may be formed from the fact of its having already cost the noble Marquis about 300,000*l.*; and an additional expenditure of considerable amount will be incurred in the erection of warehouses, &c., along the quays.

Miller's Patent Fire-bars.—A patent has been taken out for a new fire-bar, which is suited not only to the common steam-engine furnaces, but can with equal facility be applied to the furnaces of marine engines, and the locomotive engines of railways, &c. The principle of the invention consists in moving each alternate bar longitudinally in one direction, whilst the intermediate bars are moved in the opposite one. This movement, aided by the channelled surface of the bars, breaks up the clinkers the instant they are formed, or prevents their formation, and thus keeps the air way perfectly free. Considerable attention has, from time to time, been paid to the improvement of the fire-bar, now become of so much importance to the manufacturing community, by men eminently qualified, and several patents have been obtained for this purpose, all of which have been very considerable improvements over the ordinary fire-bar. The object of the inventors not being always the same, has produced a great variety of plans, which have had more or less merit. Brunton, and also Steel, with a view to an equal distribution of the fire, made the grate itself revolve; others have simply moved the fire-bars, with the intention of preventing the adhesion of clinkers, and the consequent obstruction of the air-way. This is the object of Miller's patent, which, being simple in its principle, of easy construction, not requiring extraordinary strength, and consequently no increased weight of metal, the object is attained with little increased expense over the ordinary fire-bar. The advantages it secures are very considerable; for not only, by the perfect freedom from all obstruction of the air-way, is the combustion of the fuel and its heating power considerably increased, but coal of an inferior quality can be used without the usual effect of choking up the grate. By the vigorous combustion which this grate ensures, it prevents large masses of coal from passing away unconsumed in the form of smoke, and consequently must effect a considerable saving in fuel. The ingenious patentee is the chief engineer of the extensive works of Messrs. Thomson Brothers and Sons, Primrose, near Clithero, where these bars have been for some time at work, and have fully realised the expectations of the inventor.—*Manchester Guardian.*

An improvement on Barker's mill, for which a patent bas been taken out by Mr. Stirrat, of Nethercraig, near Paisley, consists (besides an ingenious water-joint and the application of something like the steam-engine governor) in a beautiful contrivance for preventing the friction which arose from the ceutrifugal action of the water on the revolving arms of the machine. To remedy this, the patentee has had the arms of his machine made with an eccentric curve, calculated according to tbe height of the fall, so that, when the machine is in operation, the water rushes out, at its full speed, in a straight line from the centre, to the extremity of the arm, where its power is wholly exhausted by action on the sides opposite the orifices by which it runs off. The advantages of this machine are said to be very great. In the first place, while, by the common water-wheel, in some circumstances, only a small portion of the water-power can be used, and under the most favourable circumstances not more than 65 per cent., it is calculated that by this new machine not less than 95 per cent. of the motive power of the water is rendered available. Secondly, the most trifling rivulet, provided it have a good fall, can be taken advantage of by the new machine; and, thirdly, the expense of the improved Barker mill is not more than one-fifth of the expense of a water-wheel, to work in the same stream.—*Aberdeen Herald.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

(Continued from page 311.)

May 28.—James Walker, Esq., President, in the Chair.

Diving Bell.

Colonel Pasley stated the result of some experiments which he had made with a diving-bell in the Thames and in the Medway. The common rectangular diving bell, suspended from a vessel in a very strong tide, was completely swept under the boat, and in some other cases it swung round half and half, or was twisted considerably out of its proper position. He attached boat-shaped ends, and on descending at the half ebb of a strong flood tide, the bell was perfectly steady. He should think a bell fitted in this manner would be exceedingly advantageous for going alongside of wrecks. He should recommend the ends to be moveable, and if the wreck were athwart the tide he should have only one end put on, and bring the bluff end against the vessel. An experienced diver had informed him, that in the current of the Danube, running seven knots an hour, the bell vibrated tremendously. Since this arrangement had occurred to him, he discovered that a similar one had been proposed to the "then Navy Board," about 20 years ago, by Mr. W. S. Smith, who had been employed under Mr. Rennie, but it does not appear to have been tried. Colonel Pasley promised the Institution a more detailed account of his experience on this important subject.

Coke and Peat.

Mr. Parkes stated, that he would take this opportunity of the presence of Mr. Williams to lay before the meeting some specimens of French Peat, which had been alluded to on a previous occasion.* One of the specimens was that obtained by allowing the particles to come within the influence of the natural forces to which the atoms are subject. The slutch as dredged up from the bottom of the streams, in a state of great comminution, was put into moulds, and, contracting as it dried, acquired considerable density. This was an instance of density due to gradual drying; the density became doubled by this process. Mr. Parkes presented a specimen of coke from compressed peat; this Mr. Williams would explain, as he had taken up the subject where every one else had left off, and had succeeded in producing density by mechanical means, at a moderate cost, and, by carbonizing the mass, in getting rid of the volatile particles, which are injurious as a fuel; he thus produced an extremely valuable coke.

Another specimen was of the incrustation on the interior of a gas retort; it was a coke of extreme density and of great value for some purposes, but for what was a secret. This deposition accumulates until the interior of the retort is almost filled up, leaving no available space for the charge. The retorts are bought for the sake of this coke, which is a perfect carbon. A thin coating of carbonaceous matter, which would otherwise be carried off in the gas, is deposited each charge.

Mr. Lowe was not aware of the uses to which this coke could be applied; but it was of extreme disuse to the gas-makers; he believed, however, that it was used to produce an intense heat. It is sometimes stated to be a carburet of iron, but a portion from the centre of the mass shews, on being tested, not the least trace of iron. It arises naturally in the process of gas-making, and the rate of its deposition depends on the temperature; as in those retorts which have a tendency to become too hot the deposition goes on exceedingly fast. There were many curious facts connected with its deposition; that in a horizontal part is stratified in concentric layers. The upper portions will be perfectly sectile and form admirable crayons, that at the lower part will scratch glass; it decreases in density from the bottom; a portion of the sides partakes of both qualities. He suspected, that a large quantity was sold as black lead.

Mr. Williams remarked, that there were two kinds of peat, the one having a density due to impurities; this is useless for all purposes of metallurgy. But for the purest carbon, the upper surface of the moss must be used, and an artificial density must be communicated to it; it is only in this manner that a dense and pure coke can be obtained. The peat having this artificial density is carbonized, by which all the volatile matter useless in combustion is driven off, ground, and then being mixed with a bituminous matter the operation of nature in the production of various species of coal may be closely imitated.

June 4.—The President in the Chair.

The following were balloted for and elected: Samuel Castle Gant, as a Graduate; and Earl de Grey, as an Honorary Member.

A paper was read:

'*On the Dimensions and Performances of the Archimedean Steamer.*' By George Rennie, F.R.S., &c. &c. We gave particulars of this vessel in the last number of the Journal.

June 11.—James Simpson, Esq. in the Chair.

The following were balloted for and elected: Richard Griffith, as a Member; and Thomas Penson and Robert Aytoun, as Associates.

'*On Warming and Ventilating Public Buildings and Apartments, with an account of the methods which have been most successfully employed for ensuring a healthy state of the Atmosphere.*' By Charles Hood, F.R.A.S.

The author first treats of the constitution of the atmosphere; the artificial changes produced in it, and the effect of these changes on animal economy. The researches of chemists show that in atmospheric air, uncontaminated by respiration or other means, there exists from 21·1 to 20·5 per cent. of oxygen, 78 per cent. of nitrogen, $\frac{1}{10}$ per cent. of carbonic acid, and a small quantity of aqueous vapour. Besides these there are many foreign matters insensible to chemical tests, but quite sensible to our organs, whereof many being easily decomposable by heat, are resolved into their constituent gases; to this fact is to be referred the wholesomeness and pleasantness of some artificial systems of heating, or the contrary. The hydrometric condition of the atmosphere is most remarkably affected by change of temperature, as the quantity of vapour in air of 52° F. may be estimated at $\frac{1}{160}$th of the weight of air, at 59° F. at $\frac{1}{80}$th, and at 86° F. at $\frac{1}{40}$th; when then the temperature of the air within the room is considerably above that of the air without, this increased capacity for moisture is productive of effects prejudicial to the health. Moreover if iron surfaces of too high temperature be present, the vapour may become decomposed, its oxygen combining with the iron, and the hydrogen becoming diffused through the atmosphere. Consequences prejudicial to health from these causes have been repeatedly experienced in rooms heated by a hot air cockle; these effects are not peculiar to the hot air cockle, but will result in a greater or less degree whenever artificial warmth is produced from iron surfaces, the temperature of which much exceeds 212° F. The dryness of the air may in some measure be remedied by moisture, distributed artificially, but the effects from the decomposition of the particles of matter cannot be obviated by any artificial means. The system of Mr. Bernhardt is peculiarly open to these objections, as the pipes nearest the fire must become intensely heated; as also the stoves introduced by Dr. Arnott; since, independent of the difficulty of keeping down the temperature of the metallic surface, carbonic oxide is produced from the coke, and carburetted hydrogen is also formed in the stove. The gas stoves are also open to the same objections; moreover the quantities of water, of nitrogen, and of carbonic acid gas evolved by the combustion of the gas are extremely deleterious. In the latter case aqueous vapour will be in excess, and consequently the due quan-

* Minutes, January 8, 1839, page 111.)

tity of perspirable matter is not carried off from the lungs and skin, the injurious effects of which have been clearly established by M. Quetelet in his work on man. The injurious effects of an excess of nitrogen and carbonic acid gas are too well known to require comment.

The author next treats of the best methods of warming buildings in order to secure a healthy state of the atmosphere; and having shewn the disadvantages of applying heat directly to any surface, he points out the method of applying it indirectly, as by steam or hot water, contained in iron pipes: the latter is more economical and simple, affords greater permanence and equality, admits of a lower uniform temperature, and any form of heating surface. The temperature of the metallic surface rarely exceeds 180° F. and never reaches 212° F., which is too low to decompose in any appreciable degree the organic matter contained in the air. The only effect is to increase the capacity of the air for moisture, which is readily obviated. The surface which is intended to distribute the heat should be a good conductor and radiator, and the material which presents this combination in its highest degree is iron: the amount of heating surface which will be required depends on the building to be warmed, and on a great variety of circumstances; but as an approximate rule it may be laid down, that for a church or similar public building the cubic contents of the building divided by 200 will give the number of feet of surface requisite for a temperature of from 55° F. to 58° F. in the coldest weather ordinarily experienced in this country. The form of the heating surface is immaterial as regards the action of the apparatus, but the time requisite to obtain a given temperature, and the permanence of that temperature, depend on the mass of heated matter; the relative times of heating and cooling being inversely as the mass divided by the superficies. A rapid circulation of the water may be obtained by increasing the elevation of the pipes above the boiler, but it is considerably influenced by any alterations in the bore of the pipes. One great advantage in this apparatus is its perfect safety, as the water at some point is always open to the atmosphere, whereas in the system of hermetically sealed pipes, containing steam or hot water under a pressure of from ten to fifty atmospheres, this security can never exist.

3.—The author lastly treats of ventilation; a subject of the greatest importance, independent of the changes already alluded to as produced in the atmosphere by overheated surfaces, since all air respired from the lungs is found to have lost a proportion of its oxygen, and to have acquired a proportion of carbonic acid gas and vapour, and the quantity of air which will require to be changed may be taken as 3½ cubic feet per minute for each person a room contains. The author dwells at considerable length on the physiological effects consequent on these changes, and details several striking instances of the great advantages resulting from improved ventilation, in places which had previously been unhealthy. All ventilation may be placed in one of two classes, the natural or the mechanical; in the former, the excess of temperature of the air is the *primum mobile* of the efflux, and the rapidity of the discharge may be much increased by artificially raising the temperature of the discharging pipe. Ventilation by mechanical means, as by pumps, or by fans rotating with a great velocity, may be most advantageously employed, wherever mechanical power is used for other purposes; the great efficacy of this latter mode is proved most unquestionably by the experience of the manufacturing districts. The former method has recently been tried on a very large scale at the House of Commons, and it is calculated by Dr. Ure that 38 times more fuel is expended in producing the same effect by chimney draughts than by mechanical power. It appears, however, that the natural method of ventilation, by the spontaneous effusion of the heated air, through openings in the ceiling, is the best calculated for ordinary purposes; but that in all extraordinary cases ventilation by some mechanical means is the only economical and efficacious method.

A paper was read on

'*Experimental Researches upon the cost of the Light afforded by different Lamps and Candles.*' By Andrew Ure, M.D., F.R.S., &c. &c. We published this paper in the last September Journal.

June 18.—The President in the Chair.

A paper was read giving '*An Account of the New Stone Bridge, over the River Lea, at Stratford-le-Bow.*' By John Buldry Redman, Grad. Inst. C. E. We published engravings and an account of this bridge in the last April Journal.

'*A new plan of construction of Sliding Gates for the Entrance Locks of Docks, &c.*' By J. C. Singels, Engineer of the Waterstaat, Hollande, &c.

The improvement suggested consists in substituting for the ordinary Lock Gates, Sliding Gates, traversing the ends of the lock on rails laid on sills, drawn across by chains and capstans. The author in proposing this mode of construction assumes, that when a lock exceeds 50 feet in width, ordinary gates must be abandoned and caissons used. The advantages offered by it are, diminishing the length of the lock by that of the ordinary opening gate, consequently the volume of water to fill the lock is lessened in the same degree, and reducing the number of the locks; for as a small elevation is essential to the strength of the ordinary gates, the sliding gates may on the contrary be made of almost any height without any fear of impairing their strength or solidity.

In the description of the Plans accompanying the paper, great stress is laid on the whole length of the lock, with the exception of that part across which the gate traverses, being constructed on an invert arch, thus giving greater solidity than where a flat floor only is used, either for the whole length, or for the wide space necessary for the ordinary gates to swing upon. It is acknowledged that more masonry is required in this mode of construction, but it is argued that the extra expense will be met by the saving in the length of the lock and in the quantity of the water used.

In constructing the Sliding Gate, the timbers of which are cross braced and strutted, and then covered with planking on both sides, the rule to be observed is, that the thickness of the gate is one-fourth of the width of the lock, so that the main bracing timbers are at an angle of 20°. These are crossed by other timbers, also diagonally braced, extending the vertical height of the gate, so as to give that combination best calculated to withstand the pressure of the water on either side. To obviate the difficulty of setting in motion so heavy a mass as the sliding gate, it is proposed to place within it some barrels filled with air, which by their buoyancy would relieve the rollers of some portion of the weight, and enable the gate to traverse more easily.

Mr. Palmer observed, that the author could hardly be acquainted with the modern practice in constructing locks in this country, as timber had for a long period been but little used in the lock chamber. His practice had been invariably to have an invert arch at a lower level than the lock chamber. He was now constructing at Port Talbot, in South Wales, a lock of 45 feet span, in which there was at invert arch built of stone, 3 feet thick, with lias lime, placed on a stratum of concrete, 2 feet thick, the concrete being composed of four parts of gravel and sand to one of lime; above this invert, the floor was filled in with 2 feet thick of brickwork, laid in Roman cement. Beneath the roller curbs, stones were placed to bed them upon. Each lock gate weighed about 40 tons, one half of which was borne by the heel-post and the other half on the rollers, yet there was no difficulty in moving it at pleasure. The depth of the water was 30 feet, and sometimes the whole column pressed on the gates, yet no injury was feared. There had been great difficulty with the water during the course of construction, but the invert and the side walls placed on it were perfectly sound, and able to withstand any pressure. He apprehended that the sliding gate would be much heavier than the common gate—that the expense of construction would be greater—and he could not discern any compensating benefit to result from its adoption.

June 25.—John Macneill, Esq. in the Chair.

The following were ballotted for and elected: J. F. Hanson, John Llewellin, and W. Llewellin, as Associates.

The following communications were read in part:—

'*On Steam Engines, particularly with reference to their consumption of Steam.*' By Josiah Parkes, M. Inst. C. E.

'*On the Analysis of a portion of the Iron Heel-plate of the Stern-post of the John Bull, Steam Vessel.*' By David Mushet, A. Inst. C. E.

The action of the sea water had converted the iron into a substance somewhat resembling plumbago. Mr. Mushet, after analysing it, considers this substance, which had been called marine plumbago, to be composed nearly as follows:

Carbonic acid and moisture	20
Protoxyde of iron	35·7
Silt or earthy matter	3·2
Carbon	41·1
	100

'*On a method of Dowelling Timber by Iron Dowels and Asphalte.*' By M. J. Brunel, M. Inst. C. E.

'*On the Expansion of Iron and Stone in structures, as shewn by observations on the Southwark and Staines Bridges.*' By George Rennie, F.R.S. &c. &c.

'*A theoretical calculation of the amount of Fuel saved by working Steam expansively.*' By J. W. Lubbock, Hon. M. Inst. C. E.

'The following communications were announced as received:—

'*Observations on the efficiency or gross power of Steam exerted on the piston, in relation to the reported duty of Steam Engines in Cornwall at different periods.*' By John Scott Enys, A. Inst. C. E.

'*Specifications and Drawings of the Gas Works at Middlesbro-on-Tees.*' By Peter Henderson, A. Inst. C. E.

'*On the construction of the Cherbourg Breakwater; with a Drawing.*' By G. S. Dalrymple.

'*Drawing and Description of the Coffre Dam at the new Houses of Parliament.*' By G. S. Dalrymple.

The meeting of this evening concluded the session of 1839.

INSTITUTE OF THE ARCHITECTS OF IRELAND.

On Monday evening, 11th ult., the members of the Royal Irish Academy, Sir William Hamilton in the chair, called upon Mr. Morrison, Vice-President of the above-named learned body, for a statement of the nature of its objects; and the learned gentleman having complied with the demand, a resolution in favour of the Institute was moved, seconded, and unanimously adopted.

SOCIETY OF ANTIQUARIES.

At the opening meeting held on Thursday evening, November 21st, William Hamilton, Esq. V. P. in the chair, J. A. Simpkinson, Esq. M.A. was elected a Fellow. A paper was read on some ecclesiastical buildings in Normandy, by George Godwin, Jun., F.R.S, F.S.A. Lower Normandy is visited by but few Englishmen, notwithstanding its intimate connection with the early history of our country, both political, literary, and artistical, and every item of information concerning it from an observer, provided he use his own eyes, is valuable. Mr. Godwin remarks that many of the buildings are fast hastening to decay, through the use of improper stone. The French society for the preservation of public monuments are actively bestirring themselves, but their funds are so limited that their operations are necessarily confined. Some of the stone now being used at Caen did not seem to the writer of the paper in question, selected with care. The Caen quarries furnish stone of very indifferent as well as of very excellent quality, as is proved by many of the comparatively modern residences and walls in the city, which are fast decaying under the influence of the weather, and discrimination ought therefore to be employed in making selection. The paper consisted chiefly of remarks on the cathedal of Bayeux, which presents several peculiar features; it will be followed, it was stated, by other rough notes on Coutances, Falaise, Evreux, &c.

Royal Academy.—Mr. Philip Hardwick has been elected an associate of the Academy, and Mr. Cockerell to the Professorship of Architecture, in room of the late Mr. Wilkins. We trust there will be no further delay in giving the ordinary course of lectures on architecture, which has been, of late, very much neglected.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(From the Reports of the Athenæum and Literary Gazette.)

(Continued from page 422.)

On Waves, Mr. Scott Russell brought up the Report of the Committee (Sir John Robison and Mr. Russell.)

Since the last meeting the committee had continued their researches, and had, in each department, confirmed or corrected the results formerly obtained by them, and had also extended their acquaintance with several interesting phenomena. The first object of their attention, was the determination of the nature and laws of certain kinds of waves. Of these, the most important species was that called by Mr. Russell the Great Solitary Wave, or the Primary Wave of Translation; the second, was the Oscillatory Wave, or secondary species. The recent researches, while they had confirmed and extended to a larger scale the observations of preceding years, have in no respect altered the views formerly stated by this committee. The form of the wave is that to which the name Hemicycloid has been given; its velocity is that due to half the depth of the fluid, reckoned from the top of the wave to the centre of gravity of the section, where the depth of the channel is not uniform. The motion of the particles, is a motion of permanent translation in the direction of the motion of the wave, through a space equal to double the wave's height; the particles of the water perfectly at rest before the approach of the wave, were lifted up, translated forwards, and were deposited perfectly at rest in their new locations—the translation taking place equally throughout the whole depth of the fluid. It had been stated by Mr. Russell, in a previous report, that all the data requisite to derive the phenomena of the great wave of translation had been now obtained, and that he himself had found no difficulty in obtaining the laws of this wave from the equations of M. Laplace, on the hypothesis, that the motion of the water particles was not infinitely small, and the oscillations infinitely small, as had been hitherto supposed, but that they had the magnitude and nature actually found in these experiments. During the past year, considerable progress has been made in this examination, and highly satisfactory confirmation of the truth of these views had been obtained, by the labours of Prof. Kelland. Prof. Kelland had also adopted the method of introducing the hypothesis of the particles of the water having the motions observed in the experiments—viz. a motion of permanent translation in a given course; and although his results did not perfectly accord with the experiments, they had presented a much closer approximation to them than previous investigations, and were to be regarded as additions to the theory of the motion of waves. The second subject of inquiry by this committee regarded the connexion which existed between the motion of waves, and the resistance of fluids to the motion of floating bodies—a subject closely connected with practical navigation. In the continuation of this inquiry, the committee had received many confirmations of their former views, while they had been extended beyond their former means of observation. The phenomenon of vessels at high velocities riding the wave, had been exhibited to an extent never before witnessed. It had been formerly observed, that when a vessel was, by any means, drawn along the surface of water with a high velocity, it produced a wave, which was a wave of translation, moving with the velocity due to the depth; and that whenever the velocity of the vessel becomes greater than the velocity of the wave, the vessel is carried along on the top of the wave with diminished resistance. This phenomenon had been last year exhibited on a scale much more striking than formerly. The wave, divided in two by the prow of the vessel, had risen on each side to a height far greater than that even of the vessel itself; it expanded on each side of the vessel, from stem to stern, in a broad unbroken sheet of water, bearing along the vessel between what seemed to be a pair of extended gossamer wings, giving, at extremely high velocities, a resistance very much less than had hitherto been observed. The third point of inquiry concerns both the theory of hydrodynamics, and the art of practical navigation. What is the form of a solid of least resistance, is a question which has been much discussed since the days of Sir Isaac Newton. What is the shape to be given to a vessel or ship, so that it may be driven by sails, or propelled by oars or steam, with the greatest velocity, or at the least expenditure of power? is the same question, asked by the practical ship-builder, in relation to his art. It had been inferred by Mr. Russell, from certain theoretical considerations, that a certain form, which he called the Wave Form of vessel, would be the form of least resistance, and the form of greatest velocity. This form was, that the lines of anterior displacement should correspond to the outline of the great wave of translation anteriorly, and to the outline of the posterior wave of replacement, towards the stern. This form had been the subject of experiment from 1834 to the present time; and the experiments of last year confirmed the truth of the original supposition, that this form was that of least resistance. A very curious and gratifying confirmation of the truth of the hypothesis had been received during the course of last year. A clergyman in the north of Scotland—the Rev. Mr. Brodie—had seen an account of these experiments in the Reports of the Association, and had deduced from theory, without a knowledge of Mr. Russell's process, results almost precisely the same, so as to give them the most gratifying confirmation, although derived from grounds somewhat different. The views formerly submitted to the Association on the form of vessel best suited to the practical purposes of navigation, had, during the past year, received very remarkable practical confirmation. A large steam-vessel had been built on the wave principle,—a vessel of 660 tons, with an engine of 220 horse power,—and it had turned out that this was the fastest vessel now in Great Britain. This vessel, built as a pleasure-yacht, combined the qualities of sailing fast, and carrying a large cargo: she was named the *Fire King*, and belonged to Mr. Ashton Smith, of Wales. The last point of inquiry in which this committee had been engaged during the past year, was the question of the nature and laws of the tidal wave, as propagated along our shores, and up the estuaries of our great rivers. But the nature of its propagation along our shores, after it ceased to be affected by the celestial influence, formed a terrestrial mechanism, with which we were still very imperfectly acquainted. To this subject, the committee had devoted their attention, and they had made simultaneous observations for this purpose, at thirteen different stations along the Frith of Forth. The Board of Northern Lights, and Mr. Stevenson, their engineer, had afforded every facility for the observations, and results of a very remarkable nature were obtained. It was found, that there were four tides a day in the Forth, instead of two—four high waters and four low waters. Mr. Russell exhibited drawings of these tidal waves, and gave, what he conceived the explanation of a phenomenon, which is, he thinks, much more common than hitherto supposed. It is well known, that the tidal wave which brings high water from the Atlantic to the south-western shores of Great Britain, becomes divided into two parts, one of which passes upwards through the English Channel, and the other passing round the west and north of Ireland and Great Britain, brings high water to the east coast of Scotland and to the Frith of Forth. Now, it appears not to have been recollected, that the other wave, after coming up through the English Channel, and bringing along with the former, high water to London, must pass on northwards, and in doing so, will enter the Frith of Forth considerably earlier than the northern wave passing southwards. Now, this southern wave, smaller, but earlier than the other, appears to enter the Frith, and may be traced at every station. It is followed up, however, very rapidly, by the great northern wave, and the former moving more slowly than the other, according to the law of the great wave of translation, is overtaken by it at the higher parts of the Frith, and being both greatly exaggerated by the form of that channel, produced the two tides of the Frith of Forth. Mr. Russell expressed his opinion, that the tides in the upper part of the Frith of Forth would be found to rise as high above the mean level of the sea, as the tides of the Bristol Channel. The observations on this subject were not, however, completed, but would be finished in the course of next year.

Mr. Byrne asked what was the exact form of the curve which Mr. Russell considered to bound the solid of least resistance? or what was the mathematical formula (or equation) of the curve?—Mr. Russell replied, that it was stated at length in the published reports of the Association.—Prof. Forbes asked, whether the double culmination of the wave might not arise rather from the circumstance of the two waves not coming simultaneously to the mouth of the Frith than to the separation of the waves, to which Mr. Russell had ascribed it? In fact, the waves, as he considered, must be dissimilar in period, or one could not overtop the other; after they had blended into one, the effect would be either to cause the ordinate of the joint wave to be the sum or difference of the ordinates of the waves or waved depression, accordingly as the two waves or waved depression coincided.—Prof. Whewell said, No; they will separate.—Mr. Russell observed, that the waves were found frequently to separate, and the instances he had cited were remarkable exemplifications of this.—Prof. Stevelly believed the difficulty Prof. Forbes laboured under, arose from his not having been present at the Newcastle meeting, when Mr. Russell gave a very minute account of the structure of the wave of translation, which differed from a common undulatory wave in this, that every particle of the fluid had not only a rising and falling motion, but also a motion of translation, sometimes forwards, sometimes backwards. Now, the mere undulatory motion would exactly produce the effects Prof. Forbes expected, and had so well explained; but the motion of translation of the particles would, from its very nature, cause the wave to separate, even after blending into one, as explained by Mr. Russell.—Lieut. Morrison asked whether Mr. Russell had investigated the effect of the descending current of the river, particularly in the time of freshes, on the tide waves? It had been well ascertained by observations on the Thames, that at such times the descending force of the current exercised a very decided influence on the tides; and he could testify the same from his own experience in other places.—Mr. Russell said, the committee had found that effect very decided, insomuch that in the time of freshes in the Frith, it occasionally obliterated the tide wave.

Experiments upon the effects of Weights acting for an indefinite time upon bars of Iron, by Mr. Fairbairn.

The experiments of which the present is a notice, were commenced by Mr. Fairbairn in March, 1837, when a number of bars of Coedtalon iron cast from the same model, 5 feet long and 1 inch square, were placed horizontally on props 4 feet 6 inches asunder, and had different weights, as 2¼, 3, 3½, and 4 cwt., laid upon the middle of each; the last weight being within a few pounds of the breaking weight. The intention was to ascertain what effect would arise from each of these weights lying constantly upon the bars. The results are, 1st. The bars are still bearing the loads, and apparently may do so for many years. 2nd. The deflections, which are frequently measured, the temperature being observed at the time, are constantly increasing, though in a decreasing ratio,—a fact which shows that, though cast iron may be safely loaded far beyond what has hitherto been deemed prudent, still it is extremely probable that the bars are advancing, by however slow degrees, to ultimate destruction.

The Baron Eugene du Mesnil gave a description of a Safety Lamp, invented by him in 1834.

He stated, that he had presented it to the French government in 1837, and that it had been now adopted, after a favourable report upon it by M. Ch. Combes.

This lamp consists of a body of flint glass, defended by a dozen of iron bars. The air is admitted by two conical tubes, inserted at the bottom, which are capped with wire gauze, and enter by the side of the flame. The latter rises into a chimney, which has a piece of metal placed in the form of an arch over its top; the chimney, however, being quite open. The consequence of this construction is, that a strong current is constantly passing up the chimney. When carburetted hydrogen passes in, the fact is discovered by numerous small explosions, and the whole glass work is thrown into vibrations which emit a loud and shrill sound, which may be heard at a very considerable distance.

Prof. Graham stated, that the novelty in Baron du Mesnil's lamp was, the circumstance of the chimney being quite open. He considered, that the lamp was left almost perfect by that philosopher, and that all accidents proceeded from carelessness. He alluded to the deleterious effects of the after-damp, or carbonic acid left in the atmosphere of a mine after an explosion, which is believed to occasion often greater loss of life among the miners than the original explosion, and often prevented assistance being rendered in case of accidents. In many cases, it was certain that the oxygen of the air was not exhausted by the explosion, although, from the presence of five or ten per cent. of carbonic acid, it was rendered irrespirable. The atmosphere might, therefore, be rendered respirable by withdrawing this carbonic acid, and he suggested a method by which this might be effected. He had found that a mixture of dry slaked lime and pounded Glauber's salts, in equal proportions, has a singular avidity for carbonic acid, and that air might be purified completely from that deleterious gas, by inhaling it through a cushion of not more than an inch in thickness, filled with that mixture, which could be done without difficulty. He suggested the use of an article of this kind by persons who descended into a mine to afford assistance to the sufferers, after an explosion; indeed, wherever the safety-lamp was necessary, and the occurrence of an explosion possible, the possession of this lime-filter would be an additional source of security.

On a small Voltaic Battery of extraordinary energy. By W. R. Grove, Esq.

In a letter published in the *Phil. Mag.* for February, I stated (said the author) some reasons for hoping that by changes in the constituents of voltaic combinations of four elements, we might greatly increase their energy. At that period I sought in vain for improvements, which a fair induction convinced me were attainable, but, being in the country, all my experiments were with copper as a negative metal. I was constantly unable to use concentrated nitric acid as an electrolyte, and its importance never occurred to me until forced upon my notice by an experiment, which I made at Paris for a different object. This was an endeavour to prove the dissolution of gold in nitro-muriatic acid to be an electrical phenomenon, or rather that this (as I believe, with Sir Humphrey Davy, every other chemical phenomenon,) could be resolved into an electrical one, by operating upon masses instead of molecules. The experiment was the following:—The extremities of two strips of gold leaf were immersed, the one in nitric, the other in muriatic acid, contact between the two liquids being permitted, but mixture prevented, by an interposed porous diaphragm. In this case the gold remained undissolved for an indefinite period, but the circuit being completed by metallic contact, either mediate or immediate, the strip of gold in the muriatic acid was instantly dissolved. Thus, it seems, that the affinity of gold for chlorine is not able alone to decompose muriatic acid; but when it is aided by that of oxygen for hydrogen, the decomposition is effected. The phenomenon bears much analogy to ordinary cases of double decomposition. The two gold strips in the experiment being connected with a galvanometer, occasioned a considerable deflexion; and it now occurred to me, coupling this experiment with my previous observations, that these same liquids, with the substitution of zinc and platinum for the gold leaf, would produce a combination of surpassing energy. My expectations were fully realized; and on the 1 th of April, M. Becquerel presented to the Institute a small battery of my construction, consisting of seven liqueur glasses, containing the bowls of common tobacco-pipes, the metals zinc and platinum, and the electrolytes concentrated nitric and dilute muriatic acids. This little apparatus produced effects of decomposition equal to the most powerful batteries of the old construction. I have since this tried various combinations upon the same principle, and though some of the rarer substances—such for instance, as chloric acid—have produced powerful effects, I have found none superior, and few equal, to the preceding. I have therefore, directed my attention to using these materials, and rendering the apparatus more economical, although I soon found that it was not so expensive as it at first appeared—the platinum remaining unaltered. Dilute nitric acid diminishes the energy; nitro-sulphuric acid acted as an electrolyte much as nitric acid; it is an excellent conductor, yielding oxygen at the anode, and hydrogen at the cathode. Applying this to my battery, I found it to succeed admirably, and hence a considerable diminution of expence on the side of the zinc, and found salt and water nearly equal to dilute muriatic acid. It also removes the necessity of amalgamating the zinc; but it sometimes, though rarely, disaggregates the porous ware, from the crystallization of nitrate of soda; and therefore, in large batteries, I should prefer muriatic acid diluted with five times its volume of water. By using flattened parallelopiped-shaped vessels, the concentrated acid is much economized, and the metals approximated. Now, according to Prof. Ritchie, the power is inversely as the square root of the distance between the metals. The hastily constructed battery which I have to present, consists of an outer case of wood, height 7½ inches, breadth 5, width 3, (it should be of glazed earthenware, similar to the Wollaston troughs,) separated into four compartments by glass divisions: in these compartments are placed four flat porous vessels, the interior dimensions of which are 7, 2½, and 3-10ths of an inch, the thickness of the walls ¼ inch; they contain each three measured ounces; the metals, four pairs, expose each a surface of 16 square inches, and the battery gives, by decomposition of acidulated water, 3 cubic inches of mixed gases per minute; charcoal points burn brilliantly, and it heats 6 inches of platinum wire of an inch diameter; its effect upon the magnet, when arranged as a single pair, is proportionally energetic; it is constant for about an hour without any fresh supply of acids. The porous vessels are identical in their constitution with the commou tobacco pipe. As far as my experiments go, its power, with reference to the common *constant* battery, is *cæteris paribus* as six to one, but the relative proportions vary somewhat with the series. The cost of the apparatus is 2*l.* 2*s.* During the operation of this battery, the nitric acid, by losing successive portions of oxygen, assumes first a yellow, then a green, then a blue colour, and lastly becomes perfectly aqueous; hydrogen is now evolved from the platina, the energy lowers, and the action becomes inconstant. It is worthy of remark, an an argument for the secondary nature of metallic precipitation by voltaic electricity, that the oxidated or dissolved zinc remains entirely (or at least by far the greater portion) on the zinc side of the diaphragm; the hydrogen alone appears to be transferred; and yet the reversal of affinities which the theory of reduction by nascent hydrogen supposes, is an enigma difficult of solution. I have invariably observed in this battery, a current of endosmose from the zinc to the platinum, or with the current of positive electricity.

The rationale of the action of this combination, according to the chemical theory of galvanism, appears to be as follows:—In the common zinc and copper combination, the resulting power is as the affinity of the anion of the electrolyte for zinc, minus its affinity for copper; in the common constant battery it is as the affinity of the anion for zinc, plus that of oxygen for hydrogen, minus that of hydrogen for copper. In the combination in question, the resulting power is as the affinity of the anion for zinc, plus that of oxygen for hydrogen, minus that of oxygen for azote. Nitric acid being much more readily decomposed than sulphate of copper, resistance is lessened and the power increased; and no hydrogen being evolved from the negative metal, there is no precipitation upon it, and consequently no counter-action. I need scarcely add a word as to the importance of improvements of this description in the voltaic battery. This valuable instrument of chemical research is thus made portable, and, by increased power in diminished space, its adaptation to mechanical, especially to locomotive purposes, becomes more feasible.

Mr. Spencer then exhibited a cylindrical battery, so as to include great intensity in small space. Prof. Graham considered Mr. Grove's battery an important improvement, and could only account for its power from the circumstance, as in Daniell's battery, of the removal of hydrogen.

Prof. Whewell communicated some tide observations, forwarded to him by the Russian Admiral Lutke.

These observations supplied—first, the tide hours of various places on the coasts of Lapland, the White Sea, and the Frozen Sea, and the coasts of Nova Zemlia. These observations enable us to follow the progress of the tide mean further than had hitherto been done. Mr. Whewell's map of Cotidal Lines, (the second approximation contained in the *Phil. Trans.* 1836,) follows the tide only as far as the North Cape of Norway, eastward of Nova Zemlia. Prof. Whewell stated, that he was informed by Admiral Lütke, that in the Frozen Sea, east of Nova Zemlia, there is little or no perceptible tide. The observations communicated by Admiral Lütke, offered various other results, and especially the existence of the diurnal inequality in the seas explored by Russian navigators, as on the coast of Kamscatka, and the west coast of North America.

Prof. Whewell made some observations on Capt. Fitzroy's views of the tides.

In the account of the voyage of H.M.S. Adventure and Beagle, just published, there is an article in the Appendix, containing remarks on the tides. Captain Fitzroy observes, that facts have led him to doubt several of the assertions made in Mr. Whewell's memoir, published in the *Phil. Trans.* 1833, and entitled "Essay towards a First Approximation to a Map of Cotidal Lines."—(Appendix, p. 279.) Prof. Whewell stated, that he conceived that doubts, such as Captain Fitzroy's, are reasonable, till the assertions are fully substantiated by facts. Capt. Fitzroy has further offered an hypothesis of the nature of the tidal motion of the waters of wide oceans, different from the hypothesis of a progressive wave, which is the basis of Prof. Whewell's researches. Capt. Fitzroy conceives, that in the Atlantic and the Pacific, the waters oscillate laterally between the eastern and western shores of these oceans, and thus produce the tides. This supposition would explain such facts as these, that the tide takes place along the whole west coast of South America at the same time; and the supposition might be so modified as to account for the absence of tides in the central part of the ocean. Prof. Whewell stated, that he was not at all disposed to deny, that such a mode of oscillation of the waters of the ocean is possible. Whether such a motion be consistent with the forces exerted by the sun and moon, is a problem o hydrodynamics hitherto unsolved, and probably very difficult. No demonstrative reason, however, has yet been published, to show that such a motion of the ocean waters may not approach more nearly to their actual motion than the equilibrium theory, as usually applied, does. When the actual phenomena of the tides of the Atlantic and Pacific have been fully explored if it appear that they are of the kind supposed by Capt. Fitzroy, it will be very necessary to call upon mathematicians to attempt the solution of the hydrodynamic problem, either in a rigorous or an approximate shape.

On the Specific Gravity or Density of Steam at successive Temperatures, by Dr. Ure.

This Report was made agreeably to a motion at Newcastle, calling on Dr. Ure, Mr. Faraday, Mr. B. Donkin, and Mr. Cooper, to draw up a view of the present state of our knowledge upon that subject. The other members of the Committee having declined to enter upon the research, Dr. Ure undertook it. He began his Report by stating that M. Gay-Lussac was the first philosopher who devised and executed an exact process for determining the specific gravity of steam and other vapours; his principle being to measure the volume of vapour furnished by a given weight of liquid. Having weighed a glass bulb, like that of a thermometer, he filled it, by heating it, and plunging the point of its capillary tube in the liquid to be converted into vapour; repeating the heating and immersion till it was perfectly full. It was now slightly heated, to expel a drop of the liquid from the point, which was then hermetically sealed by the blowpipe. The bulb was next introduced into a graduated bell-shaped jar, about one foot long, and two inches in diameter, filled with and inverted over mercury, in a cast-iron pan. The jar was surrounded by a glass cylinder, open at each end; and the space between the two vessels was filled with oil, or water, according to the volatility of the liquid. The interstitial column of liquid rested upon the column of mercury in the iron basin or pan. This was placed over a little furnace, whereby the mercury and superjacent oil were heated to any desired pitch. Eventually the bath became hot enough to generate vapour of such tension within the bulb, as to burst the thin glass of which it was blown. In the case of water, M. Gay-Lussac continued to heat the apparatus, till the water contained between the two cylinders had entered into a state of steady ebullition; and he then measured the space occupied by the steam generated from the bulb in the bell jar, taking care to note the height of the quicksilver within the jar above its level in the basin Deducting this height from that of the barometer in the same apartment, he found the pressure of the internal vapour. He then reduced, by calculation, the length of the mercurial column to what it would have been at the temperature of melting ice; and made a small correction for the height of the liquid column between the two cylinders. In this research, we must take care that the whole of the liquid in the bulb is reduced into vapour, otherwise we shall fall into great errors. This circumstance would occur if more liquid were introduced into the bulb than would fill the whole space over the mercury in the bell jar, at the given temperature. M. Gay-Lussac found in this way, that one cubic inch, or a gramme measure of water, produced 1,694 cubic inches, or gramme measures, of steam, at the temperature of 100 Cent. or 212° Fah., under a pressure of 29,912 inches of mercury, or that of the atmosphere in the mean state of the barometer. He reduced that volume to what it would be at 32° Fah., by the rule for estimating the expansion of gaseous matter by heat, and concluded that the specific gravity of the vapour of water was to that of air, both at the said temperature, as 0·625 to 1·000. The following table of densities includes all the vapours which he subjected to experiment upon that occasion:—

Air (as 0° Cent.) being called	1·000
Vapour of Water	0·625
Alcohol	1·613
Sulphuric Ether	2·586
Sulphuret of Carbon	2·645
Oil of Turpentine	5·013

The density of the vapour is evidently irrelative of the boiling point, or density of the liquid from which it is formed; for ether boils at 98° Fah., and has a specific gravity of 0·700 or somewhat less, while oil of turpentine boils at 316° Fah., and has a specific gravity of 0·870.

The steam which issues from the spout of a tea-kettle is no hotter, as measured by a thermometer, than the boiling liquid within, and yet, when condensed in a body of cold water or ice, it gives out as much heat as one thousand times its weight of boiling water would do. This heat of steam, which is insensible to the thermometer, is called latent heat, and it differs in quantity for different kinds of vapour. One part of water at 212° Fah. requires for its conversion into steam, as much heat as would raise 5¼ parts from the freezing to the boiling temperature, or as would heat it up to 1170° Fah., could the water be made to receive that heat without changing its form. The quantity or energy of heat which steam contains or possesses is constant; that is, for equal weights, steam of every temperature and density contains the like quantity of heat;—a proposition which has been proved by accurate researches. Water at all temperatures, even in the state of ice, is convertible into vapour: the density of this vapour depends upon its temperature; so that this density, that is, the weight of the steam under a given volume, is greater the higher the temperature at which the steam is generated over water. When the steam is not in contact with water, it follows the same law of expansion with heat, as gases do. An air-tight boiler having a vacant space over the water of about 1,700 cubic inches, contains at the temperature of 212°, one cubic inch of water in the state of vapour, and has therefore a specific gravity of 3·000589; water being 1·000000; $=\frac{1\cdot000000}{1700}$. If the heat be raised to 234·5°, the incumbent steam will acquire an elastic force equal to 45¼ inches of mercury, or 22·3 lb. upon the square inch, and a density of 0·000867; if to 250·2°, the elastic force will be 59·8 inches of mercury, or 29·28 pounds, and the density will be 0·001114. In the former case, the elasticity has increased about 50 per cent., and the density 34·3; in the latter case the elasticity has increased another 50 per cent., and the density 32·1; thus, while the elastic force is doubled, the density is increased in the proportion of 1114 to 589 or 100 to 53. We see, therefore, that the elasticity of steam increases with the density, but in a greater proportion, or more rapid ratio. Since like weights of steam contain like quantities of heat, and since the elastic force of steam is the moving power in steam-engines, it follows, that for like quantities of heat, or fuel well applied, a greater effect will be obtained from steam of high temperature and density, than from steam of lower temperature and density. At all temperatures, the sum of the latent and sensible heats of steam is a constant quantity, so that steam of higher density and temperature contains always the same quantity of heat, as steam of lower density and temperature. When denser steam flows into a vacuous space, it will fill it entirely without condensation, provided that no heat is dissipated outwards; and it will possess an elasticity and temperature dependent upon its expansion. Suppose, for example, that a vessel of one cubic foot capacity is filled with steam of 212° Fah., let this vessel be placed in communication with another air-tight vessel, of nine cubic feet capacity, so as to expand into it; in filling the latter, it will become expanded into ten times its bulk, and from the table which accompanies the report, it will be found to assume, when thus expanded, a temperature of 108.5° Fah., while its elasticity falls to 2·4 inches of mercury; though the steam has neither absorbed nor emitted any heat, nor deposited any water by condensation. When dense steam escapes into the air, it assumes the same specific gravity and elasticity as the atmospheric vapour.

The table annexed contained seven columns; the first three were the scales of the three thermometers now in use; and Dr. Ure remarked, that it was to be regretted, that we in Great Britain do not adopt the Centigrade scale, as the Germans are now doing, instead of the arbitrary and inconvenient divisions of Fahrenheit. The fourth and fifth columns exhibited the elastic forces of the steam, the former in inches of mercury, the latter in pounds upon the square inch. The sixth column showed the number of cubic feet of steam resulting from one pound of water, and the seventh the specific gravity of the steam, water being called unity, or 1·000000.

COMPETITION DESIGNS FOR THE ROYAL EXCHANGE.

We need not particularly regret our inability at present to enter into the various questions which this competition suggests to us, since we foresee that whatever turn matters may take, we shall have more than one opportunity of making our comments before the business is settled, or any thing finally determined upon. As far as we can understand, that is, as far as *on-dits* may be relied on, all the three architects who gave in their report on the designs to the committee, have now declined taking any farther share in the affair; nor do we wonder that they have done so, since the task they were called upon to undertake, would have been as invidious as it would have proved difficult;—and that it would have been a difficult one, can hardly be disputed without calling their sincerity into question, there not being a single design which they could recommend to be returned to its author, in order that he might make those corrections which would remove the first objections to it. Their non-compliance with the committee's request, only confirms whatever was previously expressed in regard to it. But what course the committee will now take, we are unable to conjecture, our surmises extending no farther than to giving them credit, for at length discovering how ill-advisedly they have acted throughout the whole business.

Among other things, they have probably now found out that it would have been infinitely more prudent on their part to have had a public exhibition beforehand, and one of such duration as to afford time for people to form something better than hurried, off-hand opinions. And if it be asked where such protracted exhibition could have taken place, without causing inconvenience, we should say that perhaps, no fitter place could have been found than the exhibition rooms of the Royal Academy, where there would have been space to arrange all drawings, without hanging any of them up so high as they were at Mercer's Hall. And we must say, that it would have been no more than natural and proper, had the academy offered their rooms for that purpose;—or are we to presume that the whole affair is matter of utter indifference to that body; and that though it is one which may eventually bring credit or discredit upon the taste of the country, the academy are not willing to give themselves the least concern about it. It cannot be said that, by taking no notice in any way of what does not immediately relate to them, the academy can be charged with having neglected their duty, yet the fact itself is a symptom of the zeal with which they are animated for advancing art and its interests generally.

Undoubtedly a very great point in architectural competitions has been secured, by the public being allowed to see the designs at all, though, in the case of that for the Royal Exchange, the exhibition was no more than what is generally styled *a private view*. Still in this respect, another point remains to be carried, which is, that in future all such exhibitions shall be *preliminary:* not in order that umpires and committees should be entirely guided by, or pay unqualified deference to a majority of opinions so elicited, but that they may have the opportunity of taking into consideration whatever arguments, if any at all may happen to have been brought forward, on various points. We therefore trust, that instead of this competition, and the one for the Nelson monument being made use of to show the utility of public exhibitions of the designs, they will operate as useful corrective lessons, and lead henceforth to the adoption of a better system.

Little is it to be wondered at, if those who see no further than immediate facts and consequences, now exclaim not against ill-managed competitions, but against the system of competition at all, as necessarily bad and inefficacious; delusive to those who enter into it, delusive likewise to the public, and embarrassing to those who invite it; and moreover no better than a cloak to sinister influence, favouritism and jobbery. The proceedings attending the competition for the Nelson monument, certainly afford room for saying as much, to any one disposed to look at the matter on its worst side; while the one for the Royal Exchange coming so immediately after, and attended with no more satisfactory results, enables people to exclaim "another failure!" and then to rail at competition altogether. From the tone in which some of the *critics* have spoken of the last one, it is easy enough to perceive that we are quite as well pleased as not, that the result should not have proved more successful. While they are thus left at liberty to indulge in sneering, abusive tirades, they can excuse themselves from offering any opinions or remarks of their own upon the designs, by conveniently representing them one and all as below criticism, and unworthy of any specific remark. Such was the course adopted by the writer, who *does* the architectural criticism in the Sunday Times; but many will think that in the volubility of his abuse, he betrayed his shallowness and ignorance, when he spoke of there being designs in the Chinese style as well as in almost every other; and affirmed that out of them all, there was not one deserving serious attention or consideration.

It must be confessed, there were a great many not rising at all above mediocrity, and not a few which did not reach even that point; which certainly did surprize us, because we had imagined that owing both to the size and the number of drawings required, the labour and expense would have deterred any one from attempting a design, who did not feel that he could produce something either original in its conception, or treated with some degree of mastery: and hardly any one, we presume, would set about making a finished set of drawings of the kind, unless he had previously satisfied himself in his preparatory sketches, and found that he had got hold of a good idea to work upon. Such, however, certainly does not appear to have been the case here, since many of the designs too plainly showed that no idea, or the very poorest possible, was considered sufficient, and that little else was required than merely to provide the accommodation stipulated for by the instructions issued by the committee. It did, indeed, quite stagger us, to see many designs of such quality in all but the mere drawings, as to seem the first efforts of beginners, who thought that to be able to draw columns and pilasters of the most insipid character, was a sufficient qualification. One would suppose that some of those persons must have been exceedingly studious indeed,—so buried among their books, as to be utterly ignorant of all that has been doing in architecture in this and other countries during the last ten or fifteen years; for if acquainted with it, they were unable to perceive how greatly they fell short of the ordinary standard, and could flatter themselves that there was not the slightest chance for their designs being noticed, except for contempt and derision, they must be egregiously blind indeed; so ignorant as not to be capable of perceiving that they were only affording proof of their own incapacity.

Now, as we have seen it lately remarked in an architectural paper in Fraser's Magazine, though any one is at liberty to send in a design to an open competition, it does not exactly follow, that because he can draw, a man is called upon to do so, whether or not he possesses any of the talent that occasion demands. Common sense would say, that the invitation is to be understood as given to those possessed of talent to come forward with it, not for the dull and the stupid to step in and make fools of themselves.

At present we cannot either pursue these remarks any further, or here add to them any comments on such of the designs as on our second visit, struck us as most deserving of notice, not as being entirely unobjectionable, but as containing many good points and displaying considerable ability. Yet, though we find we must now defer more particular mention of them till our next number, we may here just point one or two of the kind which seem to have escaped the attention of others: viz. No. 25, 33, and 51. The first of these was one of the few, in which a circular plan was adopted for the inner area. This cortile was not only very spacious, but in exceedingly good taste, and would no doubt produce a fine effect. The external elevations were also of an imposing character, (in the Italian style), but we did not so much approve of the tower at the west end, particularly the upper part of it. No. 33 was also Italian; and No. 51 was a remarkable, and in many respects a very clever and original application of Greek architecture. With respect to the design which obtained the first premium, we must acknowledge, after again looking at it, that so far from being able to detect it in any kind of merit that seemed to warrant such decided preference, for if it might be free from defects and objections occurring in many other designs, beyond such negative recommendation, it seemed to possess no other. Of course we speak only from a general inspection of it: it might have merits, but they certainly did not extend to the general character of the composition, or the taste shown it. Perhaps it was chiefly on account of its deficiencies in regard to these latter qualities, that although deemed worthy of the first prize, the judges could not recommend it for execution. We think that their report ought to have left no doubt in respect either to this or the other designs pointed out by them to the committee; but should have distinctly stated both the particular merits and the objections against each of those designs. Had that been done, both the public and ourselves might have gained some instruction.

Since writing the preceding remarks, we are informed that Mr. W. Tite and Mr. George Smith have been requested to advise the committee on their selection of a design from the eight now before them; the former gentleman, we understand, declines to act, consequently the onus devolves on Mr. Smith, who is Architect and Surveyor to the Mercers' company. We believe Mr. Smith to be respected by all who know him, but to say the least of it, in whatever way his decision may be made, it will be placing him in a most invidious and unpleasant situation, in the first place Mr. Grellier who obtained the first premium, was, as is well known, pupil of Mr. Smith, therefore if he give judgment in his favour, it will be immediately set down as an act of favouritism, and if he decides against the design, it will bring him in collision with the three former architects named to examine and select the best design.

THE BUDE LIGHT.

A serious accident took place on Friday evening, the 8th ult., at the costly premises of Messrs. Hancock and Rixon, Pall Mall East, caused by the explosion of a bag of oxygen gas, with which some experiments were being tried, in order to show a few scientific gentlemen the effect of the Bude light; the force of the explosion was so great as to dash to atoms nearly every article in both the upper and lower warehouses, many of which were of the most valuable description, consisting of beautiful chandeliers, lamps, lustres, vases, decanters, &c., all were in an instant completely destroyed, the counters rent asunder, the sashes torn out and broken to pieces, and the report so loud as to alarm the whole neighbourhood. The company present about seven or eight in number, narrowly escaped with their lives; some of them were seriously bruised, one being thrown into the shop window from a considerable distance, another up the staircase, and all more or less injured. We have thought proper to give publicity to this accident, as it is most desirable that every fact connected with so important a subject as the "Bude Light," should be fully investigated, and we trust that the proper authorities superintending the experiments for lighting the Houses of Parliament, will make such inquiry into this serious matter, as to fully satisfy themselves upon the safety of this or any other light, before a decision is made upon the one to be ultimately adopted. We believe it has not yet been satisfactorily accounted for, what caused the oxygen gas to be so very explosive.

Oxford-street Experimental Wood Paving.—The settlement of this almost interminable question is completed. Out of the many competitors for laying down specimens of wood pavement within the space allotted by the vestry of St. Mary-le-bone for the additional experiment in Oxford-street, but one party has acceded to the terms of the vestry to do the same at their own expense and risk. A contract has been effected by the Mary-le-bone vestry, to lay down 4,000 yards in the space from Charles-street to Wells-street, after the mode invented by the Count de Lisle, called the Stereotomy of the Cube. This singular plan of pavement will, from its peculiar construction, possess the property, by finding an abutment, on the curb-stone on each side of the street, of forming a self-supporting bridge without the aid of a concrete bottom; and by the mode in which it is intended to lay down the blocks, the complaint prevalent against wood pavement, of its being, under some atmospheres, exceedingly slippery, will, in a great measure, be remedied, if not totally avoided. The various models which have been presented to the notice of the vestry, afford a strong instance of the accomplishment of art and ingenuity over the rude mode under which this project was first submitted to the English public as a carriage-way paving at once surprising and pleasing. The whole of this contemplated work is to be completed on or before the first of February next; and although it is to remain, if the vestry require it, twelve months as an experiment, yet the general opinion entertained by that body, of the efficacy of wood pavement, renders it more than probable that the whole of Oxford-street will be completed by the next summer, and thus render this important thoroughfare free from noise, mud, or dust, and the first street as a promenade for carriages in London.—*Times.*

NOTICES OF APPLICATIONS TO NEXT PARLIAMENT FOR LEAVE TO BRING IN BILLS.

METROPOLITAN IMPROVEMENTS.

Holborn Improvements.—For forming a new road or street on a level, commencing at the corner of Bartlet's-buildings, top of Holborn-hill, and proceeding at the back of St. Andrew's church, passing over Farringdon-street on a bridge, and terminating at the Old Bailey, opposite the end of Newgate-street.

Piccadilly to Long Acre.—For forming a new street from Piccadilly, along Coventry-street, the north side of Leicester-square, and terminating at the junction of Long-acre with St. Martin's-lane.

Long Acre to Charlotte-street, Bloomsbury.—For forming a new street commencing opposite Bow-street, Long-acre, and terminating at Bedford Chapel, Charlotte-street, and also to widen the north east corner of King-street, Seven-dials.

Oxford-street to Holborn.—For forming a new street, commencing from the east end of Oxford-street, and terminating at the south end of Southampton-street, Bloomsbury.

London Docks to Spitalfields Church.—For forming a new street, running nearly in a direct line with Leman-street, and terminating at the west front of Spitalfields church.

Fulham Road and Brompton Road.—For widening, &c. a lane or road leading from the Bell and Horns Tavern in the Fulham-road, to the Hoop and Toy Tavern, Old Brompton, and thence to Earl's-court; and also for continuing the Victoria-road, commencing at the east end of Kensington, and to terminate by the most direct line, at the north end of Battersea-bridge.

Metropolitan Bridges.—For redeeming the tolls on Waterloo, Southwark and Vauxhall-bridges, and levying a tax of sixpence per ton on coals.

DOCKS, CANALS, HARBOURS AND BRIDGES.

Wyrley and Essington Canal.—For power to incorporate the Company with the Birmingham Canal Navigation Company, and also for power to make additional cuts or canals.

Portsmouth Floating Bridge.—For power to improve landing places and approaches.

Portsmouth and Stokes Bay.—For constructing *a Pier and Tide Harbour* at Kicker Point, sitnate at Stokes Bay, in the Parish of Alverstone, and county of Southampton; and also for making, &c., a *Ship Canal* from the said harbour, and communicating with the harbour of Portsmouth.

Staffordshire and Worcestershire Canal.—For making a *canal* from the said canal at Hinksford, in the parish of Kingswinford, and to terminate in a canal now being formed by the Devisees of the late Earl of Dudley.

The Herculaneum Estate Dock Lancaster.—For taking tolls, &c., for docks about to be constructed adjoining the river Mersey.

Deptford.—For forming new *docks.*

Deptford Pier.—To alter and amend act, and for purchasing additional property.

Portishead Bay, Somersetshire.—For making a *pier*, &c., and a road to Bristol.

Southampton.—For making wet *docks* at Northam Marsh.

Isle of Wight.—For improving, &c., the *harbour* of East and West Cowes.

Dartford and Crayford Creek.—For deepening and improving the said Creeks.

Gravesend.—For making, &c. a *pier* at the Royal Terrace Gardens, Milton.

Leeds.—For building a *bridge* over the river Aire, and forming approaches.

Fulham and Putney Bridge.—For building, &c. a *bridge* over the river Thames, and for making approaches.

Newcastle-upon-Tyne.—For erecting a *bridge* over the river Tyne.

NEW RAILWAYS.

Croydon and Brighton Railways.—For the formation of a *railway* from the Croydon railway at or near the Dartmouth Arms, and terminating at the Elephant and Castle, or from the Brighton railway at the Junction of the Croydon railway at Croydon, and terminating as aforesaid.

Manchester and Birmingham Railway.—For an extension of the railway from Stone to Rugby.

Newcastle-upon-Tyne to North Shields.—For the formation of a railway.

West Cumberland Railway and Morecambe Bay Inclosure.—Por making a railway and inclosing the said bay.

FOR ALTERING OLD RAILWAY ACTS OF PARLIAMENT.

Chester and Birkenhead Railway.—For powers to raise additional money, and to alter time for purchasing land; also for extending the railway from Birkenhead to the river Mersey.

Commercial or Blackwall Railway.—To alter powers and provisions.

Eastern Counties Railway.—For alterations, &c.

Grand Junction Railway and Chester and Crewe Railway.—Powersf or the former Company to purchase the latter railway.

Great Western Railway.—For making a station or depôt in the parishes of Upton and Stoke Poges, Bucks, or one of them.

Hartlepool Dock and Railway Company.—Relatlve to the government of the company.

London Grand Junction Railway.—To alter, &c., and extend line.

London and Greenwich Railway.—To enable the Croydon, the Brighton and the South Eastern Railway Company, or one of them, to widen and enlarge the present London and Greenwich railway.

London and Greenwich Railway.—For powers to alter tolls, &c., and to make a new station at the Southwark terminus,

Newcastle-upon-Tyne and North Shields Railway.—For alterations, &c.

Northern and Eastern Railway.—For power to alter act, and make deviations.

South Eastern Railway Company.—To alter line in the parishes of Sellinge and Standford, in the county of Kent.

WATER COMPANIES.

London and Westminster pure Water Company.—For making, &c. a conduit to convey water from streams, rivulets and springs at Bushey-lodge Meadows, and the river Colne adjoining, and to terminate near the Eyre Arms tavern, Marylebone.

Surrey and Kent.—For supplying the metropolis on the southern side of the Thames, Deptford, Greenwich, Woolwich, &c., with water from Merstham, Surrey.

Bradford Water-works.—For better supplying the town with water.

Newcastle.—For better supplying the towns of Newcastle-upon-Tyne and Gateshead.

Derby.—For supplying the town with water.

Exeter Water Company.—For power to alter present act, and make additional works.

FOR INCORPORATING COMPANIES.

Farmers and General Fire and Life Assurance and Loan and Annuity Institution.

Protestant Dissenters and General Life and Fire Insurance Company.

The Scottish Widow's Fund and Life Assurance Society.

The Standard of England Life Assurance Company.

The Talacre Coal and Iron Company.

The Gwendraeth Anthracite and Iron Company.

The United Wood Paving Company.

Gas Manufacturing Company.

Great Forest Anthracite Coal and Iron Company.

City of London Gas Pipe Company.

Great Level of the Wash.—Company for reclaiming from the Sea, draining and improving, &c. land within the great Estuary, called the Wash, in the counties of Lincoln and Norfolk.

North American Colonial Association of Ireland.

FOR INCORPORATING COMPANIES TO PURCHASE THE ASSIGNMENTS OF PATENTS.

Carey's Patent, for certain improvements in paving or covering streets, roads, and other ways.

Kollmann's Patents, for improvements in railways, and in locomotive and other carriages.

Austin and Burke's Patents, for improvements in raising and lifting sunken and floating vessels, and other bodies under or in the water.

The United Wood Paving Company, to purchase patents for paving with timber or wooden blocks, and for improvements in wood paving.

John's Patent, for improvements in colouring or painting walls and other surfaces, and preparing materials used for that purpose.

Daniel Stafford's Patents, for his invention, or certain improvements on carriages.

STEAM NAVIGATION.

The New Steam-ship, "New York."—The "New York," now on the stocks at the yard of Messrs. Wilson, North Shore, is rapidly advancing towards completion. She is a noble looking vessel, superior in tonnage to the Liverpool, belonging to the same company; is of a beautiful model, and built in as substantial a manner as any of her Majesty's ships. The following are her dimensions:—Length over all, 235 feet; beam of the hull, 36 feet 6 inches; beam over paddle-boxes, 60 feet; depth of hold, 22 feet; tonnage (supposed new measurement) 1600; horse power of engines, 420. The frame of the New York is of English oak, the bends and clumps of English and African oak. Her bottom is of American elm and Baltic timber. She is fastened on the diagonal principle, by riders of iron let into the timbers, and crossed at right angles by strong trusses of English oak. Her bottom plank is five inches in thickness, the diagonal wood fastenings six inches. Her frame is peculiarly constructed, her timbers being dowelled or "coaked" together in a scientific manner. Every alternate timber has a screw bolt through it. She is filled in, fore and aft, six feet above the lower edge of the keel, and caulked, the whole forming a solid mass of timber. Her bolt and minor fastenings are entirely of copper. Her bilge planks, clumps, and bends, are six inches in thickness. In her flooring she has apparently from twelve to fourteen inches of a rise from the keel to the bilge; and being otherwise finely modelled, and anything but wall-sided, she can scarcely fail to attain an uncommon speed under steam. On deck the New York has a very noble appearance, from her great length and beam, and her unencumbered deck room. It is remarkable that she is about the same length over all as the Liverpool, (235 feet,) and that her principal cabin will also be about the same length (75 feet.) She has, however, six feet more beam than that favourite vessel, which, it is considered, will give her considerable advantages. The cabin, not yet fitted up, is under the poop, the floor of which is continuous with the main deck, which is thus "flush" fore and aft—a great desideratum as regards the strength of a vessel. She has seventeen window ports on each side to light the state rooms. Prizes are offered by the owners for the best plans of the cabins. She has a small top-gallant forecastle, and will have gangways and a spur deck, in the style of a frigate: she is what is termed a "solid" vessel, being planked up to the gunnel, which is of considerable height, and will render her unusually comfortable as a sea-going ship. The working part of the vessel will, from her construction, be quite apart from the cabins, and this will be another convenience. Her engines are now in course of construction, at the celebrated manufactory of Messrs. Fawcett and Preston, and will be of a superior description. Some idea may be formed of the strength of the frame work to which the engine will be more immediately attached, from the fact that the paddle beam is of solid African oak, 22 inches square. It is expected that she will be ready for launching in about a month, but may not perhaps be placed in her destined element until early in the spring. The carpentry of the New York, which will bear the minute inspection of the most fastidious and scientific, is highly creditable to Messrs. Wilson; and we doubt not but that when she is placed on the station from which she derives her name, she will become a favourite transatlantic steamer, and, we hope, a profitable speculation to the enterprising company to which she belongs.—*Liverpool Mercury*.

Marine Steam-engine Boilers.—M. Cousté proposes to adapt an apparatus to the boilers of marine engines supplied with salt water, by which the crystals of common salt are removed as fast as they are deposited on the heated surfaces of the inside of the boiler; and he hopes, by his invention, to avoid the loss of heat which is occasioned by the process at present employed for getting rid of the salt, in blowing off a quantity of the hot saturated solution at stated intervals.—*Athenæum.*

ENGINEERING WORKS.

Southampton Docks.—The interest excited in the public mind by the progress of these works is very great: numbers, both of the inhabitants and strangers, are continually visiting the beach to view the active and bustling scene; the work is carried on with spirit, and during every moment the tides permit, and at the low water of the night tide, there may now be seen nearly 200 men working by the light of between 20 and 30 fires, which has a singular and interesting effect. We understand that in embanking, pile driving, quarrying, &c., the contractors are paying upwards of 250 men, and are willing to employ many more able hands if they should offer; in fact, they seem determined to spare neither money nor personal exertions in expediting the work, and endeavouring to realize the anticipations of the supporters and friends of this great undertaking. They have our best wishes for their success.—*Hampshire paper.*

Opening of the Manchester and Salford Junction Canal.—This important link in the chain of water communication was made available to the public on Monday, the 4th ult. By means of this canal, which connects the Rochdale Canal with the Mersey and Irwell Navigation, near the Old Quay, all the navigations of Yorkshire, Derbyshire, Cheshire, Staffordshire, &c., will have a direct communication with the Bolton and Bury Canal, with the additional advantage of using the Mersey and Irwell Navigation (which is deeper, wider, and several miles shorter than any other line,) to Warrington, St. Helen's, Runcorn, Liverpool, &c. The Junction Canal has the advantage of double locks, which will considerably facilitate the passing of vessels from the Rochdale Canal, thereby avoiding an inconvenience which has hitherto caused serious delay. The tunnel, which is short, is well lighted with gas every 20 yards; there is also a towing path the whole length, and, for the convenience of vessels using this line, men will be in readiness, if required, for the purpose of hauling them, and assisting them through the locks, for which a small charge will be made. The ceremonies connected with the opening, we understand, passed off in the most satisfactory manner.—*Manchester Advertiser.*

Sussex.—During the summer, a great improvement has been effected at Bines Bridge, on the Horsham and Steyning turnpike road, under the superintendence of Mr. Jesse Heath, surveyor to the trust. The approaches have been raised nearly to a level with the crown of the bridge, and it is anticipated that the heaviest floods will not reach the surface of the road, whereas they formerly rendered it utterly impassable. It is, however, fearful that the waterway (only 24 feet) through the new embankment, will not be found sufficient.—*R. S.*

PROGRESS OF RAILWAYS.

London and Brighton Railway.—The Shoreham Branch of the London and Brighton Railway is now advanced within three quarters of a mile of Shoreham, and the work is proceeding with great dispatch. At the Brighton end the permanent rails are laid down to the entrance of the tunnel; the tunnel itself is completed, and we are authorised to state that the engine will make her first journey through it, weather permitting, on Monday next.—*Brighton Gazette*, Thursday, 21st ult.

Stockport Viaduct. Manchester and Leeds Railway.—Eight of the twenty-two centres for the arches of this stupendous undertaking being now formed, and five of them being turned and completed, the work of striking the centres has been commenced, in order that the timber may be made available for the continuation of the viaduct, as the arch over Heaton Lane (the 9th) will be formed from the timber of the first principal arch. The first stone of the pier of the river arch (the 12th) on the Cheshire side is expected to be laid next week—that on the Lancashire side being nearly completed.—*Manchester Guardian.*

Great Western Railway.—The works on this line near Chippenham, are advancing rapidly, and the line in progress now extends from the mouth of the Box Tunnel at Pockeridge nearly to Christian Malford. The changes in the height and level of the country, cause, in this distance, every possible change in the form of the line, from embankments of 60 feet to cuttings of so great a depth.—*Bristol Journal.*

Bristol and Exeter Railway.—The contract for building the two stone bridges near Pile Hill, for this railway, has been taken by Messrs. Richard and George Hill, masons, Temple-street, Bristol. This will complete the masonry between Bristol and Bridgewater; and as the tenders are now advertised for laying the permanent rails, the time cannot be far distant when this part of the line will be opened to the public.—*Bath and Cheltenham Gazette.*

Eastern Counties Railway.—Two iron bridges have, within the last few days, been thrown over two roads at the London end of the railway; one over the Globe road, and the other over Hand-street. It is now said that the line will be opened to Brick-lane, near Whitechapel church, about Christmas. Some alarm was created on Friday evening, in consequence of the non-arrival of the train from Romford for half an hour after its time. The delay was occasioned, it appears, by a failure in a new engine; but beyond the loss of time no accident occurred. A settlement has taken place, it seems, in the new bridge over Dog-lane, Romford, which will render it necessary to rebuild a portion of it.—*Chelmsford Chronicle.*

NEW CHURCHES, &c.

Sussex.—The new Chapel of ease, in St. Leonard's Forest, in the parish of Lower Beeding, was consecrated on the 10th of October. It is a neat, plain, building in the early English style, (of about the 13th century) which is well suited to the locality. It contains somewhat upwards of 200 sittings. It is due to the good taste of the Dowager Marchioness of Northampton and Lady Elizabeth Dickens, that the trees on the south side of the chapel have been cleared away, so as to afford a more picturesque view from the Brighton road, distant about half a mile.—The new Church at Plummer's plain in the same parish, and the parsonage house, are approaching completion, and will, when finished, afford some of the best specimens of work in our native sandstone.—*R. S.*

Horsham.—The ground is staked out for the erection of the new Chapel of ease in this town. The stone-pit which has been opened near the spot turns out favourably, blocks being now procured from two tons downwards.—*R. S.*

Greenock.—A new Church is erecting in Greenock in the Italian style. Height of the spire 180 feet, estimate about £7000. Mr. David Cousin, of Edinburgh, is the architect.

Leeds.—The parish Church of this town is slated, and the tower carried up to the under side of the clock dial, about 70 feet. It is entirely built of sandstone, in the Gothic style of the latter end of the 14th century, or transition from decorated to perpendicular; the nave and chancel are thrown open, and are 28 feet wide in the clear, 47 feet high, and 160 feet long together. Near the centre is a transept 22 feet wide, terminating with a north transept tower facing the street; the side aisles are 16 feet wide and 35 feet high, extending from east to west, and an additional north aisle forms ante chapels east and west of the tower; the plan is that of the old church, which was taken down last year. The altar will be raised five feet above the floor of the body, rising in three flights of steps; the whole breadth of the church is about 65 feet, or including the ante-chapels, 85 feet. The tower is 27 feet square, and 130 feet high. It is richly pannelled, and the wreathings over the windows are canopied and crocketted. The total cost, warmed and fitted up with gas and all necessary furniture, will be about £19,650. Architect, R. Dennis Chantrell, F.R.I.B.A.

Yorkshire.—A new church is about to be built at Middleton, near Leeds, of stone found on the spot, to accommodate 500 persons. It is a plain Flemish country church in form, and will have a good effect and character at a distance. The windows are plain lancet, and it has a square tower with shelvings, and an octagon spire. Total cost about 800*l*. R. Dennis Chantrell, Architect.

Yorkshire.—Poole Chapel, near Otley, has been taken down and enlarged. The old building contained 100 sittings, the new building 200 sittings. It has lancet coupled windows, buttresses, square tower and spire, and cost 340*l*. It is built of branched sandstone from Otley Chevin Side, (millstone grit), and is covered with slate.—R. Dennis, Chantrell, Architect.

Manchester.—On Friday, Oct. 24, the first stone was laid of a new church, which is about to be erected by subscription, in Every Street, Great Ancoats, in the centre of one of the most densely populated districts in the town. The building will be a very neat edifice in the Norman style. The subscription amounts to £2,000, and is rapidly increasing. It is intended that the edifice shall accommodate about 1500 persons; one third of the sittings are o be free.

Birmingham. Laying the Corner-stone of St. Chad's Church.—The foundation stone of the Roman Catholic Church in Bath Street, was laid with great solemnity on Tuesday, 29th ult., according to the form prescribed by the Roman Catholic Church. Owing to the irregularity and declivity of the ground, Mr. Pugin, the architect, deemed it necessary to erect, under the great church, a crypt for the interment of the dead, connected with which is a mortuary chapel, where service for the dead will be performed. The plan of the superstructure will be, internally, cruciform; consisting of a nave, transept, aisles, and choir, at the entrance of which will be constructed an open screen, usually termed the rood loft. The space between this and the sanctuary will be filled with ancient stalls. brought from Cologne, of exquisite carving, in the style of the 13th century. The high altar will be in the ancient triptic form, and will be entirely decorated in the same pure and beautiful style of architecture. The windows, which will terminate the apsis of the choir, will be filled with rich stained glass, the munificent gift of the Earl of Shrewsbury. The church will altogether contain five altars; one in the chapel of the Blessed Virgin, two at the entrance of the choir, the high altar, and one in St. Peter's crypt.—*Midland Counties Herald.*

St. Helen's—On Tuesday, 8th Oct., two circumstances of importance to the improving and prosperous town of St. Helen's took place—the consecration of a new church and the opening of a new Town Hall. The buildings are such as reflect the highest credit on the architects, Messrs. A. & G. Williams, of Tarlton-street, Liverpool, and besides being useful, are really ornamental. The Town Hall is situated in the new market place. The elevation is in the modern Italian style. The front is to the market square, and has a rusticated basement, supporting in the centre a Corinthian portico, over which is a ballustrade; the entablature of the centre is beautifully enriched, whilst the cornice of the wings is plain and massive, and supported on brackets. The ground floor is occupied by various offices. In the centre is a handsome entrance, and a stone staircase, which leads to the principal floor, containing a news room, 28 feet by 26 feet, and a magistrate's private examination-room. The court room is remarkably spacious and neat. It is 65 feet long, 36 feet wide, and 22 feet high, decorated with pilasters, and a panelled and enriched ceiling, through which light is introduced, mellowed by passing through ground and stained glass. The room is ventilated by means of scroll-work panels between the pilasters, which may be closed or opened by wires and cranks worked in the magistrate's retiring-room. The contract for the building amounted to £3000, Mr. Morrison being the contractor.—The church is in the early English Gothic, the style of architecture which prevailed in England at the latter end of the 12th and the early part of the 13th centuries, and in the form of a Latin cross. The principal entrances are in the transepts, through deeply recessed arches, and connected by a spacious aisle. The galleries extend only across the west end and the transept. There is a square tower, 76 feet high, which has long lancet windows, to give light to the gallery stairs. The whole is ornamented by gables and pinnacles. The contract for the church was about £3500.—*Wigan Gazette.*

PUBLIC BUILDINGS, &c.

Aberdeen.—A new market is about to be erected in this town under the directions of Mr. Archibald Simpson, Architect.

Glasgow.—A new theatre is erecting in this city, from designs by Mr. William Spence, Architect; also a new club house in the Italian style, designed by Mr. David Hamilton, Architect. The Custom House is nearly completed, from designs by Mr. Taylor, of London.

Edinburgh.—A new Museum for the Highland Society is just completed, from designs by Mr. John Henderson, architect, in the style of Elizabeth and James I.

Liverpool.—On the 24th ult. the foundation stone was laid of a new Institution for the Deaf and Dumb, to be erected from designs of Messrs. Cunningham and Holme, architects, on the site of the old Botanic Gardens, Oxford Street. The building is to be of a plain Grecian character, the entrance front being relieved by a solid projection in the centre, surmounted by a moulded cornice and pediment. A parapet or attic will be carried round the principal fronts, and effectually hide the roof of the building. A portico of beautiful proportions, comprising two Ionic columns, in *Antes*, will form the entrance to the principal floor, on each side of which will be windows, with moulded architraves. The whole of the principal fronts are intended to be of white stone.

Woolwich.—We are happy to learn that the observatory, some time since in contemplation, for the officers of the Royal Artillery and Engineers, is now in course of immediate construction. The site chosen for the building is in the barrack-field, between the Repository and the Mortar Battery, on the right wing of the barracks.—*Woolwich Advertiser.*

Ireland. The Caledon Testimonial.—We are happy to learn that our townsman, Thomas J. Duff, Esq., has been the successful competitor for the premium offered for the best design for the Caledon testimonial. And when we mention that there were submitted in competition *thirty-two* plans, the f ct that Mr. Duff's obtained the preference, sufficiently attests the superior taste and ability of that gentleman. The approved design (with a sight of which we have been favonred) is a Grecian Doric column, placed on a stylobate or pedestal composed from Athenian remains. The panels on the sides are to be ornamented with appropriate sculpture, executed in *basso relievo*, and having suitable inscriptions. The column is to be fluted, and will measure upwards of 54 feet in height from its inferior diameter, and is to be surmounted by a *cippus*, on which will be placed the statue of the late lamented nobleman, habited in his parliamentary robes, decorated with the collar of the order of St. Patrick, and other insignia. The stylobate is seated on a broad basement, with surrounding steps, terminating at the angles by dwarf pedestals supporting lions *couchant*. Including the steps, basement, &c., the column, when finished, will be nearly 100 feet in height. The whole is to be constructed of white freestone, procured from a quarry in the neighbourhood of Caledon.—*Newry Examiner.*

MISCELLANEA.

A New Mathematical Instrument for the purpose of ascertaining terrestrial distances and heights, has been invented by Mr. T. Sheffield, of this town. "It is very neat, and so portable that it may be carried in the pocket. It is, moreover, very simple in its application; merely requiring its sights—after some necessary adjustment at two convenient stations whose distance has been measured—to be directed towards the object; and then a divided index or handle points out, upon the geometrical principle of similar triangles, how many times the distances of the object from the stations contains the measured base line. It is also furnished with two levels for placing it either in the horizontal or vertical plane."—*Carlisle Journal.*

A New Agricultural Machine.—"A Forest Farmer," in a Nottingham paper, calls the attention of agriculturists to the newly invented machine of Messrs. Winrow and Carey, for the destruction of seeds, weeds, and insects on land, by burning the surface. He says—"It destroys animal and this vegetable matter, consequently makes manure; and to use the machine at time of the year, would destroy the slugs and their eggs, which would be of the greatest importance to the farmer. My mind upon this subject was, like many others, hard of belief, until the ploughing match at Ramsdale Farm on the 15th ult., when I was astonished to see this machine at work: although it rained fast and the grass was very wet, the machine did its work in excellent style. Mr. Winrow informed me that he could make a light portable machine, to be worked by two men without horses, that would burn about two acres per day,—say one acre per day: paring and burning would cost 1*l.* 6*s.* per acre by spade; so by this machine, supposing two men at 3*s.* each per day, and coal 3*s.* per day, there would be a saving of 17*s.* per acre to the farmer, besides 70 per cent. in manure.

Russian Observatory.—The grand observatory at Pulkhova, near St. Petersburgh, has been opened.

Bags of Wind for raising Vessels.—We witnessed an interesting experiment this forenoon on board the revenue cutter Hamilton, Captain Sturgis, which was intended to illustrate the practicability of raising a vessel by means of cylindrical bags placed under her bottom, and filled with atmospheric air. The bags were each of large size, capable of containing 2,500 cubic feet of air. They were confined by means of ropes passing under the keel, and afterwards filled by two forcing-pumps propelling the air through tubes into the cylindrical floats. The bags were made of three parts of stout cotton canvass, made air and water tight by means of India-rubber, and were prepared by Mr. Howard, of Roxbury, under the direction of the inventor, Mr. M'Kean. The cutter was raised considerably by this process. but the floats were made for a larger vessel, and, when inflated, a large portion of them rose above the water. The utility of this apparatus, thus adapting a well-known principle in pneumatics to a practical use, must be obvious to every one. It will enable vessels with large draughts of water to pass over barred harbours, as New Orleans, Mobile, Ocracoke Inlet, &c., without lightening. It may be used also with advantage to various other purposes. as raising a vessel sunk in several fathoms of water, &c.—*Boston Mercantile Journal.*—This plan of raising sunken vessels has been known in England several years.—Ed. C. E. and A. Journal.

Remains of a Cetacea.—M. Laubepin has announced to the Academy of Sciences, that he has found in Louisiana the fossil head of a cetaceous animal.

A fine suit of armour has recently been discovered in an old manor-house in the Vienne, which antiquaries declare to have belonged to an officer who fought at the battle of Poictiers. It is to be sent to the Musée d'Artillerie of Paris.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 31ST OCTOBER TO 26TH NOVEMBER, 1839.

Stephen George Dorday, of Blackman-street, Borough, Chemist, for "*certain improvements in the manufacture of gelatine size and glue.*"—Sealed October 31; six months for enrolment.

David Greenwood, of Liverpool, millright, and William Pickering, the same place, merchant, for "*improvements in engines for obtaining power.*"—November 2; six months.

Samuel Morand, of Manchester, merchant, for "*improvements in machinery for stretching fabrics.*"—November 2; six months.

Theobald Wahl, of George-yard, Lombard-street, engineer, for "*improvements in boilers applicable to locomotive and other engines.*"—November 2; six months.

Alexander Angus Croll, of Greenwich, manufacturing chemist, for "*improvements in the manufacture of gas, and in re-converting the salts used in purifying gas, and improvements in the manufacture of ammoniacal salts.*"—November 2; six months.

John Cutten, of Margate, coal merchant, for "*improvements in garden pots.*"—November 2; six months.

William Hannis Taylor, of Bridge-street, Blackfriar's, Esq., for "*improvements in obtaining power by means of electro-magnetism.*"—November 2; six months.

Frederick Augustus Glover, of Charlton, near Dover, clerk, for "*an improved instrument for the measurement of angles.*"—November 2; six months.

Henry Vanner Cocks, of Birmingham, iron founder, for "*certain improvements in stoves and furnaces.*"—November 2; six months.

Henry Crosley, of Hooper-square, Leman-street, civil engineer, for "*an improved battery, or arrangement of apparatus for the manufacture of sugar.*"—November 7; four months.

James Murdoch, of Great Cambridge-street, Hackney-road, mechanical draftsman, for "*certain improvements in marine steam-engines.*"—November 7; six months.

Thomas Yates, of Bolton-le-Moors, manufacturer, for "*certain improvements in the construction of looms for weaving, and also the application of the same in order to produce certain description of goods or fabrics by steam or other power.*"—November 7; six months.

George Hanson, of Huddersfield, plumber and glazier, for "*certain improvements in the construction of cocks or taps, for drawing off fluids.*"—November 7; six months.

Thomas Whitеley and John Whiteley, of Stapleford, Nottingham, lace makers, for "*improvements in warp machinery.*—November 7; six months.

John Thomas Laurente Lamy Goddard, of Christopher-street, Finsbury-square, merchant, for "*improvements in looms for weaving, to be worked by steam or other power.*" Communicated by a foreigner residing abroad.—November 7; six months.

John Jones, of Westfield-place, Sheffield, for "*an improved table knife.*"—November 7; six months.

Edmond Moody, of Maiden Bradley, Wilts, yeoman, for "*improvements in machinery for preparing turnips, carrots, parsnips, potatoes, and all other bulbous roots, as food for animals.*"—November 7; six months.

Thomas Edmondson, of Manchester, clerk, for "*certain improvements in printing presses.*"—November 9; six months.

James White, of Lambeth, engineer, for "*improvements in machinery for moulding clay to form of bricks and tiles, and also for compounding and moulding other substances.*"—November 12; six months.

William Chesterman, of Burford, Oxford, engineer, for "*improvements in stoves.*"—November 12; six months.

Moses Poole, of Lincoln's Inn, gentleman, for "*improvements in making nails, bolts, and spikes.*" Communicated by a foreigner residing abroad.—November 12; six months.

Moses Poole, of Lincoln's Inn, gentleman, for "*improvements in looms for weaving.*" Communicated by a foreigner residing abroad.—November 12; six months.

William Wiseman, of George-yard, Lombard-street, merchant, for "*improvements in the manufacture of alum.*" Communicated by a foreigner residing abroad.—November 16; six months.

John Burn Smith, of Salford, Manchester, cotton spinner, for "*certain improvements in machinery for preparing, roving, spinning, and twisting cottons, and other fibrous substances.*"—November 16; six months.

Miles Berry, of Chancery-lane, patent agent, for "*an invention or discovery, by which certain textile or fibrous plants are rendered applicable to making paper, and spinning into yarn, and weaving into cloth, in place of flax, hemp, cotton, and other fibrous materials, commonly used for such purpose.*" Communicated by a foreigner residing abroad.—November 19; six months.

Francis Worrell Stevens, of Chigwell, Essex, schoolmaster, for "*certain improvements in apparatus for propelling boats and other vessels on water.*"—November 19; six months.

John Parsons, of the Stag Tavern, Fulham-road, victualler, for "*improvements in preventing and curing smokey chimneys.*—November 21; six months.

Robert Hawthorn and William Hawthorn, of Newcastle-upon-Tyne, civil engineers, for "*certain improvements in locomotive and other steam-engines, in respect of the boilers, and conveying the steam therefrom to the cylinders.*"—November 21; six months.

John Faram of Middlewich, Chester, gentleman, for "*certain improvements in the mode of constructing, applying, and using railway switches, for connecting different lines of railway, or two distinct railways, and for passing locomotive, steam, and other engines, and railway carriages, and waggons, from the one to the other of such railways, and for certain apparatus connected therewith.*"—November 21; six months.

Pierre Auguste Ducote, of Saint Martin's-lane, for "*certain improvements in printing china, porcelain, earthenware, and other like wares, and for printing on paper, calicoes, silks, woollen, oil-cloth, leather, and other fabricks, and for an improved material to be used in printing.*"—November 21; six months.

William Danbury Holmes, of Lambeth-square, Surrey, civil engineer, for "*certain improvements in the construction of iron ships, boats, and other vessels, and also in means for preventing the same from foundering, also in the application of the same improvements, or parts thereof, to other vessels.*"—November 23; six months.

John Hunt, of Greenwich, engineer, for "*an improved method of propelling and steering vessels.*"—November 23; six months.

Richard Hornsley, of Spittlegate, Lincoln, machine maker, for "*an improved machine for drilling land and sowing grain and seeds of different descriptions, either with or without bone, or other manure.*"—November 25; six months.

John Sutton, of John-street, Lambeth, Surrey, machinist, for "*improvements in obtaining power.*"—November 25; six months.

James Craig, of Newbattle Paper Mill, Edinburgh, for "*an improvement or improvements in the machinery for the manufacturing paper.*"—November 25; six months.

Arthur Collen, of Stoke, by Mayland, Suffolk, plumber, for "*improvements in pumps.*"—November 25; six months.

James Matley, of Manchester, Gentleman, for "*improvements in apparatus or instruments for the cutting of cotton or wicks of lamps.* Communicated by a foreigner residing abroad.—November 25; six months.

George Rennie, of Holland-street, Blackfriar's, civil engineer, for "*certain improved methods of propelling vessels.*"—November 26; six months.

TO CORRESPONDENTS.

Books received too late for review.—Weale's *work on Bridges, Parts V. and VI. in one, contain some beautiful engravings, among which is the Wellesley Bridge, at Limerick, and the Friburgh Suspension Bridge; the letter-press consists of useful practical information on the foundation of bridges, which we shall notice next month.*

Mr. Weale *has* edited *and published a work on Ornamental Gates, Lodges, &c.*

The Companion to the Almanac contains several interesting Papers and Engravings connected with architecture.

We have received Euclid's Elements, by W. D. Cooley, A. B., *from a first inspection, it appears to be a well arranged and condensed elementary work suitable for the student.*

We have received from Edinburgh Mr. Walker's *and* Mr. Cubitt's *report on the Leith Harbour, which will be noticed next month.*

Several communications we have been obliged to condense, and others we have postponed, in consequence of the Preface, Index, &c. occupying 10 *pages of the Journal, and it was not our wish to increase the size, as that would have also increased the price.*

For the same reason we have been obliged to postpone the tables on Railway Curves, which are completed, and will appear in our next.

To Mr. Sheppard *we are obliged for his offer, he will perceive that we have the tables prepared, we shall be glad to hear from him on some other subject.*

To our new *Correspondent at Glasgow, we have to return our thanks, and trust he will continue to furnish us with similar information. We should like to have a few more particulars relative to the general character of the buildings and other public works.*

Steam Vessels Report.—In answer to numerous correspondents and engineers we beg to state that we have not deserted the cause, "we are lying on our oars," until the meeting of Parliament, when we shall be prepared, if necessary, to fight the battle; in the mean time, we shall be glad to receive any information on the subject, particularly from steam boat builders and engineers.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s*.

*** The Second Volume may also be had, Price 20*s*.

THE END OF THE SECOND VOLUME.

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[The abbreviation *rev.* indicates a book reviewed.]

LIST OF ENGRAVINGS.