THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. IV.] Copyright, 1878, HOUGHTON, OSGOOD & CO. [NO. 135.

BOSTON, JULY 27, 1878.

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IT is a great misfortune to the cause of sound building that neither from coroner's juries, county commissioners, nor from other special officials whatsoever, can we obtain a fair apportionment of responsibilities even in such flagrant cases as the fall of the Rockford Court-House dome and the collapse of the tunnel on Forty-Second Street, New York. If honest and thorough investigation and just punishment, instead of partial inquiry and mild censure, ill-bestowed, promptly ensued upon such cases, the admonition would inevitably be felt "where it would do the most good." Architects, engineers, and builders, would be far less apt to go on laying foundations, building piers, and turning arches according to the lazy rule-of-thumb process which must prevail where there is small danger of criminal procedure in case of disaster, and an even chance that the blame will be placed upon the immediate instead of the ultimate cause, upon the careless subordinate instead of the blundering principal. We rarely hear of accidents in France such as these pages are so frequently forced to chronicle out of our own experience, because there the law watches over the public interests and punishes a fault of construction or carelessness as it punishes highway-robbery or any other crime against society. We learn, for instance, that the French courts, which have been investigating the case of the fall of the passenger elevator at the Grand Hôtel in Paris, not being able to fix the responsibility upon the manufacturer, have fined and imprisoned the engineer in charge for careless oversight of the condition of his hoisting gear, and announced that the proprietors of the hotel are liable to criminal process for damages. The case seems a hard one for the engineer and for the hotel-keepers; but we picture with what renewed care all the engineers in charge throughout Paris will look after their apparatus, and with what fresh solicitude every proprietor will inspect his elevators. Thus, out of the nettle danger, if properly cultivated, will grow the flower safety.

WE have frequently had occasion to refer to the unsatisfactory condition in which the Rockford Court-House affair has been left by the investigations. The responsibilities of the architect have not been defined; the contractor, Richardson, who, according to the testimony, tampered with the plans, and put in poor workmanship and worse materials, has not only been continued in charge, but has been allowed a large sum with which to repair damages, and the Building Committee has escaped all censure. Now, however, we learn that the affair is about to go into court, where we may hope for a complete and exhaustive examination and a proper distribution of blame. Two suits, in the amounts of $5,000 each, have been entered by the widow of one of the victims of the disaster, one against Richardson, who is held to be immediately responsible, and one against the Building Committee, whose members, it is claimed, must, under the law, stand judgment as individuals and not as officials backed by the county. If either of these suits results favorably to the plaintiff, there will be a number of others to follows. It appears as if at last we shall now get at the "true inwardness" of this unfortunate affair, and that architect, contractor, and committee will find themselves set right before the public.

As for the New York tunnel, in default of open and complete expert testimony before the coroner's jury, the local press has availed itself in several instances of the services of well-known engineers, who give their opinions at great length and with much circumstance of figures and calculation. Their conclusions are virtually identical, and may be epitomized as follows: that the arch was "an ellipse within an ellipse," and as such had a rise of only ten feet in the width of forty feet; whereas it should have been "a true ellipse," which would have had a rise of twelve and a half feet; that the arch, even if built exactly according to Commissioner Campbell's specifications, could not possibly stand; that the arch had no countering whatever; that the abutments were not properly built; that the cement was radically bad, and the stones used improperly cut; that the commissioner's specification was vague and undefined, and its application could not possibly give stability to a brick arch so flat and disproportioned. The conclusion is, that for similar work a railroad company would hold its chief engineer responsible. When our municipalities conduct their affairs on a business basis like the corporation of a mill or of a railroad, we shall no longer see this baleful process of political whitewashing to cover the criminal defects in the public service.

WORKMEN are now engaged in removing from the base of the Washington Monument the accumulations and *débris* of a quarter of a century, preliminary to the resumption of work upon that long-neglected and dreary pile of masonry. We fear, notwithstanding the precautionary proviso in the joint resolution of Congress (*American Architect*, vol. iii., p. 170), that we are destined to see the completion of it in accordance with the modified plan; the discordant and barbarous conception of the Pantheon at its base having been replaced by Mr. Mead's terraced and balustraded esplanade, and the proposed height of six hundred feet for the central obelisk having been reduced to four hundred and eighty-five, at which elevation it still will overtop by five feet the highest structure now existing. But as the spire of Cologne Cathedral will, when completed, rise some twenty-six feet above our republican monument, and there is no knowing what superior aerial heights the effete monarchies of Europe may think it worth their while to attain with steeple or dome, fifty or a hundred feet will be added doubtless, if the money holds out, to the great republican obelisk, in order that it may still stand preëminent in this respect, if in no other. Fortunately, the structure is not and cannot be so nicely studied that such an addition would interfere with its essential proportions. A brute mass is not sensitive in this respect, like a work of art, and we sincerely trust that our monument may never be suffered to lose the only claim it can possibly have to the consideration of mankind; unless indeed some such claim can be found in the fact that never since the dawn of civilization has a public monument been erected in which has been combined so small a proportion of human thought with so large a proportion of human labor. The result of plainness, squareness, simplicity, and extreme height will doubtless assert itself to the common mind as a clear achievement (in the vernacular, *a big thing*), disturbing the spectator, however, with no necessity of analyzing details, requiring no intellectual effort to understand, creating no tumult of emotions, and inspiring no thought worth the thinking. If its sides were engraved or sculptured, like the Egyptian monoliths, its prototypes, or like the Column of Trajan, with legends and bas-reliefs, so that they could be read and studied and understood, if it were treated not like a monolith, but like a form built up of small parts into a great structural harmony, as the spire of Strasbourg, for instance, — which, by the bye, is only ten feet lower than our aspiration, but is crowded with evidence of human thought, skill, and love, — it would be a work of art, a true monument, a *denkmal* or think-token as the Germans call it. It is the highest function of art to inspire thought in this manner, and it is quite possible to conceive of such a

monument which should yet have every desirable quality of breadth and repose. The resources of the country are fully capable of an achievement, the merit of which should be, not that it is the highest structure in the world, but that it sets forth to the senses the idea of a national tribute to a great and pure life. In the presence of such an offence to civilization as this bald obelisk will prove to be, if ever erected, artists, whether painters, sculptors, or architects, will have need to ask themselves why they are encouraged to exist and ply their vocations if such a memorial can by any possibility, or in any way, accomplish the results which should be expected of it. The gentlemen of the Washington Monument Association, if they really decline to submit to public competition the form which this conspicuous testimonial should ultimately assume, and if they really prefer to retain the essential features of a design made some thirty-five years ago, when there was little or no art in the country, will doubtless save themselves an infinity of vexation, labor, and delay, but they will have irrecoverably lost a great opportunity. We again, on behalf of the high interests of art, commend this subject to their careful revision. It may not yet be too late.

Mr. James Jackson Jarves writes from Florence to the *New York Times* that it is proposed in France to form a separate ministry of the fine arts as one of the departments of government, in order to secure a greater efficiency in the administration of the artistic interests of the country than is obtained by the present system of entrusting them to a bureau in the Department of Public Instruction. This would be a characteristic recognition of the importance of the highest artistic culture to the welfare and happiness of a great people, and it is out of such recognition that proceeds the undoubted preëminence of France in all that pertains to monumental art. How far we ourselves are behindhand in such matters may be measured by considering our lamentable failures in respect to our public monuments. Thus, Mr. Larkin G. Meade, to whom we are indebted for the modified Washington Monument, which we so heartily deprecate, has completed the model for the monument to be erected at Bennington, Vt., at the joint expense of Vermont, New Hampshire, and Massachusetts, in memory of General Stark. According to the description in the papers, the statue of the hero, twelve feet high, is to be placed upon a structure one hundred feet high, "which in some respects is to be a copy of the famous tower of Giotto in Florence," and which "will be ornamented with bas-reliefs representing incidents in General Stark's campaigns." The Italian city spent the equivalent of five millions of dollars in erecting the Campanile, exhausting the resources of invention and skill in the midst of the greatest era of Florentine art. It is more than three times as high as the proposed American copy, and is filled with minute detail, on which its essential expression depends. The imagination cannot entertain the idea of a small copy of this monument, to be built at a cost of about sixty thousand dollars, and cannot conceive what sort of an inspiration can be derived from the great original to suggest a pedestal for a statue; and the imagination would certainly be the only means of ascertaining the qualities of a twelve-foot statue surmounting this strange pile. As Mr. Jarves justly remarks, the statue might as well be one hundred feet underground. If the description does justice to the design, the figure might as well be St. Simeon Stylites as poor General Stark. No good purpose of art, history, or patriotism can be subserved by such an erection. We trust it is not too late to be reconsidered. When will our great characters and achievements be honored as Henri Regnault and his compatriots are honored in the court of the École des Beaux-Arts, in Paris? When will our art be worthy of our heroes?

The democratic institutions and instincts of this country could have few better illustrations than the accident that happened in New York on July 15th, where a blast, improperly fired, fractured the thirty-six inch water-main at a short distance only from the obstructing rock, and was the cause of damage to the cellars of the abutting buildings to the amount of some eight thousand dollars. It seems that one Henry McGucken, a plumber, had taken a contract to connect a house on Third Avenue with the service-pipe that runs alongside of the Croton main, which, at this point, is laid in a trench cut through a ledge of rock. Through this ledge a new cutting had to be made, and it was in making this cut that the unfortunate blast, either too heavily charged or improperly covered, was fired. We question whether in any other country it is allowable, as it seems to be in this, for a person, be he licensed plumber or not, to tear up the causeway and act his pleasure on such corporate or private property as he may find below the surface. Fortunately, as no death was caused by the accident, we shall not be forced to content ourselves with the dictum of a coroner's jury; but from the litigation which will doubtless ensue, we may be able to gather some enlightenment as to how far our lives and property are at the mercy of private individuals who may choose, for purposes of their own, to put them in jeopardy. One thing seems plain, that this accident, following so closely on the fall of the Forty-Second Street tunnel, will teach the officials of the Department of Public Works the importance of attending strictly to their duties, and that even the simplest operation, for whose maladministration the city may be held responsible, ought not to be left in the hands of ordinary and inexpert workmen unrestrained by competent supervision. If experience has shown the advantage of having a special set of men who alone are qualified to tap sewers, this accident seems to show the need of licensing a similar body of men, who alone shall have the right to make connections with water-pipes. As the suggestion affects both parties, we recommend it alike to city governments and to water companies.

The communist and proletariat may rejoice at any change that will avenge, even for a short time, the fancied wrong done him and his by the engineer and the machinist, who are ever on the alert to replace manual by mechanical labor, and may see in the introduction of a system of heating cities by steam, one of the first effects of which will be to throw out of employment a large number of engineers, boiler-tenders, and steam-fitters, a species of poetical justice. The experiments that have been made at Lockport, and, we believe, at Buffalo, have proved, seemingly beyond peradventure, the feasibility of heating a large number of buildings by steam supplied from a common source; though the possibility of supplying in the same way steam for manufacturing purposes seems not to be so clearly established. A number of citizens of New York have lately purchased the right to introduce into that city the Holly system of town-heating; and already more than a million dollars have been subscribed for the purpose of making preliminary experiments; these proving satisfactory it is supposed that there will be small difficulty in obtaining money to extend the system so as to embrace the whole city. The scheme so far as at present developed is, ultimately to divide the city into five sections, in each of which is to be a battery of fifty boilers, which, it is thought, will be able to meet all probable demands. These batteries are to be placed in four-story brick buildings, presumably isolated, having an area at the ground of some two hundred square feet. Starting from these centres a system of mains and connecting pipes will be laid throughout the city, and each consumer will be furnished with a meter, so that he may be called on to pay for only as much steam as he uses. Means are provided for heating the condensed water by live steam, and causing it to circulate over the house by a separate system of pipes. No statement is at present made of the first cost of the plant. But some idea of the running expenses may be conceived from the statement that the five batteries are calculated to consume about twenty-five hundred tons of coal each day. In the economical introduction of the system the shape of the island may be of use, as it is stated that a battery of the size mentioned is capable of sending steam to points two miles distant without much loss of effective power.

The possibilities of such a system are curious to picture to one's self. Experiments made last winter show that steam can be used to advantage to dissipate snow, either as it falls or after it has collected in the streets, the actual cost of melting a ton of snow having proved to be only five cents. This use of steam may, then, be looked upon as certain, and the thousands of dollars that the city is now obliged to spend in the fruitless endeavor to keep the streets passable in a heavy winter may then, with a certain justice, be diverted to the better preservation of hygienic conditions in the summer. As the system provides for the reheating and circulating of the condensed water, it will be possible to establish hydrants on the street where hot water can be drawn at all times, and the cold water pipe alongside may be kept from freezing by the accompanying steam-coil. Not only horses and cattle, but incidentally the sparrows and other winter birds, which perish in great numbers

in a hard winter, will be benefited by these unfrozen drinking-troughs. Alongside of the cold-water hydrant may be placed a steam chest to which the fire-engines may be attached, thus making possible such remodelling of the present fire-engine that the boiler, fire-box, etc., can be dispensed with, enabling the engine to reach a fire more speedily than now. It may be possible to so apply steam to street cars as to do away in one case with horses, and in the other with the noisy locomotive overhead. It cannot fail to make the use of elevators in stores, dwellings, and, we hope, in schools, more common than at present; and the same may be said of the introduction of ventilating fans into hospitals, schools, public halls, and factories. Many of the lesser industries now carried on by manual labor will owe their development to this cheapness of the steam supply. In opposition to the scheme may be urged the increased uncheerfulness of homes steam-heated, and the spread of those ailments common to the people who inhabit them; but the saving in expense, allowing a more general use of open fires, would prevent the first, and greater attention to ventilation would obviate the second of these defects. To the charge that the explosion of one of these batteries would cause immense damage and loss of life, it may be answered that the explosions that now take place continually at unexpected places and under irresponsible charge probably cause as much damage in the course of one year as the explosion of a carefully watched and competently managed battery in an isolated building could possibly inflict in a very much longer period. The batteries could easily be arranged in relays so that accidents need not affect the working of a whole battery and so bring to a stand-still the operations of one fifth of the city.

THOROUGHFARES IN GREAT CITIES.

THE crowding of the thoroughfares of great cities is becoming a serious evil, the daily traffic having grown until it actually outstrips the capacities of their streets. There are cities, like Paris, Berlin, or Vienna, in which the circulation is so far diffused as not to be greatly embarrassed, and is tempted into particular streets mainly by their greater capacity and magnificence. But there are others, such as London, or New York, in which natural conditions concentrate such a flow into one or two channels that no existing thoroughfare would comfortably hold it. The first resort, when a street becomes intolerably crowded, is to widen it, and this, except in a few instances, is the only thing that has been tried. But there are limits to the convenient width of streets, limits which have sometimes been overstepped. If Broadway or the Strand were made wide enough for the convenience of all the passing in them, and all that their added width would tempt into them, the width would bring serious inconveniences. Too wide streets are made disagreeable by the wind in cold weather, and by the sun in hot. They are expensive to maintain, difficult to keep free of dirt and dust, and extremely uncomfortable for foot-passengers who have to cross them. In such a street as we have imagined, the opposite sides would be almost as hopelessly isolated from each other as the banks of a river. Even in Paris, where the mercantile traffic is not heavy, the crossing of the wide Boulevards is at certain hours of the day almost perilous, especially for women; filled with the traffic of Broadway, they would be almost impassable. As most New Yorkers will remember, a dozen years ago the difficulty of crossing the lower part of Broadway had grown so annoying that a foot-bridge was built across it. It was found, however, that the obstruction of the sidewalks by the piers of the bridge and the stairs which led to it, and the labor of ascending and descending every time it was crossed, more than balanced the relief it gave, and it was soon taken down. A notable instance of a city which has suffered from a too ambitious expansion of its thoroughfares is Washington; and one of the good things which the Board of Works did for it was to constrict some of the waste streets by parking them. We doubt whether a street for traffic so wide as Pennsylvania Avenue, for instance, can ever be a success. A fashionable drive, like the Avenue des Champs Elysées, at Paris, which is laid out for a throng of fast-moving carriages, and which foot-passengers are to cross at their peril, may be of such width; but for a business thoroughfare it is unmanageable. It would be extremely dangerous to invite the throng of vehicles which crowds Broadway to move at speed, and there is a limit to the size of the current which foot-passengers should be required to stem in crossing; but one horn or the other of this dilemma presents itself as soon as we get busy streets of immoderate width. There is, in fact, some natural antagonism between vehicles and foot-passengers, in which it is as important to defend the last as the first. Danger and inconvenience to foot-passengers increase with the number of vehicles which are allowed abreast, as well as with their speed, till they reach a point where they become intolerable. We are inclined to set eighty feet between curbstones as the maximum width of a convenient thoroughfare, and where there is no line of car rails we should say sixty. This gives room for two lines of carriages moving deliberately in each direction, and for a file to stand at each sidewalk. Footways of from sixteen to twenty feet on each side would increase the width to ninety-two or a hundred feet between the houses, with a greater proportion of footway than is common, though not more, we think, than is desirable in a first-class thoroughfare if the travel is to be all at one level. But Pennsylvania Avenue is two hundred feet between the houses. Such a street must be a failure in its architectural and picturesque aspect, for it dwarfs any building that can be put upon it, and men and vehicles, unless in the swarm of a great celebration, are lost in it like flies on a floor.

Finally, we may add that such enormous streets are as difficult to light and police as they are to pave and clean; that they consume a great deal of space that might be more profitably used, thus diminishing the ratio of taxable property to the cost of the highway at its charge, and furnishing a poor equivalent for the parks and pleasure-grounds which might be substituted for them.

It seems, then, that while the natural increase of ordinary traffic and circulation in modern cities has crowded thoroughfares much beyond convenience, the simple remedy of increasing their size is not adequate. This is the effect even of the growth of uses that are immemorial, but is greatly aggravated by the new uses which this country has found for its streets. The gas-pipes, water-pipes, and sewers with which cities are nowadays netted over were necessarily thrust under ground as soon as they appeared, but even then they do not cease to be obstructive. The interruption which is caused when they have to be altered or repaired is an annoyance which ought not to be tolerated. When to all the rest is added the periodic passage in certain streets of a vast number of people who, according to the fashion of many cities, live in suburbs and do business in the interior of the city, and so must further crowd those streets with special vehicles for through passengers, we find the thoroughfares altogether overburdened.

Mere increase of size being an insufficient remedy, the next resource is in classification and separation of the uses to which streets are put. The rough division into roadway and foot pavement is no longer sufficient for this; but through-traffic and way-traffic in both kinds may be encouraged to divide, and the wayside-traffic will bear subdivision according as it is for heavy business or ordinary shopping, or the mere passing of residents. The obvious device of carrying the gas, water, and sewerage services in under-ground galleries or subways, so that they may be reached without interfering with the streets above, is a costly one, and so far as we know has not yet been adopted except in Paris; yet it is one that must ultimately, we suspect, become imperative in large cities. To divide the traffic above is more difficult. One way would be to distribute the light and the heavy traffic, the through and the wayside, in different streets, parallel if necessary. But traffic is obstinate and will not be led by the nose, even though ultimate convenience were to be promoted by it. Light and heavy business jobbing and retailing will crystallize apart when they are compelled to. But the wayside-traffic clings to the through-traffic. Shops, offices, hotels, and — when they are not absolutely driven out — residences cling tenaciously to those streets which are natural thoroughfares. It is almost impossible to absolutely separate the two currents; the resource is to carry them as smoothly as possible side by side, keeping them as distinct as may be and allowing free opportunity to pass at will from one current to the other. The exigencies of quick transit have already, in London and New York, made some separation between the two classes of city passengers. Londoners and New Yorkers have solved the problem in their different ways, withdrawing the through travel from the local, by carrying it, in London, under ground beneath the other, in New York, in the air above it. The Londoners sacrifice their passengers, and they travel uncomfortably, but the streets and the way-traffic are undisturbed. The New Yorkers have sacrificed the streets to the through

passengers, or perhaps to the economy of the transit companies, in a way that is characteristic of the readiness of Americans to sacrifice everything to an immediate object, and that if persisted in must permanently change the character of the streets it affects. The method of relief which we suggested for this exigency a short time ago (*American Architect*, June 29, 1878) deserves a few more words, for it is applicable to the relief of other streets than those in which elevated railways run. It is simply the carrying out of what is already foreshadowed, a system of circulation on different levels. The subways of Paris, receiving the conduits of the city and the traffic to which they give rise, are the first hint of such a system. The Broadway bridge was another hint at a double-level circulation. It failed simply because it was isolated and of difficult access, and because its position made it an obstruction; but as part of a well-adapted system it would have succeeded. The elevated roads are another step in the same direction, and they may lead to a new order of things.

What we suggested was the lifting of a range of footways to near the level of the second stories of buildings, so that there might be a continuous circulation at a higher level as well as on the ground. This was to be done either by cutting out a passage-way from the second stories of the buildings, to be treated as an arcade, or "row;" or else by setting back the façades above the first story and leaving an open terrace in front of them. In either case the upper footway would retreat behind the under, passing over a part of the lower stories of the houses, and be continued by bridges across the side streets, with stairs at their intersections. But in the one case it would be covered by the overhanging buildings above it, and in the other open to the air. The *Nation* lately, while mentioning our suggestion with encouragement, cited some of its natural difficulties, such as the irregularity of stories in existing houses, and the reverberation of the noise of the elevated roads in case arcaded galleries were used. These, however, are difficulties incident to particular cases. When old buildings were to be adapted, there would be some trouble, some paring and piecing of the portions of the lower stories overrun by the footway; but perhaps no greater difficulty than is common in the remodelling of old fronts; while new buildings would be adapted without trouble. Where there was an elevated railway the open terraces would doubtless be preferable, as the *Nation* suggests, to the arcaded galleries, at least unless the street were exceptionally wide. It is hoped that some way will be found of abating the noise of the railways, which is said to be at present almost intolerable.

There would be many advantages in what we may call a double-level circulation, besides those we mentioned in our former article. The tendency to stratification in modern cities is very marked, and is increasing. It distinguishes many continental cities, — Vienna, Berlin, Brussels, for instance, — and is found in its completeness in Paris, where the whole city is in layers: a layer of shops and warehouses, a layer of lesser business and domestic apartments, layers of first-class, second-class, and third-class dwellings, and layers of cheap lodgings above. The tendency is resisted by people of English descent, but begins to show itself even in England, while Americans, especially in New York, already turn to it with characteristic recognition of its convenience. It is in accordance with this tendency that people who use the same quarters of a city for different purposes should circulate at different levels, where the levels are discriminated by heavier and lighter business, as by jobbing and retail trade; by shops and offices; by business premises and dwellings; or by dwellings of different classes. If women intent on shopping, or men on professional business, could make their rounds above the level of the busiest and noisiest traffic, it would doubtless be a welcome relief; but the greatest gain might be in giving facility to rapid transit in a new way. In an American city, as soon as business invades the lower stories of a block all but the poorer residents flee apace, and that quarter is lost for dwelling-places. But except in those quarters where the business tide rises to the upper floors the insulation of a single story in height might be made as effectual as that of several blocks horizontally. It is the visible juxtaposition of business and dwelling, and the living right against a busy street, that offends the Anglo-Saxon sense of domesticity. But if the two currents of business and social life were kept part, and actually out of sight of each other, as they might be at different levels, privacy and accessibility might be reconciled. The ease and safety with which — thanks to incombustible construction and the use of elevators — we are learning to carry our buildings upwards make it the more desirable to raise the level at which we can pass from one to the other, and give a chance to improve the healthfulness as well as the comfort of them by putting as large a proportion up in the light and air as practicable.

There are cities to whose natural conformation such a treatment of streets seems particularly suited. We have before called attention (*American Architect*, June 30, 1877) to the value of natural elevations in the sites of cities, and the singular perverseness with which they are neglected or deliberately sacrificed in American cities. Towns set in a natural hollow, like Cincinnati, or built on uneven ground, like Baltimore, or Boston in its old days, might be especially benefited by a plan which would allow people to pass from one high site to another without descending to a lower plane. Inhabitants might learn the excellence of the higher levels, with their natural advantages of drainage, air, and retirement. People whose eyes were wonted to a terraced construction might be spared the temptation to pare everything down to a hopeless flatness, which has already begun the ruin of many fair sites. Natural elevations might be preserved and prized for their value as resting-places, and as determining the flow of population as well as drainage.

Let us imagine a city street with a roadway of fifty or sixty or even eighty feet, flanked by lower sidewalks, say a dozen feet wide, against which rise the lower stories of a row of buildings; and upon these stories a terraced walk somewhat wider than the lower, having for its background the fronts of the buildings carried up to their full height, with a width of a hundred feet or more from house to house. Light foot-bridges would span the side streets and also the main thoroughfare at the crossings, so that the upper current at least would pass from side to side without danger or hindrance to themselves or to the traffic in carriages below. The architectural effect of such a street might be very imposing, and its convenience, we are persuaded, would solve many difficulties. The frequent bridges, as seen from below, would more or less interrupt the long perspectives, but would be a trifling impediment compared with the elevated roads, and would not hide any building except from one or two points. But the real field of view would be transferred to the upper level, where the outlook would be nearly unobstructed. There would be some impediment to those who came in their carriages to visit the upper stories of the buildings; but the natural tendency of this system of communication would be to encourage building broadly in flats around interior courts, with a great advantage to light, air, and cleanliness, which courts would give, as in Paris, the carriage entrances to all the upper apartments.

As between arcades and terraces, both would have their merits. Arcades would suit naturally with wider streets. Terraces would suit with any street that was not so excessively wide as to belittle the buildings upon it, and would by expanding upwards increase the supply of air and light. Arcades would be a shelter from hot and cold winds, and in hot weather would give the great blessing of a circulation under cover. They would also allow the abutting owners the use of their whole depth on every story except one. Either would be somewhat costly; but we are speaking of the highways of large cities, which are always costly, and either would give, architecturally and picturesquely, the means of magnificent effects.

LIGHTNING-RODS.[1]

In alluding to the plan which is now so commonly advocated, of enlisting the mains of gas service in towns to do duty as earth connections for lightning-rods, it may be necessary to say, in the way of caution, that no iron gas-pipe smaller than an inch should ever be allowed to approach to any part of a system of lightning defence, and that no gas-pipe of soft metal of any kind should be permitted to be near to the conductor. It must be well kept in mind that the very circumstance which makes the gas-main so good an earth-contact for a conductor constitutes at the same time a grave danger if this precaution is not observed. The mains of the gas service are generally so ample and excellent in the earth connections which they supply, that lightning striking a conductor with an ordinary earth-plate, or probably with some earth connection even less carefully provided than that, would be almost certain to leap across to any soft-metal gas-pipe placed near to the conductor, in order to avail itself of that better and easier path to the earth; and in doing so would melt the soft metal and set the gas alight. Fires are very frequently caused in this way. It is a radical axiom of lightning protection that the conductor must never be carried near to small, and especially to soft-metal, gas-pipes.

[1] From a paper read before the Society of Arts by Dr. R. B. Mann, F. R. A. S., and published in the *Journal of the Society of Arts*.

One of the most interesting features of the work which Professor Melsens has been carrying on in connection with his labors at Brussels is that various points of theory have been subjected to experimental investigation as the construction has been in progress. The professor was kind enough to show me some of his experiments when I was in Brussels. I may advantageously speak of two of these. He has devised an arrangement of apparatus to show that it certainly is not true that an electrical discharge goes by the nearest and easiest path to the earth. He has distributed a series of conductors, somewhat in the form of a gridiron, in which a large central stem goes from a battery direct to the earth by the nearest possible path, and in which lateral branches of much smaller diameter make longer paths on each side of the central stem. When an intensity current, or rather a stream of intensity-discharges from an induction coil, is transmitted to the ground through this system of conduction, the knuckle advanced to the small outside and roundabout threads receives a sharp shock, as well as when it is presented to the central stem. The fact is simply that the discharge traverses all the paths that are open to it, and distributes itself amongst them in proportion to the resistance which each different route affords.

Another very beautiful experiment is arranged, to show that although copper is a better conductor of electricity than iron it has less molecular strength to resist the disintegrating influence of a powerful discharge. A fine wire is carried along for several feet, of which one half is made of copper and one half of iron. The two halves are of exactly the same diameter and length. These wires are so placed as to be continuous with each other, so that the same discharge may have to pass through both. The discharge of a Leyden battery of fifteen large jars is then passed through these wires, and it is found that the copper wire is dissipated into black powder, but that the iron wire is only beaded along its entire extent, and not broken in its continuity. This affords some incidental support to the selection of iron, instead of copper, for the conductor at the Hôtel de Ville, at Brussels. But the chief reason for this preference has really been the large cost of copper in a work of this dimension, where the conductors have to be so profusely spread in all parts of the building without any concomitant advantage from its employment, since an equally good result can be insured by iron. The copper, it was conceived, would also have furnished a greater temptation to thieves in any exposed part of the structure to which light fingers could have found access.

In his "Description Détaillée des Paratonnerres," Professor Melsens insists very strongly upon a principle which I have already urged with some persistence from this place, namely, that "the chances of a lateral discharge from a lightning-rod decrease in proportion to the capacity of the conductor." I allude once again to this, because it is the fundamental condition upon which the efficiency of a lightning-rod depends. The importance of the large earth-contact and the abundant supply of points is but a part of the more general question of capacity as a whole. The tension of an electrical discharge has to be kept as low as possible as it passes through the rod, and that is accomplished in three ways: (1) by easy inlets through points; (2) by large sectional area of the rod; and (3) by spacious and free outlets to the earth.

There is one other passage in this book to which I desire also to draw something more than a mere passing attention,[1] because I glean from it that Professor Melsens holds that a "good earth" for purposes of telegraphy does not necessarily imply a "good earth" for the safe discharge of the lightning-rod, and that the indications of low resistance to a galvanic current do not certainly prove the efficient condition of a *paratonnerre*. He obviously conceives that the view which is ordinarily accepted upon this point should not in all cases be admitted without some qualification and reserve, and without precautions in carrying out processes of testing.

The method employed by practical electricians in testing the capacity of conductors for electrical currents and discharges is a very ingenious one, which depends for its efficiency upon the fact already alluded to in connection with one of Professor Melsens' experiments, that electrical currents diffuse themselves through conductors in proportion to the resistance offered in different directions. The instrument employed in the operation is some form of what is termed the "differential galvanometer." A copper wire is so arranged as to branch out into two circles, which run round a suspended magnetic needle, the one in a direction from left to right, and the other the opposite way. When a galvanic current is passed through this wire to the earth, as the two circles are of equal size and made of the same kind of wire, the current divides itself equally between them, and as one half of the current consequently goes round the needle one way, and the other half the opposite way, the needle is not deflected by either of them. It remains evenly suspended between the antagonistic impulses. If, however, a gap is made in one of the circles, and a source of increased resistance is introduced into that gap, a larger proportion of the current is immediately thrown into the other circle, and the needle does consequently deviate from its central position of rest to an extent dependent upon the excess of current that is influencing it. Known quantities of resistance, in the form of coils, can then be introduced into the other circle until the needle is brought back to its original position, and in that way these become the measures of the resistance which is required to be known. When a lightning-rod is introduced into one of the circuits of such a galvanometer, the needle will not deviate from the central line by more than one or two degrees, if the capacity and connections of the conductor are good. If, on the other hand, the conductor be faulty, the needle will diverge to a considerable degree.

From the reference which has been made to Professor Melsens' great work at Brussels, it will have been gleaned that there are two different systems of protection against lightning recognized by scientific electricians at the present day: (1) the system of multiple rods of weak sectional area,[1] which has been so skilfully carried into effect by its distinguished advocate at Brussels; and (2) the system of a single rod of large area so placed as to protect a considerable space around by its dominant height and ample dimensions.

Experience has virtually shown that either of these systems may be followed with equally satisfactory results, if intelligently and skilfully administered. M. Melsens holds that the multiple-rod plan is best adapted to structures such as he has had to deal with. A widely extended adoption and a very successful use indicate that the single-rod system is, in its turn, as well suited for its work with buildings of a more ordinary size and of a different character. But the most important practical lesson which comes out of the comparison of the two systems is, perhaps, the suggestion that the one most commonly used has some points which are capable of being materially strengthened by borrowing something from the alternative plan. This may, however, be most serviceably expressed in the form of a condensed aphorismal abstract of the fundamental conditions that, in the existing state of electrical science, may be most advantageously observed in the construction of lightning-rods.

1. The copper rope or rod employed as the main stem of a lightning conductor should in no case have a diameter of less than four tenths of an inch.

2. A rope or rod of four tenths of an inch in diameter is not large enough for the protection of buildings that are more than eighty feet high. The resistance offered by a conductor of any given diameter increases with its length. Long conductors, therefore, require to be of larger size than short ones.

3. For every additional eighty feet of height or of extent a second rope or rod, of the same transverse dimensions, must be added, or the sectional area of the single rod must be increased in a similar degree.

4. It is of no practical importance whether the conductor possess the form of a rope of twisted wire or of a rod, provided it be of sufficient dimensions for the work which it has to perform.

5. If a cylinder or pipe is used instead of a rope or rod, it must be considered as furnishing the same conducting capacity that it would have if slit up along one side and opened out into the form of a flat band.

6. Galvanized iron may be used as a conductor instead of copper, but it must have considerably larger size, because iron is of inferior conducting capacity to copper. Increased size can quite compensate for inferior transmitting capacity.

7. An iron rope or rod, to be equally efficient, must be rather more than double the width of a copper rope or rod. In exact figures the proportional diameters needed are as 6.7 to 2.5. The conducting capacity of iron is five and a half times less than that of copper, or, in more exact figures, as 14 to 77.

8. A galvanized-iron rope conductor should, in no circumstances, be less than eight tenths of an inch in diameter.

9. When a strip or tape of copper is used in place of a rope or rod, it should be in no case less than three quarters of an inch broad and one eighth of an inch thick. Such a strip contains a sectional area of a tenth of a square inch.

10. Galvanized iron, when used in the form of a strip, should be four inches wide and an eighth of an inch thick. Such a strip would contain a trifle more than half a square inch of sectional area.

11. A lightning-rod must be absolutely unbroken, or of continuous length from end to end.

12. When metallic water-pipes, or other similar stretches of metal, forming part of the structure of an edifice, are made to do service as lightning conductors, all joints must be carefully made good by solder, and tested afterwards to ascertain the sufficiency of their conducting capacity. Without this precaution, the arrangement is liable to be a source of danger, instead of a means of safety.

13. It is quite unimportant how a lightning-rod is attached to a building. It does not need insulating fastenings; ordinary metal clamps of any kind may be quite safely employed, provided the rod be of good conducting capacity, and otherwise efficient.

14. The rod must be terminated above in metal points, well projected up into the air.

15. The terminal points may be made either of copper or of iron, but they must be tapered out very gradually, and be perfectly sharp. An alloy composed of 835 parts of silver and 165 parts of copper forms an excellent material for tipping the points, because it enables these to preserve, for a long time, their sharpness under the circumstance of exposure to moist air. The silver tips should be made about two inches long, and be firmly screwed into the termination of the conductor.

[1] Page 70.

[1] *Conducteurs nombreux, mais à faible section.*

16. The air-terminal of the conductor should be branched out into several points. Multiple points — or aigrettes, as they are termed — of this kind are now made in copper, of very good form, by all the best electrical engineers.

17. The larger the building that has to be protected, the more points or clusters of points should be used. In the case of buildings of any considerable extent the conductor itself must be branched out to all parts, and each branch must end in its own projecting tuft of points.

18. Terminal points should project into the air at least eight feet beyond the building itself.

19. The general idea may be kept in mind that lightning conductors approximately protect a conical space around them whose base is four times as wide as the conductor is high. This principle, however, is not an infallible one, and it must not, therefore, be too implicitly relied upon. Whenever any parts of a building approach towards the limiting surface of such a conical space, additional points should be fixed there, and be brought into connection with the general system of the conductor.

20. The bottom of the conductor must be carried down into the earth, and be connected with it by a surface-contact of large extent.

21. About the best earth-terminal that can be contrived consists in connecting the end of the conductor with the iron main of a gas service or water service. The end of the conductor should be attached to a broad piece of copper or iron, and this should be laid close along the metal surface of the main underground, or, where practicable, be even attached to it by some kind of solder.

22. Where there is not the opportunity for adopting this expedient, the lower end of the conductor should be placed in a shallow trench, opened out twenty feet in the moist ground, and be carried along in it to the end, and be also well packed round with gas coke, broken into small pieces, before the trench is covered up with earth.

23. Plates of copper or iron may be used as earth-terminals, if this be preferred. The plate should not then, however, in any case, furnish less than two square yards of earth-contact, reckoning both sides, and it must be carefully rivetted and soldered to the conductor, and be surrounded with broken coke, before it is buried up in the earth.

24. When the earth is unavoidably dry, the earth-contacts of the conductor must be made proportionally large. Abundant size may be so managed as to compensate for the disadvantage of dryness.

25. With dry earth-contacts, lightning-rods may be a source of danger instead of safety, if this precaution be not observed. The only means by which it can be ascertained whether a dry earth-contact has been made large enough is the employment of the galvanometer. This test should never be omitted when the conductor terminates in a dry soil.

26. The danger of a lateral discharge from a lightning conductor diminishes with its capacity. A large, well-pointed, and well-grounded conductor will convey a very powerful discharge to the earth without the slightest tendency to strike through any object external to the rod. A small and imperfectly appointed conductor, on the other hand, is always prone, during the transmission of lightning, to flash off some portion to surrounding objects.

27. The capacity of a conductor may practically be increased in three ways to insure this efficiency and safety: (1) by the employment of larger ropes or rods; (2) by a more abundant service of points; and (3) by amplification and improvement of the earth-contact.

28. The proof that a conductor has been made capacious enough by the judicious employment of these means is furnished by the magnetic needle of a galvanometer not being materially deflected when a galvanic current is passed through the conductor to the earth.

29. All large masses of metal contained in a building should be metallically connected with the lightning-rod, unless when such are liable to be occupied by living people during a thunder-storm, as in the case of an iron balcony fixed outside a wall in front of a casement; it is then better that such masses should not be connected with the conductor, because, under such circumstances, persons standing upon them would be in less danger of being struck. When they are connected with the conductor there is always some risk of persons standing upon them furnishing a path for the lightning to the conductor.

30. The best method of connecting masses of metal with a conductor is by closed circuits; that is, a connecting metallic band should proceed to them from two different parts of the conductor.

31. Soft-metal gas-pipes must never be allowed to run anywhere near to a lightning conductor, because there is always danger when they are so placed of some part of the discharge deviating from its proper route to avail itself of the good earth-contact furnished by the expanded mains of the gas supply, and in doing so of melting the small fusible gas-pipe and setting fire to the gas.

32. Zinc or iron pipes on the tops of chimneys are always to be regarded as masses of metal that are to be brought into connection with the conductor.

33. Lofty chimney shafts may always be satisfactorily protected by a single conductor. Care must, however, be taken that the size of the conductor is adequate for the height, and the top of the shaft must be entirely encompassed by a bar or parapet edge of metal, and points must radiate from it on all sides into the air.

34. In the case of manufactories where corrosive vapors are emitted from the chimneys, copper or iron terminals should be soldered into leaden tubes, and a subordinate service of points should be added at some lower level, where they would not be liable to be affected by the corrosive vapors.

THE ILLUSTRATIONS.

THE PALACE OF THE TROCADÉRO, PARIS.

The accompanying illustration, which we copy from the *Illustrated London News*, will serve to make our Paris correspondent's letter more intelligible.

HOUSE AT MANCHESTER, MASS., FOR PROF. O. S. FOWLER. MESSRS. CABOT AND CHANDLER, ARCHITECTS, BOSTON.

The site occupied by this house is a rocky promontory on Smith's Point. It is just finished at a cost of $6,500. The builders were Messrs. Phillips and Killam, of Manchester.

DESIGN FOR THE MOORE MEMORIAL PREPARED BY MR. JOHN F. HENNESSY.

This design was presented in competition to the St. Patrick's Society of Brooklyn, who wished to erect a monument in Prospect Park on the anniversary of the poet's birth. The Celtic cross was chosen as being the most appropriate form to give the memorial. It was intended to be cast in bronze and to rest on a granite base. The bas-relief in the medallion was to be copied from Lawrence's portrait of Moore.

DESIGN FOR THE EMPLOYMENT OF SIX COLUMNS, MR. R. D. ANDREWS.

This is one of the designs prepared by the members of the school of architecture attached to the Massachusetts Institute of Technology, Boston, in accordance with the following programme: —

A wealthy amateur of the arts is in possession of the shafts of six columns of rich marble, which he wishes to make use of in the erection of a small building or monument. As these columns can serve equally well to form part of a great variety of structures, each student is left free to choose the subject of his composition. It may be a fountain, well, portico, tomb, or any other structure whatever.

These columns are to be taken as twelve feet long, exclusive of base and capital, which are to be supplied. Any substructure or base that the nature of the composition may require may be added.

Required: A Plan and Elevation, both on a scale of one fourth of an inch to the foot, finished in pencil, with the shadows cast, with or without color.

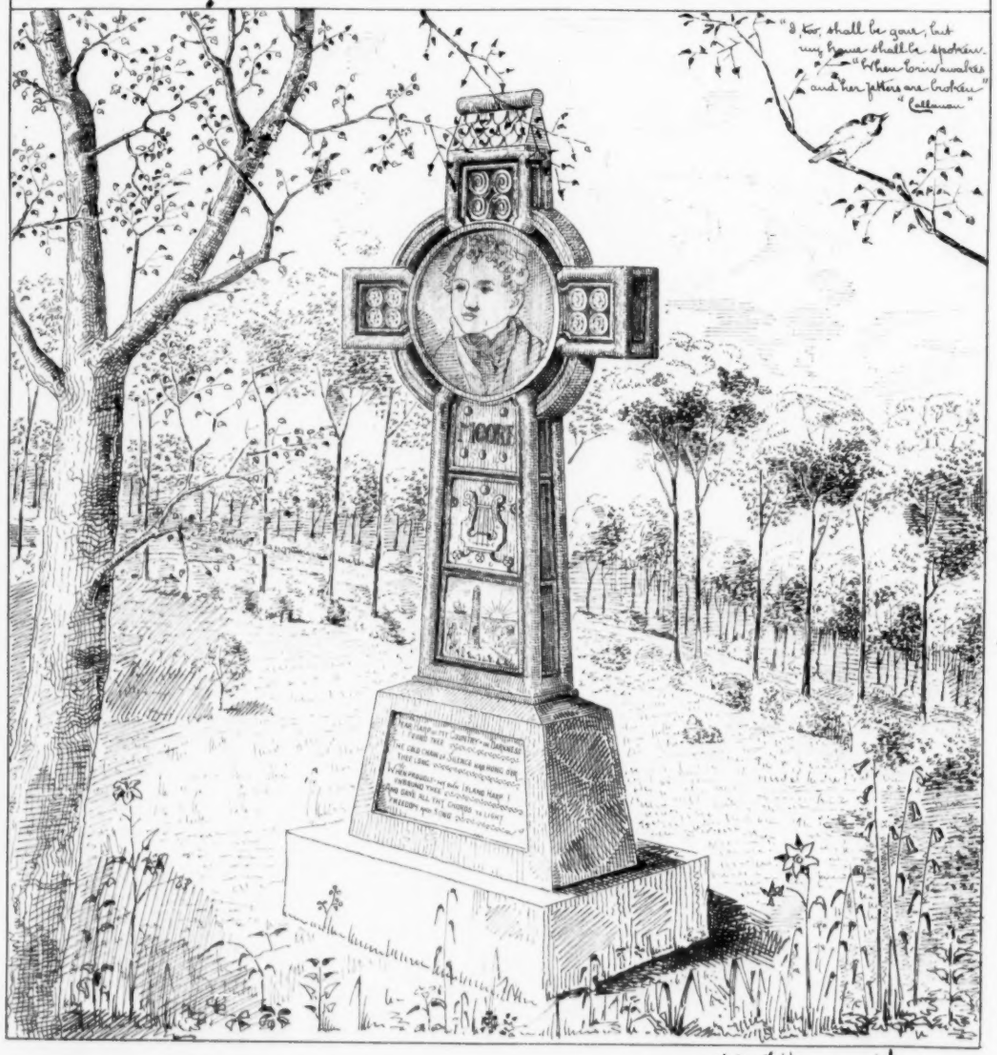
DESIGNS FOR A STONE FIRE-PLACE, — COMPETITION NO. IV.

MONREALE.

Monreale, *Mons Regalis*, almost tells its story in its name. It is the royal mount of William the Good, crowned by the church and city which arose out of no great need of his kingdom, ecclesiastical, military, or commercial, but simply because the spot was hallowed by associations personal to himself. Our notions of ecclesiastical geography are startled when we stand at one of the gates of Palermo, and see on the hill-side at so small a distance the metropolitan church of another province. Archbishops are certainly thicker on the ground in Southern than in Northern Europe; but we are hardly prepared to find one in this way almost at the gates of another. On the spot where the church stands King William believed himself to have been honored with a heavenly vision. That the vision should be commemorated by a church and monastery on the spot was almost in the natural order of things. That a town should grow up round the monastery was also almost in the natural order of things; a crowd of English boroughs have sprung from such an origin. But that the monastery should contain the throne of a new bishop, of a new metropolitan, that a new diocese and province should be marked out for it, that the little town which gathered around it should become an ecclesiastical metropolis, is what certainly no one could have looked for. It shows how dearly the good king loved his own creation. And Englishmen will naturally ask another question. Monreale, as we have implied, was one of the very few episcopal churches out of England which were served by monks instead of secular canons. Among the ecclesiastical changes of the Italian kingdom the monks of Monreale have shared the fate of other monks. But as the metropolitan of Canterbury is still installed in his place as abbot of Christ Church, so the metropolitan of Monreale heads the pastoral in which he calls on his people to weep for Pope Pius and to rejoice for Pope Leo with the style, episcopal, monastic, and baronial, of "Arcivescovo ed Abate di Monreale, della citta e dello stato signore." But how came this specially English use into the Sicilian church? Was it prompted by Queen Joan or by Archbishop Walter? Master Thomas Brown had, we fancy, gone back to his place in King Henry's exchequer before the church of Monreale was founded.

From the gate of Palermo, from any favorable spot of the city or its neighborhood, we look up at the church and town of good King William nestling on the mountain side, with the height crowned by

: Design for the "Moore" Memorial :



: John F. Hennessy del :

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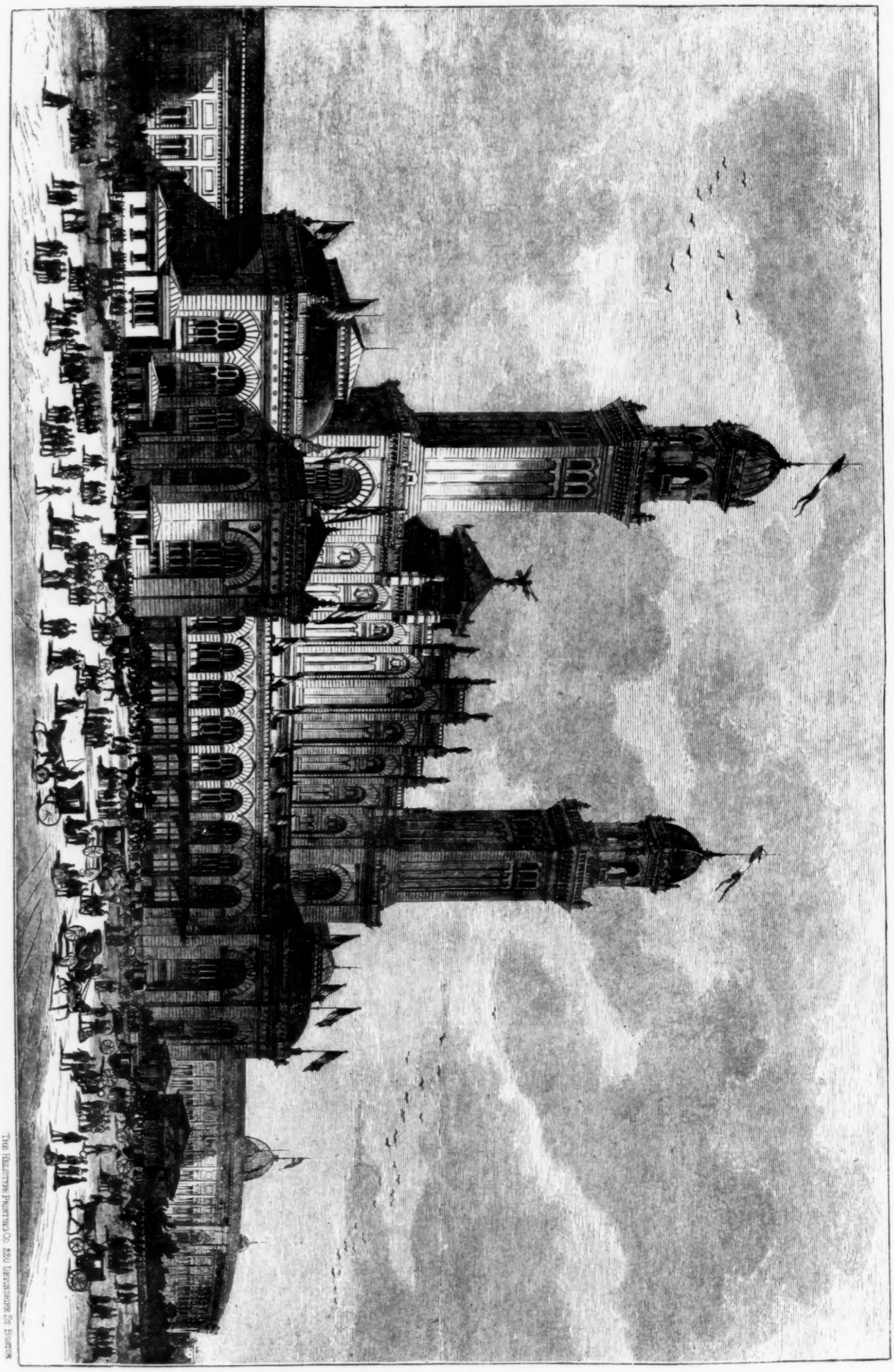
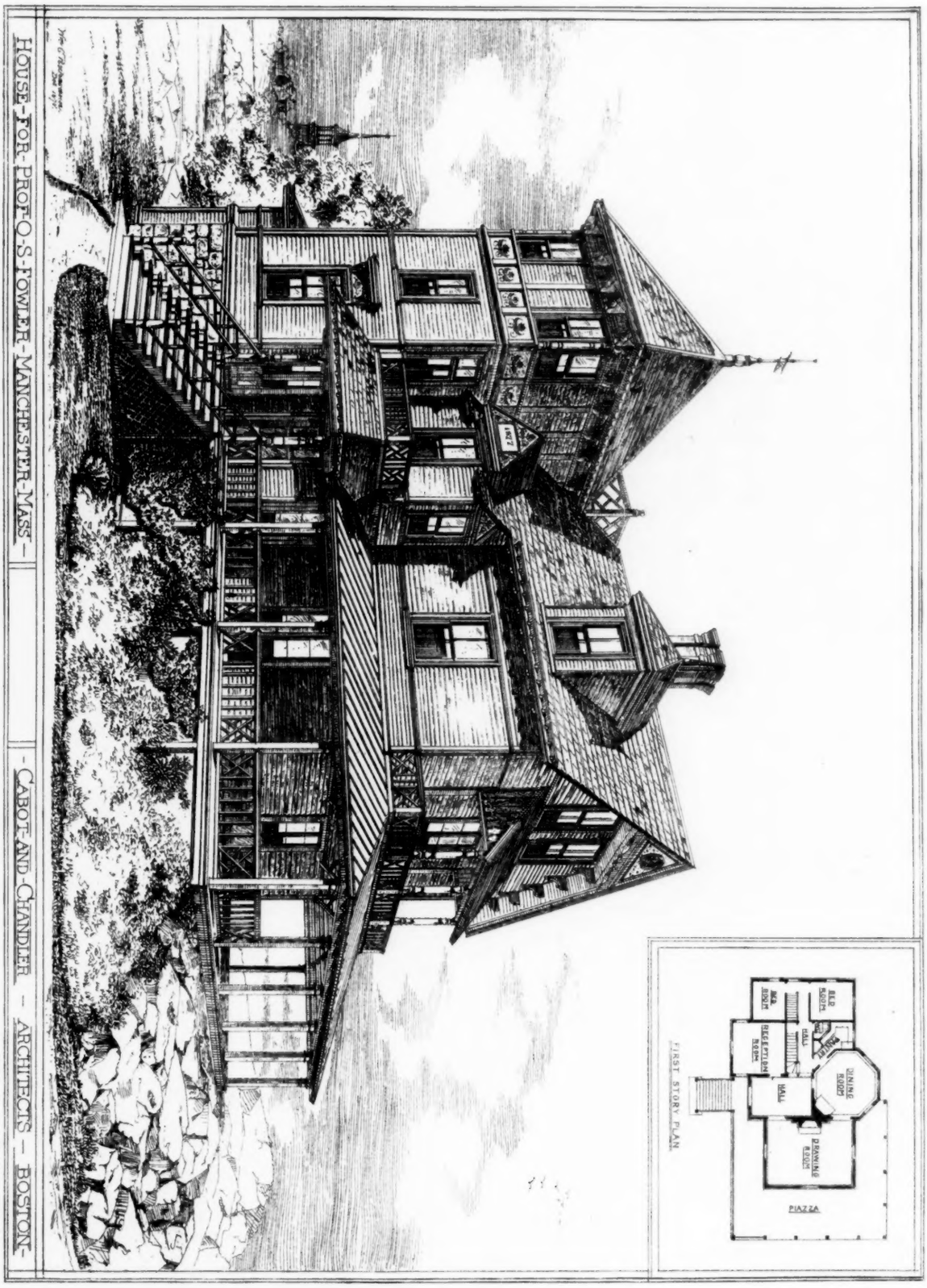


THE PARIS EXHIBITION BUILDING AT THE TROCADERO.

THE HELIOTYPE PRINTING CO. 330 DEVONSHIRE ST. BOSTON.

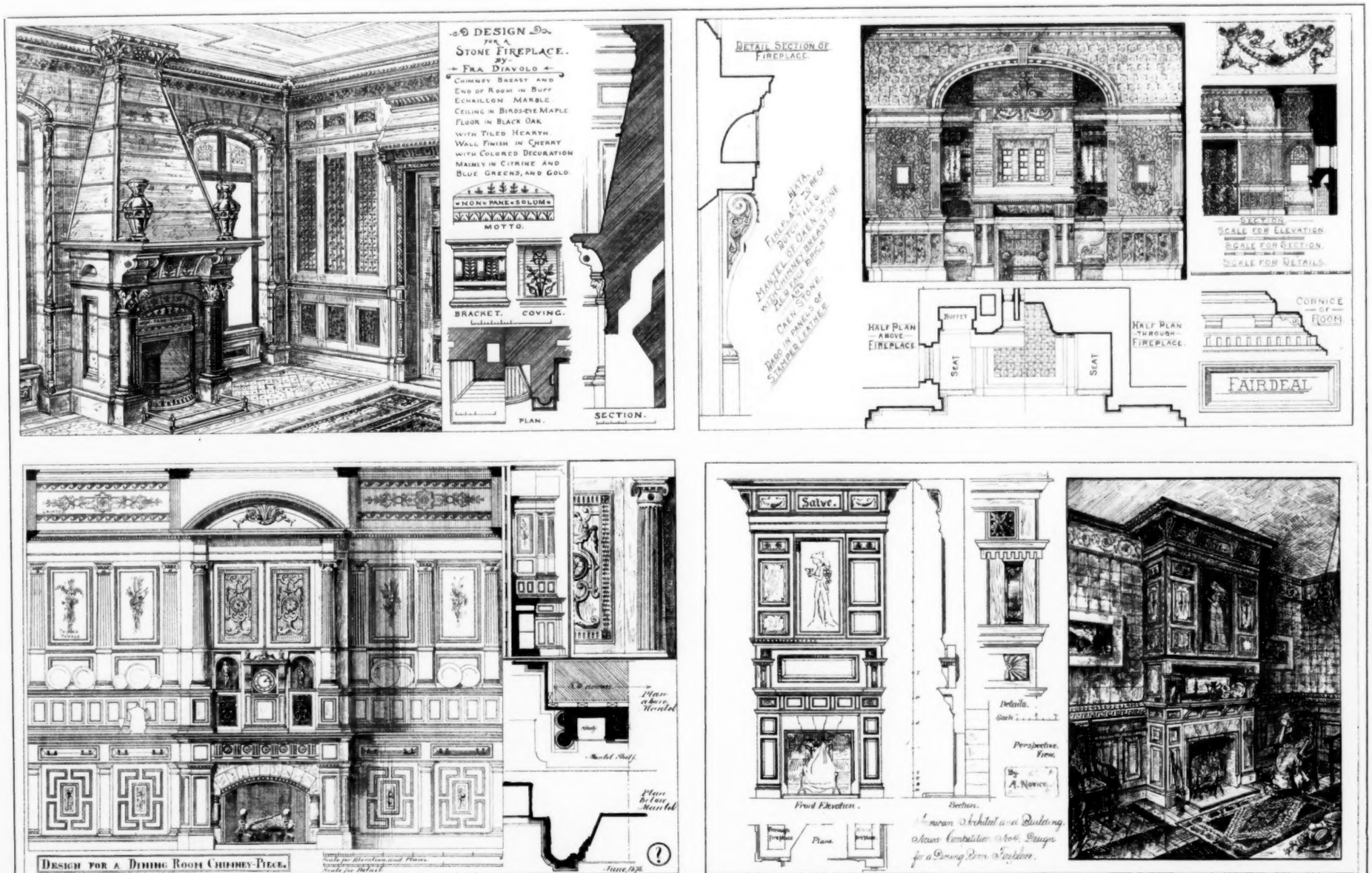


HOUSE FOR PROF. O. S. FOWLER, MANCHESTER, MASS.

CABOT AND CHANDLER, ARCHITECTS, BOSTON.

THE HELIOTYPE PRINTING CO. 239 DEVONSHIRE ST. BOSTON.

American Architect and Building News July 27. 1878. No 135



— COMPETITION IN INTERIOR DECORATION —
— DESIGNS FOR A STONE FIRE PLACE —

THE HELIOTYPE PRINTING Co. 220 DEVONSHIRE ST. BOSTON.

a castle, — whose examination must be left to Alpine climbers, — soaring above it. And from the road which winds up alongside of the royal mount we do indeed look on the Golden Shell, on the hills, on the shore, on the city which lines it, on the headlands which guard the inner sea, on the broad Mediterranean spreading boundlessly beyond them. The *campagna*, once golden with corn, has changed to an expanse of olive and orange trees, with houses and villas dotted among them, with the bare limestone mountains rising over villages and monasteries on their sides, and fencing in the whole favored region. We look down on the whole history of Sicily, but with one blank forcing itself on the mind, to which it is a kind of mockery to give an answer which is little more than formal. We look down on the proud city, and count up its endless lords — Phœnician, Roman, Gothic, Byzantine, Saracen, Norman, Angevin, Spanish, Austrian, and Savoyard. We look down on the battle-field of Metellus and Hasdrubal, and on the bloodier slaughter-place of the Vespers. We look on the city which in distant ages welcomed the deliverance of Belisarius and the deliverance of Garibaldi. But round no spot within our view can we call up the memories which give their first charm to other Sicilian prospects. The Golden Shell was never the territory of a free Hellenic commonwealth. We look to the right of the bay, and we may remember that the hill of Punic Soluntum once yielded to the arms of Hellenic Tyndaris; if we are disposed to be liberal of the Hellenic name, we may look to the left, and remember that the height of Heirktê — now the Pilgrim Mount of St. Rosalie — beheld the warfare of Molossian Pyrrhus. But the scene on which we look can hardly be brought by such faint memories as these within the limits of the true Hellenic world. The land and the city on which we look are before all things the land and city which the Roman won from the Carthaginian, and which the Norman won from the Saracen. And the spot from which we look down is that whereon is reared the last and greatest of the ecclesiastical works of the conquering line of Hauteville. The succession of buildings which begins with the small votive church of Robert Wiscard ends with the vast votive minster which arose on the mountain slope at the bidding of William the Good.

The church of Monreale is, from its position, seen far away, and yet it is not an object which really stands out in the landscape. It is not, like so many Sicilian churches, altogether without a tower, but it has nothing like either the tall *campanili* of Italy or the towers and spires of northern lands. It has, in fact, or was meant to have, two western towers; but one only was ever carried up, and that one is of no great height, richness, or beauty. We need hardly say that there is no long line of roof; but there is no outline of any kind. There is no central cupola, only the high choir of the type of churches to which Monreale belongs, a feature which, unlike the central tower or cupola, rather adds to shapelessness than produces outline. Yet Monreale has one external feature of extraordinary splendor which gradually opens on the traveller as he draws near. Tastes may differ as to the merits of the peculiar kind of decoration employed; but there can be no doubt that the east end of the church of Monreale is a perfect triumph in that kind. Mr. Fergusson says that "all the architectural features in the building were subordinate in the eyes of the builders to the mosaic decorations." There is truth in this remark; but it is a little too sweeping. We may admit it to be true with regard to the eastern part of the church. Architecture is certainly sacrificed to mosaic when only a single unimportant window lights the central apse. And of course this has its effect on the outside also. The part of the mosaics within is played without by an elaborate system of surface decorations, blank arcades, circles, bringing in also the element of color. These enrichments have nothing to do with the construction of the building, nothing to do with any of its essential features, as doors and windows. We may well think it a truer form of ornament when, in a German or North Italian church, the apse is enriched with arcades, put there doubtless for ornament, but which still are brought into a relation with the essential features of the building, such members of the arcade as are needed being pierced for windows. But the Monreale east end is a magnificent thing in its own way, and it is the more interesting as a study because it is clearly the climax of several efforts, some of which were not very successful. In the churches of Magione and San Spirito we find the first rude beginnings of the three apses adorned with intersecting arches, the windows, if there were any at all, being at most cut through them in a kind of incidental way. Whether Cistercians, when the Cistercian order was young, would have run after such an ecclesiastical luxury as mosaics may fairly be doubted. But if they did not mean to have mosaics, why did they not have windows? Anyhow, it is in these two Cistercian churches that these arcaded east ends begin, and they go on vastly magnified in the two metropolitan churches. But the east end at Monreale is an incomparably better design than the east end at Palermo. The east end of our English Walter is a most rich and elaborate piece of work, and we have a further fondness for it because, like the east end of San Spirito, it keeps the Saracenic billet, which is not to be seen at Monreale. But the apses, especially the side apses, have not their full importance; they have an air of being stuck on against the high choir, which here has a very elaborate outside. The high choir at Monreale, if it ever had any artistic character outside, has utterly lost it through modern changes. This may perhaps help to give yet further importance to the apses; but they have of themselves far greater importance than those of Palermo. There are few things more striking in their own way than the three apses when looked at from a little way down the slope to the south side. And we suspect that they typify a remarkable piece of ecclesiastical history. We must remember that the use of the Greek rite prevailed during the earlier days of Norman rule in Sicily. We have spoken already of the very small apses, hardly to be called apses, in some of the smallest churches of that date. At St. John of the Hermits they are in the thickness of the wall. With the coming in of the Cistercians they grow larger, till they reach their climax at Monreale. In the Cistercian churches we may be sure that the Latin rite was always used; so it doubtless was at Palermo, at least from Walter's rebuilding; at Monreale it was of course used from the beginning. The cupola and the small side apses are in short the sign of the new Rome; the high choir and the larger apses are the sign of the old.

Besides the east end there is nothing very striking in the outside of Monreale. The west front is poor, except a single splendid doorway, which comes nearer to northern Norman work than anything else in the church. But how come the two towers to project, after the manner of several examples in Scotland? Perhaps rather, we should ask why the arrangement is followed in Scotland? For at Monreale we may believe that the towers were meant to be united by a portico, which we can hardly fancy in Scotland. A portico there is at Monreale, but not at the west end; it covers the north side of the nave, a specimen of that earlier and better kind of Renaissance which practically does not differ from the more classical type of Romanesque. We pass under its arcade, through the magnificent wrought door with its carvings, into the renowned nave of Monreale. On what do our eyes rest first? That is a matter of taste and habit. Some eyes will fly at once to the colored splendors of the mosaics; others will light, even before the mosaics, on that of which the mosaics are after all but the festal dress, on that noble range of columns which makes Monreale a rival of Pisa. While Palermo was still Saracen, the men of Pisa had carried off trophies from her harbor, and with them they had carried off some germs of Saracenic skill to be pressed into the service of the mighty temple which commemorated their victory. In the double ranges of columns at Pisa the lesser row of arches are pointed; at Monreale the pointed arch is dominant. Arches of that shape rest on the single row of columns which parts off the wide nave from the narrow aisles. Nothing can be less like the sprawling arches of the pseudo-Gothic of Italy than these narrow, stilted arches rising from those mighty shafts; it is like a basilica of the noblest design, like the peristyle of Jovius himself, with the pointed arches of Tiryns or Tusculum taught to discharge an artistic function. In all this the nave of Monreale is essentially akin to the nave of the palace chapel on a greater scale. But with the nave the likeness ends. At the palace chapel everything fits into everything else; nave, cupola, apse, are all bound together, and form a single whole, — a whole far more perfect than Pisa. At Monreale Mr. Fergusson's criticism, untrue of the nave, is most true of everything east of the nave; it is a mere display of mosaics, and nothing else. Wash over all the mosaics, the nave, like the palace chapel, would still remain one of the noblest of strictly architectural compositions; the eastern part would lose all beauty and interest, except that which it is hard in any case to take away from the bold sweep of the apse. But the high choir, with four arches of different heights and widths, with not a single column, nothing but square surfaces, is a wretched substitute indeed either for the cupola of the East or for the soaring lantern of the North. Four arches, forming a kind of crossing, make us ask for one or the other; but the prayer for either is disappointed.

It is well to insist on both the merits and the defects of this wonderful church strictly as a work of architecture, because to so many eyes it seems to be hardly a work of architecture at all, but a mere display of color. The capitals are worth a study, though they show but few patterns. A few of the columns keep their classical capitals, which quite cower down below the vast overhanging *quasi*-abaci; but most of the columns are fitted with capitals evidently made to suit the abaci, classical, but with the *cornucopiæ* to play the part of the volute, a type seen also in the church of Magione. In the extreme eastern parts we again get a few columns, smaller, and in some cases coupled. The mosaics have been discussed over and over again. We will mention two or three points only. While there is a great deal of Greek at the palace chapel, there is very little at Monreale, and the Latin in some places runs off into strange forms which are said to belong to the local dialect. This is a most important element in the puzzling question as to the language of Sicily. Secondly, the ark distinctly rests on *two* Ararats, very much as they are drawn in Mr. Bryce's book. Thirdly, Abraham's ram is caught in a thicket which looks very like the cactus so commonly seen in the island, and yet botanists tell us that the cactus, like the prickly pear, came from America. It is well, though it involves leaving the nave for the high choir, to turn from such thorny questions and look at the mosaic of the coronation of William the Good, placed over the throne which, here as elsewhere, marks the sacred character of the Sicilian monarchy.

So, among all the various capitals in the famous cloister — each one is a study — the one which comes home to us most is that which records the founder's offering. Remembering Arles, Moissac, Aosta, a crowd of others, the Monreale cloister must be allowed to hold the first place in its own class. Above it on one side rises the long

range of lancets of the forsaken refectory, — the archbishop and abbot of Monreale holds his lower rank as a sinecure, — and another such range marks the dormitory. From the cloister garth the church rises above the endless ranges of columns and wrought capitals; the mountain with the castle rises again above the church. If one of M. Viollet-le-Duc's immortal students could drop from the clouds into the cloister of Monreale, he ought to feel at once that he was within the precincts of a Sicilian monastery, as, if he were in the like sort dropped into the cloister of Wells, he ought to know that he was within the precincts of an English secular college. King William's Benedictine house, built after true Bendedictine rule, is a relief after the endless monasteries of Palermo, built mostly after no rule and no shape at all. Before the traveller goes down the hill, let him once more go within the church; let him gaze on what else he will, but let him, as his farewell to Monreale, make his way to the south transept, the resting-place of the two Williams. There William the Bad sleeps in the sarcophagus found for him by the filial duty of his son, while William the Good owes his tomb and epitaph to the piety of an archbishop and abbot many ages after. — *Saturday Review.*

CORRESPONDENCE.

THE PALACE OF THE TROCADÉRO.

Paris, June 7, 1878.

Last week the completion of the roof of the second of the two great towers left the Palais du Trocadéro completely finished. Naturally, a building which will be for all time one of the greatest French monuments has called forth much criticism, or rather discussion; for, apart from the architects, political bias generally asserts itself too strongly to allow fair criticism. When the republican proudly lauds the new monument the sincere imperialist cannot openly agree with him; the least he owes his party is a shrug of the shoulder. As a rule the building is pronounced by the architects a success, especially when it is remembered that the immense structure and its foundations have been completed in about eighteen months, an extraordinary feat for the deliberate French architects, who usually are allowed a deal of "pottering," as we should say, over their work. The foundations gave unexpected trouble, because of the site having been quarried formerly and loosely filled in again, and in places had to be begun twenty metres down. The architects have shown themselves men of greater energy and capacity than was expected by the profession, and their rivals honestly concede it. M. Bourdais is rather more engineer than architect, while his partner, M. Davioud, is a thorough artist, with long experience, and in his designs was, in the present case, ably assisted by M. Rollin as his chief inspector.

Architecturally the real front of the building is what the public call the back, that is, not the façade facing the Champs de Mars, but the one towards the spacious square which, adorned with a huge spray fountain, crowns the hill of Chaillot, and from which avenues radiate in all directions. The entrance to the hall should be by a vestibule or *salle de pas perdus*, sixty-one metres long, extending its shelter by a glass *marquise*, and flanked by pavilions in which are iron staircases and columns supporting cupola vaulting with iron ribs, as at the Bibliothèque St. Geneviève. Behind this part of the building rises the great gable, divided into square-topped bays *en échelon*, which masks on this side the roof of the amphitheatre. The gable is flanked by two square belvedere-capped towers, whose platforms are eighty-two metres from the ground. These are provided with elevators for visitors, who can be lifted some ten metres higher than the towers of Notre Dame. At present the public pass by this advanced *corps de bâtiment*, and enter on each side under two long, rectangular pavilions, whose first floor contains halls devoted to conferences in art and science, and whose ground floor forms open vestibules. The ceilings of these halls are supported on eight massive marble columns. Here, as throughout the building when possible, the iron beams are frankly shown, and are filled in with plaster or terra-cotta. No wood is used in the construction of the building.

From these vestibules the visitor may reach the stairs and elevator, or turn at once into one of the long elliptical galleries, thirteen metres wide, in which now are exhibited the loan collections of historical curiosities, or, passing through, may descend at once into the grounds beyond; but let him follow the throng, and he will find himself in the lower of the two circular porticoes which surround the amphitheatre. These magnificent galleries, some six metres wide, are not idle decorative features, but are justified by the surpassing view from them. The eye sweeps from the height of Montmartre on the left over the whole of Paris, with all its domes and towers. Of all its monuments only two are hidden, the Arc de Triomphe and St. Augustin, and the eye ranges far across the dwindling suburbs to the green hills on the right, and again follows the steamers up the river to the gay scene just opposite. Here the shining roofs on the Champs de Mars with their countless flags, and the grounds swarming with restless figures, confuse the brain, and one gladly turns to the nearer scene on the slope on this side of the river, where, half hidden by foliage, are picturesquely scattered pretty châlets and pavilions of varied architecture. But especially is the tired eye soothed as it rests upon the large basin below, with its jets of spray. Into it daily fall thirty thousand cubic metres of water, over a series of eight wide basins flanked by two smaller series of cascades and jets. The source of the water is at one's very feet; for, taking advantage of the falling ground, and to mask the lofty basement, a terrace has been built out a few steps below the lower portico. Here from a projecting elliptical basin a clear sheet of water falls some nine metres, half veiling the arch of the grotto underneath. The effect on the tired sight-seer is delicious, and an eager crowd is always pressing forward to watch from above the falling waters, or below passing into the grotto to look wonderingly at the view through the clear crystal sheet. The terrace is enriched with six colossal figures of the continents in gilt bronze, and of the same material are spirited statues of a rhinoceros, an elephant, a wild ox, and a horse, placed at the angles of the great basin below. The cascade at present looks bald, but when the vases in the original design are placed along their sides this may disappear; its chief fault is want of height for the slope. At any rate, the view from this point will be to many the most notable thing in the Exhibition, and their most agreeable memory.

The two stories of porticoes above mentioned are inclosed within twenty-nine round arched bays, and give easy access to an admirable series of corridors and stairs leading into the hall itself. On entering one is struck by the airiness of the great circular hall, which, with a diameter of forty-five metres, and thirty-one metres high, crowned by a flat, conical ceiling, as in the Cirque d'Hiver, gives an impressive effect. A segment is cut from one side to form a wide and shallow niche for the orchestral platform. Ample light streams in from nine huge round-arched windows, scantily filled with the baldest mullions, which both inside and out are fatally ugly. The bays are continued down below the window, and include tribunes cleverly lodged between the projection of the deep, square, outer buttresses, and hidden by the roof of the porticoes. The seats slope rather steeply down to a range of open boxes on a lower level, and these are high enough to give room for covered boxes beneath. As the rows of amphitheatral seats beginning at the sides increase in number towards the middle, the parquet takes a horse-shoe form, and avoids the dryness of concentric circles. There are about 4,500 seats, exclusive of the ample accommodations for orchestra and choruses on the platform. The decoration shows haste, but in general is light and harmonious in tone. The groundwork is of a dull yellowish bronze tint, much the fashion here now, though M. Garnier failed to make it attractive in the Opéra. Here it is agreeable enough as contrasted with panels and bands of dark red below, and with the pale green of the ceiling above. The difficulty of arranging a vast flat niche surmounted by a segmental arch in a circular hall is not satisfactorily met, but attention is diverted from this by a successful painting by Charles Lameire in the space over the arch. It represents France calling around her the nations. Painted in pale, flat tints, with strongly marked outlines, it is in its simplicity a fine example of architectural decoration. The hall has turned out good in its acoustic qualities, and is well ventilated.

After this general description let us approach the building from the Champs de Mars, for which view it was especially designed. This façade more frankly explains its uses than the other. The rotunda with its open galleries suggests a festival hall, and the towers which flank it, apart from the valuable accent they give, may be explained as gala features, in spite of their solidity. The long wings faced with colonnades suggest museums and collections for the public. The proportions in themselves are agreeable, and so the vast edifice, essentially modern in its architecture, presents itself with grace and frankness. There is one serious criticism to be made: these porticoes, — which by the way are not semicircular, as generally termed, but halves of a flat ellipse, — in spite of their extending some four hundred and thirty metres, appear mean and insignificant. Nothing but near approach to them will convince one that they are in reality monumental in proportion, with a width of about six metres. The architect evidently expected to show the enormous size of his central feature, about fifty-eight metres in diameter, by contrast with these colonnades, which he was at pains to subdivide by lesser pavilions. But just the opposite effect is produced; instead of porticoes, really of ample size, giving a colossal scale to the central part, the latter is taken as the normal scale, and the galleries are dwarfed. It is the ever-recurring problem, perhaps the most difficult in architecture, of how to give scale. Up to a certain point subdivision will give a desired scale, but that point passed the parts before taken as units suddenly become fractions, and the scale drops, as in this case. It is not easy to show what would make it otherwise, but certainly it was a fatal mistake to divide the immense windows of the rotunda into only four divisions, and with mullions really good-sized columns. These great bays are very conspicuous, and, catching at first the eye, give a false scale. Had they been subdivided, as in the best Gothic windows, it would have been very different. There are many minor criticism which might be made, but they can hardly be of interest far from Paris. It is more interesting to note the agreeable tone of color which adds a charm to the building. It is of pale yellow stone; the more constructive parts emphasized by alternate courses of a reddish stone, which, with the towers, give an Oriental aspect. Narrow bands of red and green mosaics are effectively introduced. The walls of the porticoes, of soft Pompeian red, give a rich relief. The style of architecture, though borrowing here and there, is homogeneous from its thorough constructiveness and *raison d'être*.

R.

Bricks in India. — The native brick now used in India is five inches by three inches by one inch.

THE DULL SEASON. — THE NEW ARCHITECTURAL PROFESSORSHIP. — COUNTRY HOUSE AT ISLIP.

NEW YORK.

AT the office of the Superintendent of Buildings it has long been noted that the fortnight between the 1st and the 15th of July is the most laggard time of the entire year; about one plan per diem is then the average, and there have been weeks when but two plans were offered. But while matters are dull at the special headquarters they are not really so among the offices. A few of the architects who were fortunate enough to have commissions early in the spring are busy, and there are a few rumors of new projects afoot.

In the matter of the falling tunnel the jury's verdict puts the blame upon the contractor and the inspector, the one for loading and the other for permitting the placing of the superincumbent earth in a manner other than that called for in the specifications, namely, by layers of uniform depth.

The really important thing of the past few days is the appointment of Mr. Russell Sturgis, Jr., to the post of Professor of Architecture and the Arts of Design at the College of the City of New York. This is the great free college in which the school system of the city finds a fitting culmination. It is a hard-working college, too, with a course to accomplish which requires work on the part of the students. Mr. Sturgis is an alumnus. The subject of architecture has been curiously treated during the twenty-five years of the existence of the college. While the mathematical and classical sections of the course were attended to by able specialists, drawing and architecture were placed under the care of an old German refugee of 1848, whose opinions on all subjects were very fixed, but what those opinions were nobody either inquired or cared to know. He has gone, and in his place one graduate has been already installed as professor of drawing, and now another is chosen to the new seat of architectural instruction. New York, with such a man in such a position, will rank with Boston, Cornell, and Ann Arbor as an architectural school. The experiment — for such it is — promises to create no small amount of criticism, and with a man of such energetic enthusiasm for his art as Mr. Sturgis possesses, the matter will be made interesting, however it may result.

Mr. Richard M. Hunt has lately designed a country-house for Mr. Wm. H. Vanderbilt, and the work is now going on near Islip, L. I., where Mr. August Belmont and Mr. Lorillard already have fine country places. In a general way the plan measures 85 × 86 feet, but is of such an irregular form that the building appears much larger. The building is two and a half stories high, in half-timbered work, with broad, slated roofs, truncated, and of so many and various slopes that a wonderfully picturesque effect is secured for a building so broad and "squat," for there is nothing in the shape of a tower. The main feature of the place is a great hall 20 × 60 feet and 14 feet high; running through the building, and opening from one side of this at right angles is another hall 20 × 20 feet. At one end of the long hall is the main entrance; beside it, to the side, is a deep window-seat, looking out upon the veranda, which extends two thirds of the distance about the house. Opposite the side or jutting hall is a grand fire-place, massive with brick and stonework ten feet wide and running up to the ceiling, the fire-place lined with brick, but otherwise built of stone. At the end of the main hall, opposite the principal entrance, is the wood staircase running up a half story and then turning at a broad landing-stage. Rising from this landing-stage to the second floor ceiling is a great window, almost church-like in size, but made up of small windows closely grouped. It is about fifteen feet square and lights the halls above and below. It is glazed in cathedral glass, with the colored bull's-eyes introduced at the centre of each subdivision of the window. The stairs are to be white ash, while the hall itself is to be in oak panel-work, showing a timber roof; at the end of the side hall, facing the southwest, is another large window, completely occupying the end of the hall; three deep mullions divide the space into four separate lights, which, running from floor to ceiling, give opportunity for a broad field of colored glass. The upper hall has a fire-place over that on the first floor, but of more modest proportions. In one of the outer angles formed by the intersection of the two walls is a parlor nineteen feet square, and in the other a guest's bedroom — the only one on the first floor — which, with a bold bay, plenty of windows, and exterior doors, is a proper hot-weather chamber. Behind the fire-place is the dining-room, entered by two doors, one on either side of it; a conspicuous fire-place has been fixed in the dining-room, which is also finished, like the hall, in oaken cabinet-work.

Window-seats are a favorite feature, and are placed here and there in hall, dining-room, and bedrooms, in a most inviting fashion; at the head of the first flight of stairs the sill of the broad window above mentioned is turned into a cushioned seat.

Without, the building may provoke criticism. The windows, broad or narrow, long or short, as best suited the interior arrangements, seem to jut out in a miscellaneous way, and over the main door-steps a bold hood answers the purposes of what is known in America as a *porte-cochère*, and the highest point is the cresting of the main roof, above which line the chimneys rising from the lower roof do not extend. The broken roof outline gives opportunity for some good light and shade effects. The entire cost will reach $60,000.

W.

LACUSTRINE DWELLINGS. — Lake dwellings have been discovered at Letzen, Switzerland, at the junction of the rivers Limmat and Sihl.

FIRES IN THEATRES.

A FEW additional statistics, taken from the list of theatres destroyed by fire, contained in the work of Herr Fölsch, will teach us, if instruction were needed, how highly dangerous our modern stages are. Nearly every theatre in London and Paris has been burnt down in its turn; in London alone, to the number of thirty-one. During the last thirty years, fifty-seven fires were officially recorded in London, and a great many fire alarms may have never come to the knowledge of the authorities. No better criterion of the combustible nature of play-houses can be formed than by looking at their respective ages. The author has been able to collect exact data with that view of 252 theatres. Of these, there have been burnt down: —

5	theatres	before opening				
70	"	in the first 5 years after opening.				
38	"	"	6 to	10	years after opening.	
45	"	"	11 to	20	"	"
27	"	"	21 to	30	"	"
12	"	"	31 to	40	"	"
20	"	"	41 to	50	"	"
17	"	"	51 to	60	"	"
7	"	"	61 to	80	"	"
8	"	"	81 to	100	"	"
3	"	over 100 years after opening.				

Total, 252 theatres.

The abnormally great number of theatres burnt down in the first five years after being opened is explained partly by the fact that most of them were wooden erections, or merely provisional buildings, which, of course, are of the most dangerous nature. The above figures show that the average age of those theatres destroyed by fire amounts to about twenty-two years and three quarters. Carrying inquiry a little further, we find that the 516 theatres burnt down were distributed over the globe as follows. They included: —

176 in the United States.
68 in Great Britain, exclusive of the colonies.
63 in France.
49 in Germany.
45 in Italy.
26 in Austria.
24 in Russia.
17 in Spain and Portugal.
30 in the various European countries.
18 in the various extra-European countries.

A comparison of these figures does not permit of forming an opinion as to the more or fewer fires in theatres in the different countries; but they are a safe index of the care bestowed there in collecting the required data.

It is further interesting to observe the time when theatres generally burn down. On the average, about thirteen theatres are destroyed each year; the worst months being from January to March, the fewest fires taking place in July to September. Most of them have taken place in the middle of the week, the most fatal days in the month being, strangely, the 8th, 15th, and 22d. Fortunately, of the many conflagrations chronicled in the work, only thirty-six broke out while representations were going on; but these have, on the other hand, been the most disastrous on record. Most of the fires took place in the middle of the night; taking the risk of theatres to catch fire during the day at one, 6.8 represents the liability about two hours after the conclusion of the performance.

Another point, which is generally too much neglected, should not be lost sight of. It is the extreme rapidity with which conflagrations generally spread in theatres, leaving no time to save anything, and involving too often great sacrifice of life. A case in point is the destruction of the Berlin Opéra on August 18, 1843. On that evening the military ballet, "The Swiss Soldier," in which guns are fired and fireworks let off, was represented. At the inspection, half an hour after the end of the performance, there was not the slightest sign of fire. Soon after, however, flames were seen issuing from the right side of the stage, and ten minutes later the whole building was one mass of flame. The old Opéra, like the present one, stood completely isolated, and yet it required the utmost exertion to save the surrounding buildings from taking fire. At the destruction of the Munich Court Theatre on January 14, 1823, it was with the greatest difficulty that another theatre close by, the Royal Castle, and other important buildings were saved. In too many cases it has not been possible to arrest the conflagration, and to confine it to the theatre on fire. Among the many catastrophes of this description of older date may be mentioned the first destruction of Drury Lane Theatre (January, 1672), when sixty other buildings were destroyed; the burning down of the provincial theatre in the court-yard of the Royal Palace of Amalienborg, near Copenhagen (April 19, 1689), when the destructive element annihilated the whole palace, the park with all its buildings, and endangered even the fleet in the roadstead.

Of the more recent fires of this nature, let us only refer to that of the English Opera House (February 16, 1830), when fifteen neighboring houses were destroyed. The fire which broke out in the Olympic on March 29, 1849, either entirely destroyed or greatly damaged twenty other houses. It may be asked, confining the inquiry to London, In how many cases would a fire in a theatre *not* involve the destruction of surrounding property?

In the work under notice, a list is given of thirty-six fires in theatres which occurred during representations. It is not our intention to particularize them here; but those of our readers who take an interest in them will not regret the time spent in perusing the

part of the book dealing with them. For notwithstanding all that has been asserted to the contrary effect, namely, that fires in theatres rarely begin during representations, and that the catastrophe of Brooklyn was unexampled, they will see that experience says otherwise. Since 1770 no fewer than thirty-six were burnt down while performances were going on, and in most cases the loss of life has been frightful.

There is no doubt that effective measures against fires in theatres are imperative. While searching for the best means for preventing them, an inquiry into the origin of those fires is of great value. But in by far the greater number of instances it has not been possible to trace their causes. In this country the verdict of the jury is similar to that found after the destruction of Covent Garden Theatre, in March 5, 1856, namely, "That the theatre has been destroyed by fire; but that there is not sufficient evidence before the jury to say how the same originated." In other countries where no such juries exist, in most cases, after a fruitless inquiry, the subject is silently dropped. The reason why, only in rare instances, the causes of the fire are established is to be sought in the rapid spread and the destructive effect of the conflagration. The thick smoke arising at once obscures all observation; the extraordinary haste and confusion render even subsequent evidence of eye-witnesses unreliable, and such traces which might possibly lead to a discovery are obliterated by the rapidly spreading flames; so that there remain only assumptions upon which to proceed.

Most certainty exists with respect to fires which break out during performances. They are caused either by badly protected or naked lights, or by leaky gas-pipes, or by careless handling of the gas, or by gas explosions. Other fires have arisen from the employment of petroleum for lighting, or through careless smoking, or through firing of guns, or letting off fireworks. Fires, finally, have been caused by the faulty condition of the heating apparatus. In all these cases, carelessness with respect to all those dangerous appliances has been at the bottom of the outbreak. And yet we are going on in the same course.

It has already been remarked that the rapid inflammability of our theatres arises from the large quantity of material easily set in flames, and stored up within a narrow compass, which has been dried up by continually applied heat, and thus prepared for combustion, but also from the extensive way in which a theatre is lighted up. This danger is considerably increased not only by the frequent use of very thin stuffs, which are on that account set ablaze all the more rapidly, but also by the more or less fine or coarse threads of the canvas employed for decorations, which depend from them after frequent use, and which act like slow-matches for the fire. The dust also which settles on the decorations, and which consists mostly of thin fibres, favors the spreading of the flames, so that in an incredibly short time after they once get hold of the objects within their reach their extinction becomes a matter of impossibility. A fire breaking out must consequently be promptly stifled, or the whole house will be in flames. Experience tells us that such a danger sets in very frequently, or more often than is generally believed in wider circles. — *The Builder.*

THE SUBTERRANEAN WORKS AT WELBECK.

It pleases the Duke of Portland to penetrate his magnificent domain by a series of burrows, and to startle his dependents by unexpected appearances from these subterranean depths. These burrows are no narrow tunnels, but lofty, spacious passages, lighted by costly apparatus for letting in the sun at intervals, and by innumerable gas-lights. Lined with brick and stone, and perfectly watertight, they enable their owner to be everywhere by turns, and nowhere long, unless it please him to go into detail with any of the numerous subdirectors of the extraordinary works, complete and in course of construction, at Welbeck.

The sudden apparition of the duke among the grooms exercising his horses in the great riding-house, whose like exists nowhere else, astonishes, but does not dismay. As his pale face rises from the earth in the left-hand corner of the enormous building, there is no sign of trepidation among those assembled, while their master surveys the magnificent work, raised at a cost which sets calculation at defiance. Nearly four hundred feet long, with a width of rather more than one third, this riding-house, carpeted with tan, has walls of solid stone, and a roof of wood, glass, and iron. Two rows of columns divide it into a nave and two aisles, the latter with beautiful wooden roofs. The great central compartment is decorated with a frieze of painted brass-work, representing birds, beasts, and foliage; while the whole structure is adorned with a stone frieze of elegant design and perfect workmanship.

The Duke of Portland is a builder-up of good work, and a puller-down of bad. An architect at one time employed by him built a gateway, which when completed became abhorrent to him; yet so considerate was he of the artist's feelings that he could not find it in his heart to remonstrate with him. So he tried another way. One night he waited till the architect had driven off in his dog-cart, and then set all his men to work at overtime and double pay to pull down the hated edifice. By morning not a vestige remained, and the architect on his arrival rubbed his eyes in amazement; but neither he nor the duke ever took the slightest notice of its disappearance. There was, too, a memorial bridge erected to the memory of Lord George Bentinck, near the spot where he breathed his last, close to the wood end opposite the village of Norton. Short work was made of this bridge, as of numerous other odds and ends of architecture on the domain, and the present reign of perfection was inaugurated.

The half hundred lodges for keepers and other servants on the Welbeck estates have all been built by their present proprietor, who has in their construction carried out his passion for subterranean work. The dining-rooms and bed-chambers make a handsome little house enough, solidly and perfectly built of stone. The unseemly part of the dwelling is buried in the earth; kitchens, pantries, and other offices are plunged below. Many of the finest apartments in the Abbey itself are actually under ground, and illuminated by all kinds of ingenious devices. Welbeck boasts a subterranean library of great size, whose natural gloom is completely dispelled by gas burners sempiternally aglow. Near this strange room, but above ground, is the riding-house, built by Huntingdon Smithson, from the designs of the Duke of Newcastle, in 1623, now converted into a superb picture-gallery. Of course the gas used at Welbeck is made on the premises, and lofty mounds covered with rhododendrons hide four unsightly gasometers from the eye.

The duke is most interested in what may be called "the works" at Welbeck, — the mighty burrowings and scoopings, the levellings, the widening and deepening of the lake, the building of the new subterranean church, and the manufacture "on the premises" of the rolling stock necessary to the operations in the wood-yard and machine shops, hard by the new riding-house and covered tan-gallop. But he has yet plenty of time to care for the Alderneys with black points which furnish Welbeck with milk, and the black polled Scotch oxen which supply Worksop as well as Welbeck with magnificent beef.

These oddities are viewed with mixed feelings by the inhabitants of North Nottinghamshire. On the one hand, there is the potent incentive to tenants and dependents to exalt the rich man by whose spoils they live; and on the other, a slightly rebellious feeling against territorial absolutism. Ducal freaks are condoned by patronage in the region known as the "dukeries." The last of the "dukeries" is Welbeck, but in notoriety it abundantly supplies the places of all the rest. One of its chief marvels is the tunnel, or rather covered way, built across the park lest any plebeian form should come betwixt the light and the nobility of the Duke of Portland. It seems that a right of way exists across Welbeck Park for foot passengers and pack-horses, — in fact, an old-fashioned bridle-path. Previous Dukes of Portland endured the misery of seeing unseemly figures pass within a quarter of a mile of their princely home, but the present incumbent long since revolted against this infliction, and declared that, as the right of way through Worksop Manor and Welbeck could not be contested, his part of it should be made as comfortable as possible. To that end he constructed a covered way, which, decked with turf, rhododendrons, and other shrubs above, should not prove an eyesore to Welbeck, and by dint of thorough lighting and ventilation should satisfy the public. The public of Worksop and Whitewell is easily satisfied by a duke who employs a couple of thousand workmen, and this flagrant violation of public rights has evoked no village Hampden to denounce it. Is it not a small matter of passing under a road or a lawn, but a mile and a half of tunnel to be traversed by the voyager in that particular direction, and can only be avoided by a tedious *détour*. It is perhaps lucky for the Duke of Portland that his subterranean "Folly," as the country folk call it, is not nearer to Sheffield, or some great town rich enough to care nothing for his patronage, and strong enough to make him pull his ridiculous structure down. As the matter stands, the tunnel, although an illegal and impudent outrage, is only laughed at by the vassals who make a good thing out of Welbeck generally. — *London World.*

GERMAN HOUSES IN CINCINNATI.

Cincinnati.

To the Editor of the American Architect:

Dear Sir, — During the past few years a very noticeable feature of house building in this city is what is known as the German tenement house. The house is invariably of brick, generally three stories high, with a nondescript kind of freestone cap and sill to the doors and windows; it is never painted, always has a side entrance (either a side yard or else a portion of the house partitioned off, in which latter case the second story extends over the entrance), and at a distance of some thirty-five feet from the front the one stairway gives communication to the several stories. There are generally four rooms on a floor (two on each side of the stairway). In almost every case these houses are filled with six different families, one family to each suite of rooms, and they all make common use of the above-mentioned single stairway.

The houses cost about $400 per room, and on an average they rent for $50 to $60 a room per annum, which rent yields the owner the very handsome income of twelve to fifteen per cent on his investment. Large numbers of these houses go up every year, and it is seldom that a room is vacant.

While this plan of house-building is, as shown above, a good investment for the owner, it certainly is a very bad investment for the community. This matter of from six to twelve or more families living together in one house, with seldom over two rooms to a family,

where each does its own cooking, washing, sleeping, and living, must of necessity breed vice and corruption. And what puts a worse face on the matter is the fact that the majority live in this way from choice and not from necessity; they are industrious and could if they chose have neat small houses of their own. C.

THE RAILROADS OF PERU.

ALMOST every one has heard of the late Mr. Henry Meiggs, and knows in a general way the engineering marvels he has accomplished in Peru during the score of years just passed, notwithstanding the obstacles he had to encounter in the way of political disturbances, intrigue, and an impoverished government exchequer. We take from the New York *World* the following, condensed from the narrative of Mr. W. H. Cilley, one of Mr. Meiggs's assistants: —

The work originally undertaken by Mr. Meiggs for the Peruvian government comprised the building of several lines of railway that were considered military and political necessities, namely, the Callao, Lima, and Oroya, and the Oroya and Cerro de Pasco railroads, crossing the Andes to the east; the Chimbote and Huarez Railroad, extending to the north along the westerly slope of the Andes; the Mollendo and Arequipa, and the Arequipa and Puno roads, extending north and eastward, and penetrating the interior several hundred miles, and the Juliaca and Cuzco road, all forming a network of rail that puts Lima into direct communication with all portions of the republic. The contracts were made with a liberality on the part of the government that would have done credit to more prosperous nations. The work was pushed forward with a rapidity and thoroughness unexampled in the history of engineering, when the tremendous obstacles met with in the formation of the country are taken into consideration. Scientific and railroad men everywhere watched the progress of the work in astonishment, as all their theories and predictions of failure were overthrown one after another. Political and physical disturbances, revolutions, and earthquakes retarded the work at intervals, but it was never abandoned by Mr. Meiggs and his colleagues. A little over a year ago the financial depression that had affected other nations reached Peru, and a panic ensued that threatened to put a stop to the work, and the government scrip issued in payment on the contracts depreciated to about 40 per cent of its face value. It was feared by many in this country that Mr. Meiggs would be unable to withstand the shock, and that the work would necessarily be abandoned for years to come; but the panic subsided when it became evident that there was no real cause for it, and the nation began to recover slowly from its effects. Both the government and Mr. Meiggs were determined that the work should proceed, and the latter directed attention to the Cerro de Pasco mines, long since abandoned, in whose depth lay imprisoned the means for finishing the great undertaking, awaiting only the introduction of modern machinery to yield up their great treasures. The government authorized Mr. Meiggs, or any company that might represent him, to issue bonds to the amount of £2,400,000 sterling, bearing gold interest at 7 per cent, the principal and interest being guaranteed by the Republic of Peru, and the means for paying interest and principal were placed directly in the hands of Mr. Meiggs.

All the mineral lands belonging to the government in the Cerro de Pasco district were ceded absolutely to Mr. Meiggs, and persons owning and working claims in that district were allowed the option of continuing their work and paying Mr Meiggs 30 per cent of the ore taken out, or relinquishing their claims to him and receiving 20 per cent royalty. There were fifty-three legal claims of 100 metres by 300 metres, and nearly all of the owners preferred to give them up to Mr. Meiggs and receive the 20 per cent of ore extracted. The death of Mr. Meiggs last year did not interfere with this arrangement, as the contract held good with any persons who might succeed him.

The building of the Oroya Railway, from the seacoast over the summit of the Andes, through the ruggedest country on the earth, is the most stupendous engineering feat of the age. Unlike the overland road in the United States, which reaches its greatest elevation in the Rocky Mountains by almost imperceptible gradients, the Peruvian highway in the clouds begins to climb the steep sides of the Andes at grades that are startling in their boldness and precipitousness. The heaviest grade on the line is 4 per cent, or 211 feet to the mile, and on some of these grades there are curves of 373 feet radius, or in the metric system, which is used exclusively in this work, 115 metres. Some of the curves on the easier grades are much sharper even than this. The road winds up the side of the mountain in a zigzag and oftentimes almost circular path, and at one point there are two tunnels through the side of the peak, one directly above the other, in the same lateral direction. The rarefied atmosphere at the great elevation reached on the summit presented many new features in railroading, as a locomotive had never before been worked at these heights. It was supposed by engineers generally that it would be impossible to keep up steam above 8,000 or 10,000 feet, and many men eminent in their profession in Europe wrote to Peru, asking how this difficulty would be met. The problem solved itself in a very simple manner as soon as the test was made. Hydrogen is necessary for combustion, and of course, in a rarefied atmosphere, the amount of hydrogen is less than in the same bulk of air where the density is greater. At great elevations it was merely necessary to introduce into the furnace a greater quantity of air in a given time than at the sea level, and the simple operation of opening the dampers wider accomplished this result.

The world-famous Cerro de Pasco silver mines are at the intersection of two immense mineral lodes in the Province of Junin, one running through the Cordilleras in a northeasterly direction, and the other through a spur of the same range with a northwesterly trend. The ore body averages seven eighths of a mile wide by one mile and a half in length, is of irregular shape and unknown depth. The mining done by the Spaniards and Peruvians has all been in the surface deposit, and really amounts to nothing more than prospecting in these days. Their deepest shaft is only 360 feet below the surface, and has been sunk through the decomposed rock forming the surface ore. The shafts vary in actual depth from the surface, which is irregular, but they are all sunk to the same water level. The unstable character of the formation in which these shafts were worked caused many accidents, and working in the old Spanish mines of Cerro de Pasco was a decidedly dangerous occupation. The surface to-day is honey-combed with deep and extensive sinks or *tajos*, where the mines have fallen in, and many a miner's bones are entombed in these great sepulchres. The most terrible of these accidents occurred in 1710, when 300 persons were buried alive beneath the roof of a mine, through the giving away of the supporting timbers. All of the top deposit in this district of a square mile is what miners call pay dirt, — that is, it is decomposed rock containing free-milling ore that averages $40 to $45 per ton. The ore remaining in this surface deposit of decomposed rock is sufficient in quantity to run all the mills in Nevada at their full capacity for 150 years.

Below the depths to which the Spanish miners worked their shafts, the diamond drill has been used to prospect the mines. The rock is hard and uniform in character, averaging about $165 to the ton in the assaying. Pockets are frequently struck yielding ore that contains from 50 to 80 per cent of silver.

Professor Raimondi, who has conducted scientific explorations in Peru for many years, is of the opinion that the coal fields of the Huarez Valley will prove to be the most extensive in the world. The coal is principally semi-anthracite, although cannel and bituminous coal have been found in considerable quantities in the interior.

A DANGEROUS LIGHTNING-ROD.

IN connection with the article which we print in another part of the paper the following letter from the late Professor Henry, concerning a lightning conductor without ground connection, is of interest: —

SMITHSONIAN INSTITUTION,
WASHINGTON, April 27, 1878.

SIR, — The plan of lightning-rod you describe is an extreme application of the method introduced some years ago of discharging electricity by points. It was supposed that a great improvement was made by placing projecting points on all sides of the rod throughout its whole extent. Another supposed improvement was to terminate the end of the rod near the ground in a sharp point. But both these plans are at variance with the true principles of electrical protection, which consists in drawing the electricity from all the space occupied by the roof of the house to the point of a continuous rod intimately connected with the earth by means of water-pipe, gas-pipe, or other masses of metal. The rod should be perfectly smooth, and so constructed as to receive the electricity at the upper end and transmit it silently to the ground.

The action of a positive cloud on the U-shaped rod, shown in the circular you send, would, by induction, render each branch of the U negatively electrified, and the horizontal part positively. In this case a discharge would tend to enter each branch at the same moment, and descend in a current through the middle of the horizontal part into the roof. In my opinion, a rod put up in this manner is worse than none at all. I am very truly yours,

JOSEPH HENRY, Secretary S. I.

NOTES AND CLIPPINGS.

HUDSON RIVER TUNNEL. — Once more laborers are at work on the Hudson River Tunnel, the courts having removed the injunction obtained by the Delaware and Lackawanna Company, and foreign capitalists having subscribed some three million dollars to begin the work. As soon as the old shaft at the foot of Fifteenth Street, Jersey City, has reached the depth of sixty-five feet, work will begin upon the tunnel proper.

LIMESTONE PAVEMENT. — Mr. H. G. Wilson, of St. Louis, who is said to be an expert in the matter of road-making, has evolved the theory that the healthfulness of a city is in great measure dependent on the material used for paving. Finding that the mortality record of the year ending in April, 1878, shows that St. Louis is the healthiest large city in the United States, and that the other large cities, ranged in comparative order of healthfulness, are Cincinnati, Chicago, Philadelphia, Boston, Brooklyn, Baltimore, and New York, he has been led to seek the reason for such conditions. At first suspecting, naturally, that the classification was but an interpretation of the efficacy of the drainage systems of the respective cities, he was led to abandon the supposition by the fact that Chicago, whose natural advantages for drainage are of the worst, and whose artificial system is avowedly not of the best, ranked third on the list. The condition of the streets next fell under his notice, and here again, although much of the pavement of Chicago is of wood, rain-soaked and rotten, it is evidently a healthier city than those cities where granite and other hard stones are used for paving. The streets of St. Louis, on the other hand, are macadamized, the material used being limestone, and to the filtering of ground air through this material, and the giving off of lime phosphates, Mr. Wilson attributes much of the healthfulness of the citizens of St. Louis.

The Rusting of the Britannia Bridge. — At the conference of architects lately held at London, Mr. Carroll, during the discussion that followed the reading of a paper by Professor Barff on his process for preserving iron from rust, stated that he believed "tons upon tons of rust were taken monthly from the tubes of the Britannia Bridge." This statement, which created no little excitement, as it seemed to foretell the speedy dissipation of one of the engineering marvels of Great Britain, has been emphatically denied by the engineers who have charge of the bridge. It is on record, however, that at one thorough cleaning in 1865 forty tons of rust were taken out.

Cleopatra's Needle. — The preparations for erecting Cleopatra's Needle, says the *Athenæum*, are well advanced. Nearly the whole of the iron-work has been removed, and the inscription on the fourth side is at present in an excellent position for examination and comparison with the various editions which have been given of it. There are several points of interest to be observed with regard to the palæography of the older or central line, and that of the two nearer lines with which it is flanked; the former being far superior in workmanship and treatment to the later additions. This is particularly remarkable in those parts which have been covered by sand, and so protected from injury by weather or design. Some of the hieroglyphics are executed in a different manner; the circle, for instance, of the middle column of text is slightly raised at the centre; in the side lines it takes the form of a deep and cup-like depression. It is expected that the work will be completed in about two months' time. The solid base of masonry and granite blocks is being built; above this the Needle will be raised upon a staging, and swung by an armed collar, which will enable the monolith to be balanced, and thus easily transferred from a horizontal to a vertical position.

A Harmony in Yellow and Gold. — The Paris correspondent of the New York *Tribune* gives the following account of some work at the Paris Exhibition, by the Baltimore artist, Mr. Whistler: —

Not far off is a section of a room for the decoration of which Mr. Whistler is responsible. Ever since Mr. Whistler did the famous peacock room for Mr. Leyland in Prince's Gate he has had a reputation as unique in upholstery as in higher walks of art. He is building a house for himself in London; like no other house, of course; meant, perhaps, as a protest against the sudden popularity of Queen Anne fronts in red brick, with their balconies and drawbridges — a popularity which might end in a new form of monotony hardly less tiresome, though in itself immensely better, than the stucco horrors of which so many square miles have come out of the same troughs and moulds. What Mr. Whistler means, alike by his pictures, his peacock decoration, and this last caprice in yellow, may be that there is something good in the world of art outside of the conventional world. He calls this room a Harmony in Yellow and Gold. Against a yellow wall is built up a chimney-piece and cabinet in one, of which the wood, like all the wood in the room, is a curiously light yellow mahogany — something very different from the flaming veneer known to the American for generations past, with drunk and straddling patterns all over it. The fire-place is flush with the front of the cabinet, the front panelled in gilt bars below the shelf and cornice, inclosing tiles of pale sulphur; above the shelf a cupboard, with clear glass and triangular open niches at either side, holding bits of Kaga porcelain, chosen for the yellowishness of the red, which is a characteristic of that ware; the frame of the grate brass; the rails in polished steel; the fender the same. Yellow on yellow, gold on gold, everywhere. The peacock reappears, the eyes and the breast feathers of him; but whereas in Prince's Gate it was always blue on gold, or gold on blue, here the feather is all gold, boldly and softly laid on a gold-tinted wall. The feet to the table-legs are tipped with brass, and rest on a yellowish brown velvet rug. Chairs and sofas are covered with yellow, pure rich yellow velvet, darker in shade than the yellow of the wall, and edged with yellow fringe. The framework of the sofa has a hint of the Japanese influence, which faintly, but only faintly, suggests itself all through the room. Its lattice-work back and wheel-patterned ends might pass for bamboo; the carpentry is as light as if the long fingers of a saffron-faced artist had coaxed it into shape.

Gobelins Tapestry at the Paris Exhibition. — The Gobelin manufactory now employs only fifty-three workmen, twenty-two of whom are engaged in making "la Savonnerie" carpets. The tapestry workers are very indifferently paid. But it appears there is no difficulty about recruiting for the Gobelins, on account of the prestige which is attached to the place; because the tapissiers are lodged, because each man has a little garden in the grounds surrounding the hotel, and because when old age comes on, a pension of from forty to fifty pounds a year is granted. The Gobelins, too, is a kind of family concern. The tapissiers are tapissiers from father to son. M. Duruy, who was minister of Public Instruction under the empire, — and a good and liberal-minded minister, too, — belonged to the family in question. His father was one of the head workmen at the Gobelins; he himself was an apprentice, and two of his cousins and several other relatives are to-day in the establishment. As a specimen of "la Savonnerie" work two carpets are exhibited, the price of which is enough to astonish one, even after the tapestry. One carpet, destined to cover the apartment at Fontainebleau which was inhabited by Pius VII. during his captivity, is eighty-three metres square and cost twelve thousand pounds. The smaller carpet, also destined for Fontainebleau, and which is not finished, is forty-eight metres square. There is a tendency on the part of the present director of the Gobelins to give up copying pictures and to confine his tapestry to the decorative art; and this idea has been highly approved of by critics. — *Pall Mall Gazette.*

Bending Wood in a Dry State. — Messrs. Bahse and Haendel have proposed the following method for bending hard wood when quite dry, chiefly for sieve hoops: Two rollers are used, one above the other, the upper one having less velocity, so that it acts by holding back, while the lower extends the wood fibres. When the board, thus bent, leaves the rollers, it is fastened in the mouth of the sieve. The upper roller is fluted, the under one smooth. If two smooth rollers were used a very much greater pressure would be necessary.

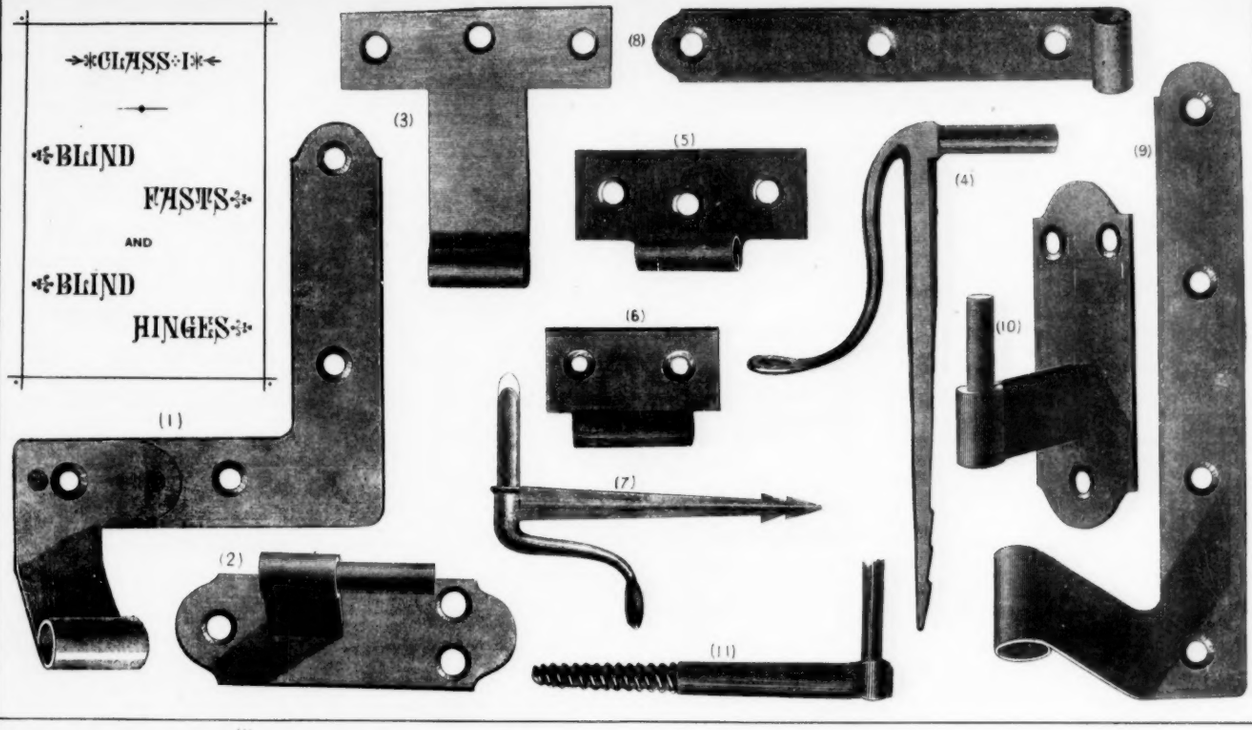
Plumbing Hints. — The correspondents of the *Plumber* often furnish some practical hints which are worth repeating. Thus, one plumber says that to prevent the waste-pipe of safe-pans under water-closets from giving passage into the upper parts of the house of kitchen or cellar smells — for these pipes usually stop over the kitchen sink, or over a sink in the cellar — the waste-pipe should be turned up at its lower end so as to form a slight trap; then the orifice is enlarged with a turnpin, and a light rubber ball is put in, so that if the water in the trap dries up the ball may still trap the opening. A perforated plate or wire netting keeps the ball from being thrown out by the rush of water, while it offers no material hindrance to its passage. Another plumber mentions an empirical way of determining by inspection for what purposes the different pipes inclosed in the same casing are used. He says that after a few months' service only the hot-water pipes will show the cleanest exteriors. The circulation pipes will be less clean, while the cold-water down pipes will be much dirtier, and the pressure pipes will be the dirtiest of all.

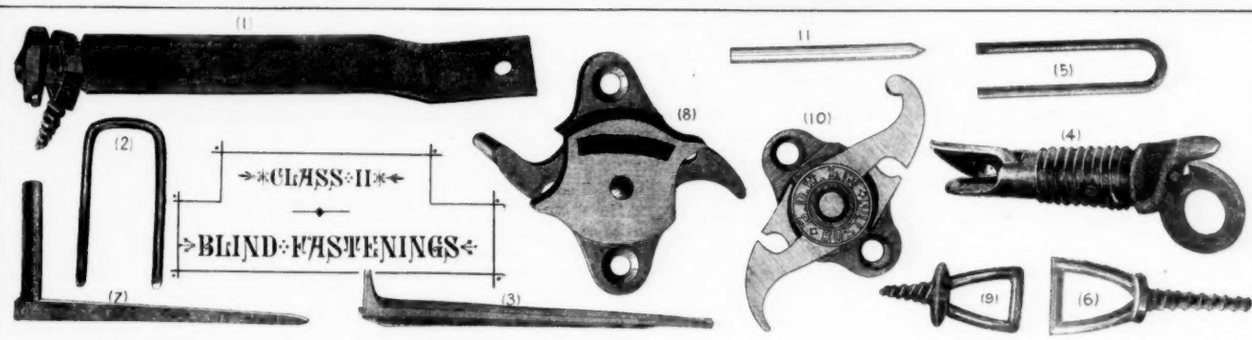
Drawing in French Colleges. — The Minister of Public Instruction has arrived lately at an important conclusion. Henceforth instruction in drawing will be obligatory in the colleges in all the classes from the sixth to and including the classes in philosophy. The course will include instruction in linear drawing, perspective, ornamental design, elementary instruction in anatomy and the proportions of the human figure, and finally in drawing the human figure from the flat and from the round.

Tin Mines. — The mines of Cornwall, for a long time thought to be the only tin mines in the world, are finding serious rivals in the tin deposits of Tasmania. Four years ago the value of the exports of tin and tin ore from this island was $35,000, while last year it amounted to nearly $1,500,000. One of the most productive regions is the Mount Bischoff district; but this has now been eclipsed by the discovery of a tin mountain at Mount Heemskirk, on the west coast. The "wash-dirt" is some twenty feet thick, and produces about 25 per cent of tin; but the existence of solid seams of the metal, traversing the mountains in veins several feet in depth and width, has been demonstrated. Some "nuggets," weighing several hundred-weight each, have been found, yielding nearly cent. per cent. of pure metal. Mixed with the tin, too, is a small quantity of gold, about ten ounces to the ton, not sufficient in itself to render it worth seeking, but adding considerably to the tin miner's profits.

Street Sprinkling. — The city of Paris sprinkles not only the planted alleys, the squares, bridges, quays, but also those parts which are watered by the land tenants. The operations last from March 15th to October 15th for metalled roads, and from April to September for the paved ways. Water is thrown daily by means of water tanks, or hose and nozzle, the latter being used on the boulevards and some of the more important streets. Tanks and hose, with their frames, belong to the city, contractors supply horses and drivers, — the whole being under the supervision of the city. The best tank used is the tank Sohy. It is an oblong box made of sheet-iron, has a seat for the driver, whence the tank can be worked. The tank contains 340 gallons, and works on a strip 15 feet wide at each passage. It is emptied after a run of from 1,500 to 2,000 feet, according to its capacity. The filling is done by a leather or India-rubber hose, screwing to hydrants under the sidewalk, and so spaced that the tanks have short distances to run when emptied. One tank suffices for an area of 2½ acres of metalled surface, or 5 acres of paved streets. Hand sprinklers are used for the planted alleys: the hose is screwed to hydrants placed at suitable distances, and the apparatus, which is from 40 to 46½ feet long, can with a head of 50 feet throw a jet of an amplitude of 40 feet. One man can, with this apparatus, sprinkle 5 acres in 35 minutes, time employed in moving being deducted. It is economical and convenient, and its use has been largely introduced into the interior of the city. There are 322 tanks in use, which consume a daily average of 1,600,000 gallons. The cost of each tank, including driver, is $48 per month. Hose sprinkling, all incidentals being counted, costs a trifle over one half the expense of water-tank sprinkling. This chapter would be imperfect without an account of trials made to replace water by deliquescent salts, which trials had for their main object the doing away with the unsightly water tanks and the inconvenience resulting from an uneven spreading of water. In 1859 and 1863, M. Darcy, chief engineer in charge of promenades in Paris, experimented on the principal avenues of the Bois de Boulogne. He first used refined chloride of calcium, which was very expensive; as it could not be dissolved in water so as to be thrown from tanks, it had to be thrown by hand, in quantities of 250 grammes for each square metre; its efficiency was felt for 5 or 6 days. Later, in 1862, experiments were resumed with crude salt mixed with chloride of manganese. It was sprinkled by hand, 500 grammes to the square metre, but was efficient only three days, and if the air was not moist a light sprinkling of water was necessary. In 1864, General Inspector Homberg made some new trials. Pure and white chloride of magnesium was the salt used, and which could be completely dissolved in water. It was found that the operation had to be performed in the evening, by throwing the salts either dry and by hand or in solution in water, so as to spread 500 grammes per square metre for the metalled roads, and 400 for the pavements. For the first 24 hours the result is good, but the following day one sprinkling has to be done, two sprinklings are necessary the second day, and the effect has entirely disappeared on the third day. Sprinkling the dissolved salt with the tank costs more than salt thrown by hand. An area of 2½ acres requires 5 tons of salt, lasting only three days, costing 100 francs, and 112 with the labor, against 36 francs, the cost of *ordinary* tank sprinkling for the same area. Hence it results that the use of deliquescent salts would be very onerous. The sprinkling with water adds freshness to the air, prevents dust and opposes dryness, whilst salts, taking the little moisture left in the atmosphere, would prove far less hygienic if used, and only in case of lack of water is it allowable to use deliquescents in Paris. Street sprinkling costs the city of Paris $90,000 annually. — *Engineering News.*

The Cave at Glasgow, Ky. — It is now said that the cave, the discovery of which we mentioned a week or two ago, is far from being as remarkable as the first reports stated. The finding of any mummies is also denied.





CLASS I

BLIND FASTS & BLIND HINGES

(1) **New Style 8-inch Wrought Elbow Hinge, for Wood.**—Our new style Elbow Hinge attaches to Hanging Stile and Bottom Rail of Blind, thereby preventing possibility of sagging. We furnish these with any Throw desired, and to apply to Segment or Full Circle Top Blinds.

(2) **Hook adapted to above Hinge.**—The Hook we manufacture chiefly for this Hinge is applicable to outside Window Casing. We adapt them for the Bevel Staff Bead used in the New England States. We commend this description of Hook as not open to the objections possessed by the Long Drive Hook, which, in inserting, frequently splits both the Staff Bead and Pulley Stile. The expense of this Hinge is but a fraction more than that of the cheap goods more generally in use, of which Nos. (3), (4), (5), (6), (7), (8) and (11) are illustrations. We will pay the expense of removal in any case where our Improved Goods fail to give satisfaction.

(9) (10) **Wrought Iron Centre Hinge and Hook, for Brick.**—This Hinge and Hook are intended for use in the centre of long and heavy Blinds, usually attached to Brick and Stone Structures.

CLASS II

BLIND FASTENINGS.

(1) **Our No. 6 Fast.**—This is the best Fast for Blinds where the Stile runs below the Bottom Rail. Where the cheap Hinges above referred to are used, this Fast aids to keep the Blind in position. We guarantee this to be superior to any Blind Catch used underneath the Bottom Rail.

(2) **Sill Staple**; (3) **Back Catch.**—Used with above Fast.

(4) **Our Old Style Screw Fastening, for Blinds.**—The most reliable in the market. This requires simply to bore with a ⅝-inch bit the Bottom Rail of Blind, and screw up to the shoulder. When closing the Blind you insert your finger in round hole in lever, and by drawing towards you it is unlocked. The great advantage of this Fast over others is the clutching of Hook or Staple in such way as to entirely prevent rattling with wind. The Springs in these Fasts are the most durable we can procure, rendering them far superior to all other goods in the market. We have adapted the Clutch to our No. 4 (8) and Excelsior (10) Fasts.

(5) **Sill Staple**; (6) **Screw Catch, for Wood**; (7) **Drive Catch, for Brick.**—All used with No. 4 Fast.

(8) (10) **New and Improved Lock Fasts, for use on Wood.**—Will always be preferred, after examination, to the Vesey and other Lock Fasts.

(9) **Back Catch**; (11) **Sill Staple**, sometimes preferred to (5)—Adapted to these Fasts.

CLASS III

WROUGHT METAL PULLEY.

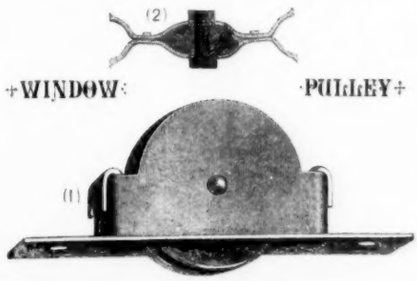
(1) Represents the Pulley complete and ready for insertion. (2) Represents a section of the Wheel formed of two discs of metal, securely riveted together, with a wooden centre projecting beyond the outside of the Wheel so as to impinge against the inside of the Pulley frame, thus keeping the Wheel in position, and running noiselessly. A thorough practical test has been made of the durability of this Pulley, as well as the wear of the Pulley Cord, by attaching heavy weights to one end of the cord, and running the other over the Wheel, and keeping them in motion by machinery for a long time. We confidently affirm that these Pulleys will show less wear than any article made wholly of metal. We are enabled to offer these goods in Brass and Iron, and of various sizes, at prices which defy competition, except from the cheapest class of cast iron Pulleys. Great saving will be found from the less liability of fracture of the face-plate in setting, and the cord will be found to last much longer than in the ordinary Pulley, as there are no sharp corners to fray it.

CAUTION.—The above goods are protected by Letters-Patent in the United States, Canada, and Europe. All parties are warned against infringing.

B. D. WASHBURN & CO.

CLASS III

NOISELESS WROUGHT METAL (BRASS AND IRON)



B. D. WASHBURN'S PATENTS.

The above Illustrations represent some of the latest and most approved

BLIND TRIMMINGS AND WINDOW PULLEYS

manufactured by us, to which we direct the attention of Architects and Builders.

B. D. WASHBURN & CO.

(ESTABLISHED 1830.)

35 & 37 Batterymarch St., Boston.