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WE have this week to mourn the death of a prominent Massachusetts architect, Mr. Alexander R. Esty, who died at his home in Framingham, July 2, aged fifty-four years. Mr. Esty received his early professional training in the office of the late Richard Bond of Boston, and has practised in and about that city for many years, with eminent success. Among his principal works are the Union Congregational Church on the corner of Columbus Avenue and West Newton Street, the Harvard Street Baptist Church in Cambridge, Grace Church at Newton, Emmanuel Church, on Newbury Street, Boston, the new station of the Boston and Albany Railroad in Boston, the buildings of the Colby University, Waterville, Maine, the State Normal Schools at Framingham and Worcester, and the University of Rochester, N. Y. For the past five years he had been Superintendent of Construction to the new United States Building in Boston, and was a member of the special commission appointed by the President last winter to prepare a report in regard to the proposed Congressional Library at Washington. He was an influential citizen of his native town, and had been chairman of its board of selectmen and a representative to the legislature from that district, besides occupying various other responsible offices. His loss will be regretted as that of an architect of high and well-balanced attainments, an upright citizen, and a conspicuously active and intelligent man.

WE print in another column a communication from Dr. George W. Hawes, the Special Agent of the Tenth Census, who, with the help of a large number of eminent geologists and professional men, is engaged in forming a collection of the building-stones of the country, and in making a thorough and scientific examination of their properties, for the benefit of the nation at large, and of architects in particular. Every member of the profession will be interested in this most important work, and very many can give valuable information concerning stones not in common use, but of which they happen to have had some experience. Such persons will, we hope, communicate with the special agents in charge of their district, for the service of their fellows. As an example of the questions which often present themselves to architects, and which can be better answered by other architects than even by geologists, may be mentioned that of the discoloration to which many stones are subject. Certain sandstones, of a beautiful color and texture when first cut, soon become stained with a repulsive exudation of petroleum; while others gradually assume a spotted appearance, in some cases from the presence of small quantities of petroleum, and in others from the oxidation of iron. Again, iron, though very injurious to the beauty of stones when scattered irregularly through their substance, may, if uniformly distributed, be of positive value, as in certain marbles from Berkshire County, Massachusetts, which are, when first cut, of a cold, gray color, but acquire by long weathering a tint of exquisite warmth and transparency. There are also discolorations of another class, such as those which occur in some limestones by the unequal drying out of the "quarry sap," as well as certain phenomena of fading or change of color in various slates and marbles, about which trustworthy information is much needed. Such observations as these can be far better made by those who employ the stones in building than by geologists or chemists, while the latter can point out qualities which it would be impossible for an architect to discover, so that by engaging, as Dr. Hawes has wisely done, the services both of architects and scientific men, it is reasonable to expect that the report of the Commission will be one of the most useful works ever offered to the building world.

MUCH apprehension has been expressed during the past two years in regard to the drainage of Coney Island, a place which is in midsummer often resorted to by from fifty to one hundred thousand persons a day, while its position and character, as a long, low peninsula of sand bordered on one side by a beach which it is important to keep free from offensive deposits, and on the other side by the sluggish estuary called Sheepshead Bay, is very unfavorable to any ordinary mode of sewerage. An immense amount of capital has, however, been invested in the great hotels, with their dependencies, which occupy the eastern half of the peninsula, and their owners have taken the wise determination to maintain the value and reputation of the property by the most thorough and efficient system of sanitation which they could devise. After some discussion, the drainage of the Brighton Beach Hotel was placed in the hands of Mr. Powers, the consulting plumber of the Board of Health, who originated and carried out a plan which is certainly very creditable to his capacity as an engineer. After rearranging the waste-pipes in and about the building, so as to facilitate the flow through them as much as possible, Mr. Powers united the whole in one large pipe, which was carried a distance of a thousand feet to two large settling-tanks, situated beneath the coal-bins of the Coney Island Railway. Each tank is double, one half being separated from the other by a strainer, which retains all solid matters, allowing only liquid to enter the second division, where, by means of a ball cock, a quantity of "disinfectant" is mingled with it just before the tank is filled to the top. A sufficient dose is poured in to precipitate the suspended matters, as well as to fill the tank to the overflow line, when a siphon is brought into action, and all the liquid contents of the reservoir, thus purified, are rapidly poured into a discharge pipe which empties into the creek. The "sludge" is allowed to accumulate in one tank to a certain point before shifting the inlet stream to the other, and the mass is then mixed with lime, charcoal-dust and other substances, and after a short drying taken out and dried into *poudrette*. At first this was sold as a fertilizer to farmers, but the lawns and flower-beds about the hotel now receive the whole product, which is not very large, amounting to some three hundred cubic feet for the season.

THE Manhattan Beach and Oriental Hotels dispose of their sewage by a joint arrangement, costly and effective enough, but hardly so scientific as that employed at Brighton. An eighteen-inch sewer, receiving a twelve-inch pipe from the Manhattan Beach Hotel, and another which should, it would seem, be even larger, from the Oriental, extends a little more than half a mile to the edge of Sheepshead Bay, continuing thence by means of a "trunk," which means, we presume, a wooden box, supported on piles, to a good tide-way. Gates are arranged to confine the sewage until the ebb tide gives an opportunity for discharging it under the most favorable circumstances. A singular device for flushing the sewer is added to the system, in the shape of a pipe connected with tanks in the attic of the Oriental Hotel, and extending alongside the main sewer, with which it communicates by numerous openings. Possibly the intention of this may be to obtain a hydrostatic pressure for lifting the sediment from the bottom of the sewer, as the mere effect of the flow would be trifling in so large a channel. Whether any effort is made to intercept the brushes, boots, bottles, napkins and articles of apparel which find their way into the drains, we are not informed. The reporter of the New York *Herald* was shown a basketful of towels and table-linen which had collected in the settling-tank of the Brighton Beach Hotel in a single week; so that this might be expected to form an important portion of the engineer's duty.

THE strike of the Cincinnati iron-workers has entered upon an interesting phase, in which public and temperate discussion takes the place of blind partisanship on both sides. Of all the large cities in the Union, Cincinnati is perhaps the one where so rational and American a treatment of the subject would be most congenial to the temper of the inhabitants, and the striking workmen have won deserved respect and sympathy by their willingness to make explanations and listen to criticisms regarding their course. In brief, the argument of the workmen is that although their demand is for a rate of wages apparently higher than that fixed by the Pittsburgh schedule, they would be, even if it were granted, unable to earn as good a living as the Pittsburgh men, by reason as much of the inferior machinery used in Cincinnati as of the different character of work done by the mills, which run principally on small special orders, requiring frequent changes of the rolls or other apparatus, and involving much loss of time, which the workmen have to bear. In a letter to the Cincinnati *Gazette*, an operative, explaining at length the reasons why the Pittsburgh men, although paid a lower rate per ton for their work, can work nearly twice as much iron in a day, and thereby earn much more money than those in Ohio, says that the Pittsburgh mills have steam lifters, feed rollers, and other mechanical appliances, which in some kinds of manufacture enable three men to do work which requires seven in Cincinnati, while the Cincinnati mills are often compelled by their inferiority of equipment to keep part of their machinery idle while changes are being made, or the furnaces, clogged by the bad coal used, are cleaned out. It is furthermore said that the men are willing at any time to accept the Pittsburgh schedule of wages, if the mills will furnish Pittsburgh facilities.

Per contra, the mill-owners in Cincinnati say that there is no difference between their facilities and those of the Pittsburgh mills; that they believe that their men can make as much money on the Pittsburgh scale as their brethren in Pennsylvania; and that until they are willing to accept that scale the mills will stand idle. They see no immediate prospect of an agreement, and have made up their minds to a suspension of operations until the latter part of September, advising their customers to place their orders abroad until that time. Meanwhile, business is steadily turning to Pittsburgh, where the mills are full of orders, and prices are rising. What will be the end, no one can tell. To our mind, it seems very probable that "Tubal Cain," the correspondent of the *Gazette*, is right, and that the Cincinnati mills do not, as a rule, yet possess the appliances or administrative experience which Pittsburgh has acquired. At all events, the question is one of facts which can be very easily investigated, and if the workmen would take the trouble to have an examination made, and an opinion authoritatively delivered by impartial and competent men, upon the relative facilities offered to the operatives by the Pittsburgh and Cincinnati mills, they would, if their assertions were confirmed, gain the support and sympathy of the public, and bring to bear on the mill-owners a pressure of opinion which they could not long resist.

Contracts have been made for the construction of three sections of the New York underground railroad, aggregating nearly a mile and a half in length, and including the portions between the Battery and the Post-Office, and between Union Square and Twenty-third Street. Mr. Joseph Patterson, of Baltimore, is the contractor, and his agreement requires him to complete his work within two years from the time at which he is notified to begin operations. About the remainder of the line there is for the moment some doubt, since it is not yet definitely decided whether the commissioners appointed by the Supreme Court will permit the tunnelling of Broadway between the Post-Office and Fourteenth Street; but if a favorable conclusion is reached, contracts for the remainder of the work will at once be made by a construction company, able and willing to take its pay in bonds of the railroad corporation. The announcement that these preliminary steps have been definitely taken seems to awake the most glowing anticipations in the minds of the New Yorkers, and the *Tribune*, commenting upon the fashion which has recently grown up of erecting immensely high buildings in the business part of the city, predicts that before many years all the lower part of the town will be occupied with blocks of ten and twelve story structures, whose tenants will transact their vast business by means of subterranean railroads, while the present streets will be left to light passenger traffic.

Another telephone accident is reported from Connecticut; fortunately, not a very serious one, but conveying a warning which should be remembered by all who use the instrument. Mr. W. F. Osborne, at Derby Neck, had recently put in a telephone for communication with his factory at Ansonia, and the agent had grounded the wire through the medium of the water-pipe over the kitchen sink, to which he connected it by a copper wire. During the heavy thunder-shower of the last Sunday in June, the telephone bell was rung at nearly every flash of lightning, and the ladies of the household, fearing worse consequences, left the room. Soon afterwards came a loud clap of thunder, with vivid lightning, and at the same instant a crash was heard in the room where the instrument was placed, with a sound of breaking glass in the pantry, and cries of terror from the cook in the kitchen. On examination, it was found that the lightning had struck near the wire at some distance from the house, and a portion of the charge had passed through it, sufficiently large to melt it through its whole length. Where it passed near the house wall the paint was scorched off; the telephone box was blown to pieces; the brass faucet was melted, and the glass of a window near the wire was shattered. What would have been the consequence if any one had happened to be using the telephone, it is impossible to say. Possibly the conduction of the lead pipe would have been sufficiently good to prevent injury to a human being, but there should be no question on such a point, and metals of less resistance should be employed.

An immense acquisition of real estate has just been made by Mr. Hamilton Disston of Philadelphia, a young but very rich manufacturer. Mr. Disston holds a large interest in the enterprise for draining and colonizing the lands about Lake Okechobee, and was led by the knowledge which he had incidentally acquired of the character and resources of the country to contract with the State of Florida for the purchase on his own account of some four million acres belonging to the public domain, which the Government of the State had decided to sell for the purpose of cancelling some burdensome obligations. By the transfer of this vast tract, covering an area nearly equal to that of the State of New Jersey, Mr. Disston becomes, it is said, the largest landed proprietor in the world. It is true that much of the Southern territory is of so little value that the acquisition of a large acreage does not necessarily imply a great outlay, but Mr. Disston's land is, it seems, of the best quality in the State, nearly adjoining the property of the Okechobee Company, and suited to the production of all tropical and semi-tropical fruits, cotton, sugar, jute, indigo, rice and tobacco. The work of colonizing will begin at once, and agencies are to be established in England, Scotland, France, Germany, Holland and Italy. The new citizens will be transported directly to the ground in special steamers, and arrangements will be made for their comfort and convenience. Mr. Disston will need to display all the tact and energy of which he is master to carry out his scheme successfully.

An energetic, though rather ungrammatical, correspondent of the Chicago *Times*, Mr. S. B. Evans, has been making a tour for archæological investigation in the vicinity of the city of Mexico, and his letters, while occasionally a little over-picturesque, do not have that air of pure fiction which characterizes much of the archæological informat n that we receive from the West, and contain a great deal that is interesting. His last undertaking which we find described is a journey from Mexico by canal to Tezcuco, the ancient rival of Mexico itself, and, according to the historians, once the site of splendid villas, pyramids and terraced gardens adorned with statues. Modern travellers differ in their accounts of the present condition of the place, some asserting that beautiful remains of its early grandeur are still visible, while others deny that anything of the kind exists, and believe the whole story to be fabulous. This discrepancy in the testimony of various writers Mr. Evans thinks is due to the fact that they never saw the place, but obtained their information about it from the Indians who inhabit the modern village, some six miles from the royal seat of the fifteenth century. He therefore resolved to inspect the ruins, if any existed, for himself, and was so fortunate as to find, almost at his first landing, an Indian proprietor who had been vexed, while digging in his garden at the foot of one of the mounds which are scattered over the place, by the discovery of a large stone in the spot where he wished to plant vegetables. Mr. Evans, with some laborers, was allowed to assist in the excavation, and soon brought to light a portion of a noble bas-relief in granite, bearing the colossal figure of a man, twelve feet in height, with various attributes, among others the peculiar Mexican calendar, another example of which is built into the wall of the Cathedral at Mexico.

CIVIC MONUMENTS IN NEW ENGLAND.[1] — IV

THE CHARLESTOWN, JAMAICA PLAIN, CAMBRIDGE, AND ROXBURY SOLDIERS' MONUMENTS.

THE granite group upon the Soldiers' and Sailors' Monument (Fig. 31), in Charlestown, made by Martin Milmore, has in its idea the possibilities of an imposing effect, but its execution is most slovenly. It represents the Genius of America crowning the figures of a soldier and sailor. Nothing can be more repulsive in statuary than granite shabbily used. The habit of employing it without treating it with a respect due to its exacting nature is one of the most unfortunate facts in the history of New England monuments.

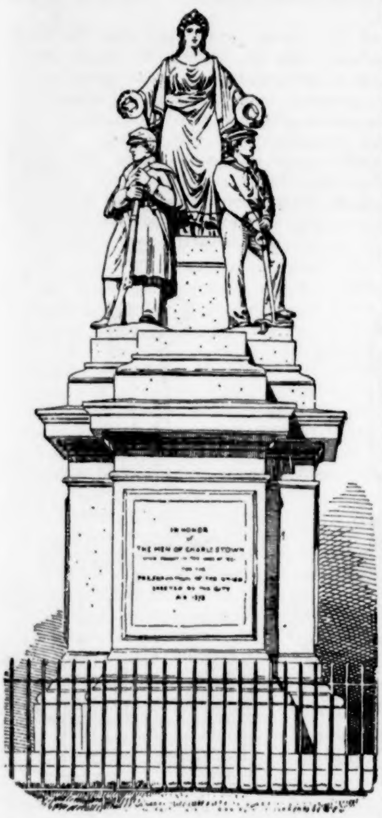

Fig. 31. Soldiers' and Sailors' Monument, Charlestown, Mass. By Martin Milmore.

The statue in bronze of a soldier, also by Milmore, upon the Roxbury Soldiers' Monument, in Forest Hills Cemetery, is, because of its imperfect expression of an appeal to the sympathy, the most suggestive of ridicule of any in Boston. The intent of the statue, a soldier watching the last resting-place of his dead comrades and guarding their sacred dust, is beautifully chosen, but the execution is thoughtless. It needs reflection on the part of the observer to prevent a feeling of pity for the poor fellow, who looks sick and lonely. It illustrates the danger of undertaking to carry out in sculpture one of the most difficult of tasks, — that of expressing an emotion, and that, too, of sadness. The unpretentious character of the monument is to be commended, but the display of granite in the enclosure of the lot does not contribute to the sentiments belonging to the locality, since nothing save a preponderance of art can make this material endurable in connection with human feeling.

Fig. 32. Bronze and Marble Monument in Turin, Italy.

Fig. 33. Bronze Statue of Alessandro Lamarmora Del Cassano, Turin, Italy.

[1] It has been found desirable to enlarge and develop the scheme upon which these articles were based. Intended originally to treat only of Boston statues, they have been extended so as to take in some of the more important monuments in the neighborhood of that city. Moreover, it has been found desirable to supplement the illustrations of these statues and monuments by others which serve to show what the master-hands of foreign artists have done when striving to embody similar ideas and sentiments: they may be considered, in fact, among the writer's strongest arguments in support of the criticism and analysis he has undertaken to make. — EDS. AMERICAN ARCHITECT.

There is a granite soldiers' monument in Cambridge, surmounted by the accustomed soldier in immovable contemplation.

The Jamaica Plain Soldiers' Monument is a Gothic-looking structure, tipped with a soldier. It is of granite throughout, and in all respects appears cold.

PLYMOUTH MONUMENT AND HINGHAM STATUE.

It would be surprising to find a more unique motive than that which has caused the partial erection of the National Monument to the Forefathers (Fig. 34), at Plymouth, Mass. It would be still more surprising to find one of any considerable dimension containing so little art in its execution. The subject, the design, the size, and the character of the workmanship make it the most interesting structure in America. Its history, into which we have not space in this paper to go but to a limited extent, forms an important additional element of interest. The design was made by Hammatt Billings, a distinguished Boston architect, in 1855. He contracted with a committee of the Trustees of the Pilgrim Society to collect money and erect the monument. Its original dimensions were one hundred and fifty feet high, and eighty feet wide at the base. The large amount of money and the great length of time required to complete a design of such proportions were considered sufficient reasons for reducing its size. The present height is eighty-one feet, the pedestal being forty-five and the statue of Faith thirty-six feet high. The monument is thus described: "The design thus determined upon was that of an octagon pedestal on which should stand a statue of Faith. In the four larger faces of the pedestal to be set large panels, bearing the names of those who came over in the Mayflower, and other suitable inscriptions, beneath which are to be smaller panels for records connected with the society and the building of the monument. From the four smaller faces of the pedestal to project buttresses, having upon them seated figures emblematic of the principles which the Pilgrims proposed to make the basis of their Commonwealth. One of these figures to be Morality, holding in her left hand the Decalogue, and in her right the scroll of Revelation, looking upward toward the impersonation of the Spirit of Religion above, and having in a niche on one side of her seat a Prophet, and in another niche on the other side one of the Evangelists. Another figure to be Law, having on one side Justice, on the other Mercy. Another to be Education,[2] having Wisdom ripe with years

Fig. 34. National Monument to the Forefathers. By Hammatt Billings, Plymouth, Mass.

[2] The press informs us that the "statue of 'Education' and the bas-relief of the 'Signing of the Social Compact' in the cabin of the Mayflower, which is to be placed under it, on the face of the second of the four buttresses at the base of the National Pilgrims' Monument at Plymonth have been completed in clay." They were modelled by two New York sculptors, whose work may well find place beside that of the sculptors whose images already add so little to the Plymouth pedestal.

on one side, and Youth led by Experience on the other. Another to be Freedom, with Peace on one side resting under his protection, and Tyranny on the other overthrown by his prowess. Below these figures, in panels fronting the ends of the buttresses, to be alto-reliefs in marble of 'The Departure from Delft-Haven,' 'The Signing of the Social Compact in the Cabin of the Mayflower,' 'The Landing at Plymouth,' and 'The First Treaty with the Indians.' The whole structure, with the exception of the alto-reliefs, to be of granite, and in size amply sufficient to present a majestic and imposing effect."

The progress of an undertaking like this was necessarily slow, and it was not until 1873 that the contract for the pedestal was made by the architect. He died before its completion, in November, 1875. His time, energy and professional services, valued at $10,000, were given gratis to this enterprise. Joseph Billings, his brother, continued the execution of the monument until his death in 1880, when it was taken in charge by Rev. Wm. M. Harding, who had been its financial agent since 1858, and who had been identified with it for two previous years. The execution of the two completed statues was accomplished under Joseph Billings's authority and supervision. The figure of Faith was erected in July, 1877, and cost $32,300. It was the gift of the Hon. Oliver Ames, of North Easton, Mass., who was a native of Plymouth. The sitting figure, Morality, was the gift of the State of Massachusetts, and cost $10,000. It is fourteen feet six inches high from the bed of the plinth to the top of the head. The single alto-relief, 'The Departure from Delft-Haven," was given by the State of Connecticut, and cost $3,000.

In an architectural sense the original design of this structure would not be called monumental,— that is, it has not the composite elements of architecture. It is a collection of figures arranged with more or less success. The part below the plinth of the Faith is to a certain extent monumental. The sitting figures are as a whole well thought out, though slightly more illustrative than emblematic. They compose well with their surroundings. The pedestal and figures make the beginning of a high monument, but the Faith does not carry it out. The intention of the architect was evidently to make it a figure monument, and it is fair to believe that had he lived he would have attempted to carry out the necessary perfection of the design in its execution. He evidently understood that a design on paper is but an indefinite shadow of its realization in form, and that the proper execution of sculpture of colossal size was the real work of the monument, and that the essential quality, that of symmetry, could only be obtained by rare genius and great study. It is the total failure to comprehend these vital principles, these self-evident facts, these important elements of the monument, that proves the total absence of art of any kind in the two figures of Faith and Morality. The difficulties of making a work of art in a statue thirty-six feet high can hardly be stated. There is no statue of modern times of anything like that height which holds any place in the esteem of the art-world. Moreover, the reward of success is usually so small, and the effect is so limited in proportion to the time, labor and money expended, that the ablest sculptors will not undertake such works. Public appreciation and comprehension of the true purposes and scope of sculpture do not demand them. It is architecture that should be grand in effect and great in dimension. It is a well-known fact that the difficulties of making a large figure increase far more than the ratio of size. It is the habit of cheap workmen in sculpture to make a model one-quarter, one-half, or one-third the intended size of a statue, and give it to the stone-cutter to reproduce in marble or stone. This comprises the length and breadth of the process by which the greater part of so-called sculpture is manufactured. It is the charlatanism of art in form. It explains the existence of bad statues and confirms the belief, too natural to the Anglo-Saxon mind, that sculpture is matter and not sentiment. It brought the figures of this monument into existence, and advertises their cubic contents as their chief claim to distinction, when the beauty of their forms should be their sufficient appeal to public esteem. The names of the sculptors[1] are not mentioned, but the quarry and the workman are published as evidences of their claim to be regarded as works of art. The original plaster model of the monument indicates that the architect was aware of the chief purpose of Faith as a piece of sculpture,— that of preserving the completeness of the figure as a decorative mass. The executed figure is very materially different, and has none of the suggested qualities of the original design or model, nor any of progressive development that must inevitably appear in the execution of a design on paper to that of form. The granite Faith is a little figure enlarged, not a large figure. The plaster model was made nine feet high by the late Dr. William Rimmer for $2,000. It was not satisfactory to those whose business it was to decide upon the matter, and it was given into the charge of a Mr. Perry to "make over," a task he succeeded in accomplishing. From this tinkered model, costing in all $2,300, representing in no sense a work of sculpture, was cut, four times its size, by the hands of workmen, the statue of Faith, at a cost of $30,000.

The astounding error of the above proceeding may be better appreciated when it is stated that no sculptor of repute would have made a model for such a price, nor have permitted its execution in stone without his personal supervision and guidance, for the reason that such execution properly done requires, if possible, more care than the preparation of the model. Another reason is that an artist understands that a statue of this height becomes a piece of architecture in relation to space and distance, it assumes to form an harmonious relation to light, and is no more a material of weight, feet and inches.

Fig. 35. Governor Andrew. By T. R. Gould. Hingham, Mass.

Fig. 36. Monument to Daniel Manin, at Turin.

There were two objects to be attained in the execution of the Morality: first, a good statue; second, that it should fill its place as an important decorative part of the monument. It fails in both of these objects, and it gives no evidence that they were particularly considered. The process of making it was the same as that followed with the Faith. A sculptor of small reputation among artists was employed to make a model in plaster for a few hundred dollars, and the remainder of the $10,000 went to the granite-cutter.

The bas-relief of the Embarkation, by C. Conrad, of Hartford, Conn., is the best piece of workmanship on the monument, but it is as far from sculpture as are the statues. The sentiment of the female figures is indeed pitiful. The bas-relief has neither identity with itself nor with the place it occupies.

The writer has dwelt with some length on this monument because of its importance, its unfinished condition, and the necessity of its being completed in a manner worthy of its high motive. It were better never finished than fail to represent the best progressive genius of the country in monumental art.

There is a marble statue of Governor Andrew (Fig. 35), by T. R. Gould, in the cemetery at Hingham.

THE CONCORD MINUTE-MAN.

Fig. 37. The Minute-Man. By D. C. French. At Concord, Mass.

It was originally intended that this paper should be confined to the consideration of the public monuments and statues erected in Boston and those of the immediate vicinity executed by Boston artists; but the representative character of the Concord Minute-Man, the Lexington statues, and the Newburyport Washington, are of such interest that it was decided to include them with the others.

No statue of a soldier that we remember in this country suggests so much of a soldier's readiness, duty and purpose as that of the Minute-Man (Fig. 37), at Concord, Massachusetts, by D. C. French. This colonial plough-boy springs to the height of a sudden occasion. The young sculptor who made it was also ready to meet the emergency of getting his work done for a memorable ceremony. Both lacked the training of venerable warriors in their arts, but were equal to the spirit of the moment. It is this seizure

[1] There is no more suggestive and curious part of American history than that of its various public monuments. The subjects and characters to whom we erect statues and memorials are as full, rich and imposing as any that have their honored place in history. As wide a public interest is taken in the preservation of their memories; as much generosity is shown, to give that interest worthy dignity. The master-spirits of the land are selected to lay the corner-stones in lofty strains of eloquence. A general holiday is made that collective honor may give the widest expression of appreciation of the completion of the work. The unveiling is attended with the sound of cannon and the strains of music. The whole occasion is one to be forever remembered; but the stone or bronze result over which all this ado has been made, and that is expected to appeal to the admiration of the world, is too often the work of a mere jobber or speculator. Yet to him is confided the production of the most lasting part. His work is really the tribute to martyrdom, to great civic virtue, to death-attained sacrifice.

of the spirit of the subject, combined with a sense of sculpture not small, that has made a general feeling of satisfaction towards this statue. This fact goes to show that a genuine sentiment in the right direction will, under certain conditions, meet its welcome.

The tendency of the composition of the Minute-Man is true; it is intended to mean something definite; it has a positive aim in seeking to illustrate a thrilling fact. The statue will retain its interest because of this merit, and also because of its suggestion of possibilities in the future efforts of the sculptor. The maturity of its character as a composition, and the sincerity of its execution, will make grand work. It was modelled before the artist was twenty-five years of age, and with but little previous study.

Before this statue, as before those of Milmore, considering the favorable opportunities surrounding these sculptors, one involuntarily asks why they did not take more time and do their work much better? Is it the fault of the sculptors, or of the public, that a statue should be made for erection on a certain day, month or year, when it ought to be known and understood that the best work that the sculptor can possibly do with ample time for study is really the only object to be seriously considered? We admire the Minute-Man, and the sailor on the Army and Navy Monument, not so much for what they are as for what they might have been. We should have admired them if they had been made of stuffed clothes, because there is an individuality in their composition worthy of the most serious and intelligent study. It is not necessary that an art idea in sculpture should be cast in bronze or cut in stone to prove or demonstrate its place in art. What was there to prevent French studying several years in Paris among the only sculptors of the world, and then making his Minute-Man? The same question may be asked of Milmore. Both of them could then have made grand things. It is a possibility, confirmed by too many evidences, that the average committee-man is not too susceptible of the importance of good sculpture, and over-tenacious of his own notions. It is both possible and certain that there is some responsibility resting upon the artist. That the Minute-Man should be erected on the 19th of April, 1875, was a frivolous necessity in comparison with that of the sculptor's making — what he was well able to do, by taking more time — a thoroughly fine statue, one fit for a century, instead of a date. The existence of a work of art is the appeal to posterity; the circumstances attending its production or erection are soon forgotten. The time ought to come when the sculptor will insist upon the fullest convenience for the execution of his productions, and committees upon contributing a well-considered work of art to history rather than to the interest of a ceremony.

THE LEXINGTON STATUES.

The Memorial Hall at Lexington contains marble statues of John Hancock (Fig. 38), Samuel Adams, the Minute-Man (Fig. 39), and the Union Soldier. The first two were made by Conrad, of Hartford, Connecticut; the third by T. R. Gould, and the last by Milmore. It is an ungracious task to say anything about them. They were erected by a grateful, patriotic people, as tributes to sacrifice and principle, to men and inspirations, to past and future history.

Fig. 38. John Hancock. By C. Conrad. At Lexington.

Fig. 39. Minute-Man. By T. R. Gould. At Lexington.

Every propitious influence existed in fulness except art or design in sculpture at the time when the Lexington altar was erected. This event is especially noteworthy when it is remembered that many years before, the Lexington Monument Association had procured from Hammatt Billings a design (Fig. 40) for a monument possessing remarkable art qualities. Events prevented its execution, and the four above-mentioned statues are the result, so far as they go, of the efforts of the people of Lexington, and of their interest in the patriotic glory of the town. Billings's drawing of the Minute-Man, a trifle more than an inch and a half high, which he intended should surmount the pedestal of his design for the Lexington monument, is worth more than all these statues, — more than all the statues and monuments in Boston or its vicinity, built as memorials to men or events. It has more reach, nerve, bigness and sweep in it than any statue or design for a statue we have ever seen by an American. Compare it with the wretched effigy of a minute-man in Memorial Hall. Who would believe that such an object could be accepted as the symbol of the spirit that inspired Jonas Parker?

We have nothing better to say of the other statues. What the persons who made them were thinking about during the execution of these works we cannot imagine. What they did fails to interest us. It is often urged as an ample justification of the existence of such work that at some future time it will be interesting as showing the beginning of art in form in New England; that it will occupy the same interesting place in our art history as the primitive art in form of other nations occupies in theirs. This statement appears reasonable, sufficient and true; but in reality it has neither one of these merits to give it value. Primitive specimens of any kind of art are distinguished by one or more of the positive, prophetic art elements, more or less feelingly expressed. Because a mass of stone or metal resembles a human or animal form, it does not follow that it is sculpture. Without the art element it is simply an unfortunate degradation of material. The Memorial Hall statues emphasize this.

Fig. 40. Design for the Minute-Man at Lexington. By Hammatt Billings.

It was an untoward fate that prevented the execution of the original design of the Lexington Minute-Man. What fate was it that imposed the intermediate infliction? For it must be that this grand design will yet become the inspired symbol of those who "poured out their generous blood like water, before they knew whether it would fertilize the land of freedom or of bondage," and the living oracle of those who partake of the inheritance they secured.

STATUE OF PRESIDENT QUINCY.

The Memorial Hall of Harvard University contains a marble statue of President Quincy, by W. W. Story. It represents the president in his official robes, in the act of presenting to the graduate his collegiate degree as represented by a roll of parchment. The purpose of the statue is indeed simple. Its value as a work of sculpture must mainly depend upon the impressive, earnest manner in which this purpose is accomplished. If compared with the famous full-draped statues of ancient or modern times, it would be found lacking in those qualities that characterize good sculpture.

T. H. BARTLETT.

THE TENTH CENSUS STATISTICS CONCERNING BUILDING-STONES.

BY means of the unsystematic investigation of the resources of this country, the abundance, variety and quality of our natural materials of construction have been sufficiently demonstrated, but no attempt has been made to bring the knowledge which we possess concerning these resources into systematic form, or to aid in the development of this portion of our wealth by the application of scientific methods. The local resources of some States have been systematically treated in reports to legislatures, and the stones collected at exhibitions have been catalogued and described in a general way; still, anything which aims to give definite information concerning the position of quarries in this country, their extent, and the kind of material which they produce, does not exist. It is, on the whole, a striking circumstance to note, that while the resources of mines have been investigated with utmost care, and the compositions of their products have been determined in the minutest detail, an attempt even to determine in the crudest manner the nature of the materials which we employ for building purposes has not been made.

The collection of the statistics of the quarrying industry, which has been authorized by the Superintendent of the Census, will therefore give an opportunity for an exceptional amount of original research, which it is hoped will prove to be both of economic and scientific interest.

A considerable portion of this work will be devoted to those statistics which are demanded by the census and which will show the extent and importance of the quarrying industry in this year of our Lord. But the authority which has been conferred upon the Superintendent of the Census by Congress has allowed him to appoint agents who will not merely gather the statistics and the information concerning these special industries that are placed in their charge, but their commission enjoins upon them the duty of discussing the results obtained by the enumerators. The discussion of these results, it appears to me, may prove of advantage to the architects of the country, and the work may be much improved in this respect if their interest in this subject would lead them to give to the work their coöperation.

All of the quarries in the United States which produce such an amount of material as to give them anything more than local importance are to be visited by gentlemen of scientific reputation. In many areas, these gentlemen are the State geologists; in others they are professors or architects. Such names as Prof. N. S. Shaler of Massachusetts, C. H. Hitchcock of New Hampshire, Prof. G. H. Cooke of New Jersey, Prof. Alexis Julien of New York, Prof. Edward Orton of Ohio, Prof. N. H. Winchell of Minnesota, Prof. G. C. Broadhead of Missouri, Prof. J. R. Proctor of Kentucky, and other gentlemen of like reputation, cannot fail to give to this work such a character as will certainly render it of great value to the community. The statistics which are to be gathered by these gentlemen will inform us as to the locations of all important quarries; the kind of stone which they produce; the uses to which it is applied; the extent to which it is used in the neighborhood, or shipped to distant points; the amount of material which is annually produced; the amount of material which has been produced as indicated by the area of the excavation; the size of a single block which has been extracted; the size of a block which might be extracted if desired; the structure of the stone as regards stratification and jointing; a description of the methods employed in quarrying, in dressing, and in transporting the stones; and scientific information concerning the geological age, and the forms in which the stones are found. Appended to the schedule upon which this statistical information is gathered, there are a number of pages which are to be devoted to remarks and to information which applies to the individual quarry under consideration. Our work has progressed so far that we are able to say, that from the experience and knowledge of the parties who are gathering the statistics, we are obtaining a vast amount of most valuable information under the head of these remarks. And we also know that already in these remarks we have a great deal of information which will prove of much value to those who employ stones in construction.

Upon a second schedule we inquire what quarries are located upon given routes of transportation. The geological features of the country which is traversed by the route are given, and some information is thereby elicited concerning the kind of stones which might be quarried in the given directions if desired. By means of the table which is to be constructed from these schedules, a person can immediately inform himself as to the kind of stone which he can obtain on a given railroad or water route, as to the extent to which stones are at present brought over these routes, and the approximate cost of the transportation to centres of consumption.

Another schedule which is bringing to us information that is of much interest is devoted to the consideration of the stone which is employed in the various cities of the United States. From these schedules a table is to be constructed which will show the extent to which stone is employed in each of these cities, and the kind of stone which is there employed for constructions of all kinds. Some questions are included which are intended to give information concerning the utility of the stones which have been employed. We thus are obtaining a great many facts which show the effects of various climates upon stones of different kinds, and a great many circumstances which are to aid us in the subsequent discussion of these stones. Upon this schedule which is devoted to the cities, there is, again, an opportunity given for remarks; and here we obtain information concerning the materials which have been selected for the construction of all the most important buildings in the United States, as well as the public works and rougher constructions. The observation of these buildings and constructions is bringing to light a great many circumstances which cannot fail to be of interest to the architectural community.

Although the tabulation of statistics and the gathering of information of this character is of very great interest, it is plain that a scientific tone and character cannot be given to a work of this kind unless the materials as regards composition are subjected to a more critical study than heretofore. The necessity for this study of their mineral composition is sufficiently apparent to any one who deals in these materials. If one should ask a quarryman, or perhaps an architect, of what many of our most important stones are composed, the information obtained would be of necessity most crude, because no one possesses information upon these points. It is sufficiently evident that many stones which pass under one name are very different in composition, — a black, a gray, a blue, a white granite, cannot be the same, and where durability and permanence of color is of utmost importance, it is evident that these materials should be submitted to a critical examination in order to classify them for arrangement in our tables. The method which we have adopted for this purpose is the microscopic study of thin sections. From each rock we cut one or more thin sections, and by means of our various optical appliances we can determine with accuracy the mineralogical composition of each stone; and we intend to classify and name our rocks according to the composition which is thus ascertained. The results already achieved are such, I think, as would excite considerable surprise if they were made public. For example, some of the stones which have come to us designated as granite have been found to consist of a number of minerals, every one of which is entirely absent from other specimens also designated as granite. The most superficial consideration of this statement will indicate the importance of this work, for every architectural consideration must be more or less dependent upon the nature of the materials which are employed for given purposes.

Another feature of our microscopic work appears to us to be very important, and that is the structure of the stones as seen in these thin sections. The knowledge which architects have thus far had at their disposal concerning stones is largely composed of arbitrary information obtained from the results of physical experiments. Take for example the tables which give to us the crushing strength of stones per square inch, the ratios of absorption of stones, the specific gravity and other physical properties of stones which are necessarily considered by the architect. It is important that connected with these experiments we should have a very definite knowledge concerning all the ingredients which make the stone, and the different manners in which the grains are aggregated. The determinations of the strengths of iron and steel are always attended by the most careful chemical study. If iron is found to give way under tension, or compression at a given point, the reasons for this are always sought, and the composition of the material and the deleterious ingredients are determined with the utmost care and accuracy. Yet, the experiments upon the physical condition of stones have never been attended with this kind of observation. The tables which give us these physical properties designate the stones with such crude terms as "trap," "sandstone," "bluestone," "greenstone," "granite," etc., taking no cognizance of the variations to which these substances are subject. Without submitting these substances to microscopic examination, it is sufficiently evident that the structure of a stone should explain many of the phenomena which have been observed. The state of aggregation of the grains as indicated by the thin section cannot fail to explain its peculiarities as regards strength and decomposition. The examination of a stone under a highly magnifying power cannot fail to indicate the presence of those substances which, by their decomposition, will produce a discoloration of the stone. And in fact it appears to me that the microscopic study of these stones may develop a method which may prove to be of eminent utility.

In addition to all such practical and economic considerations, an accurate knowledge of the compositions of these stones will also be desired for its own intrinsic interest. I would like to bring this microscopic method of study to the attention of the architect, because, in connection with this work it would be of great advantage to us if stones which architects have found to be possessed of certain peculiarities, advantageous or disadvantageous, were, with a statement of these peculiarities, submitted to us for microscopic examination.

It is our intention finally to compare the physical properties of stones with their microscopic compositions and structures, yet no material would be so valuable to us as fragments, no matter how small, of stones which in actual practice have been found to possess given peculiarities.

We intend to accompany our report with a volume of plates which shall represent the compositions and structures of our building-stones, as seen under the microscope, and we are making a collection of the building-stones which we intend shall include a specimen from every quarry of importance in the country. These specimens are obtained of such size that they can be finished into cubes with an edge of four inches, are dressed in various styles upon the different faces, and illustrate the appearance of the stone when rough, axe-hammered, draughted rock-faced, bush-hammered, or rubbed and polished. The collection has already attained such proportions as to demonstrate that it is to prove eminently useful to those who wish to select or introduce stones. It contains most of the stones exhibited at the Centennial Exhibition at Philadelphia in 1876, in addition to the systematic census collection. This collection is at the disposal of American architects, if at any time a comparative study of stones can be of service to them. Dr. George W. Hawes,

Curator in National Museum,
Special Agent of Tenth Census,
Washington, D. C.

THE ILLUSTRATIONS.

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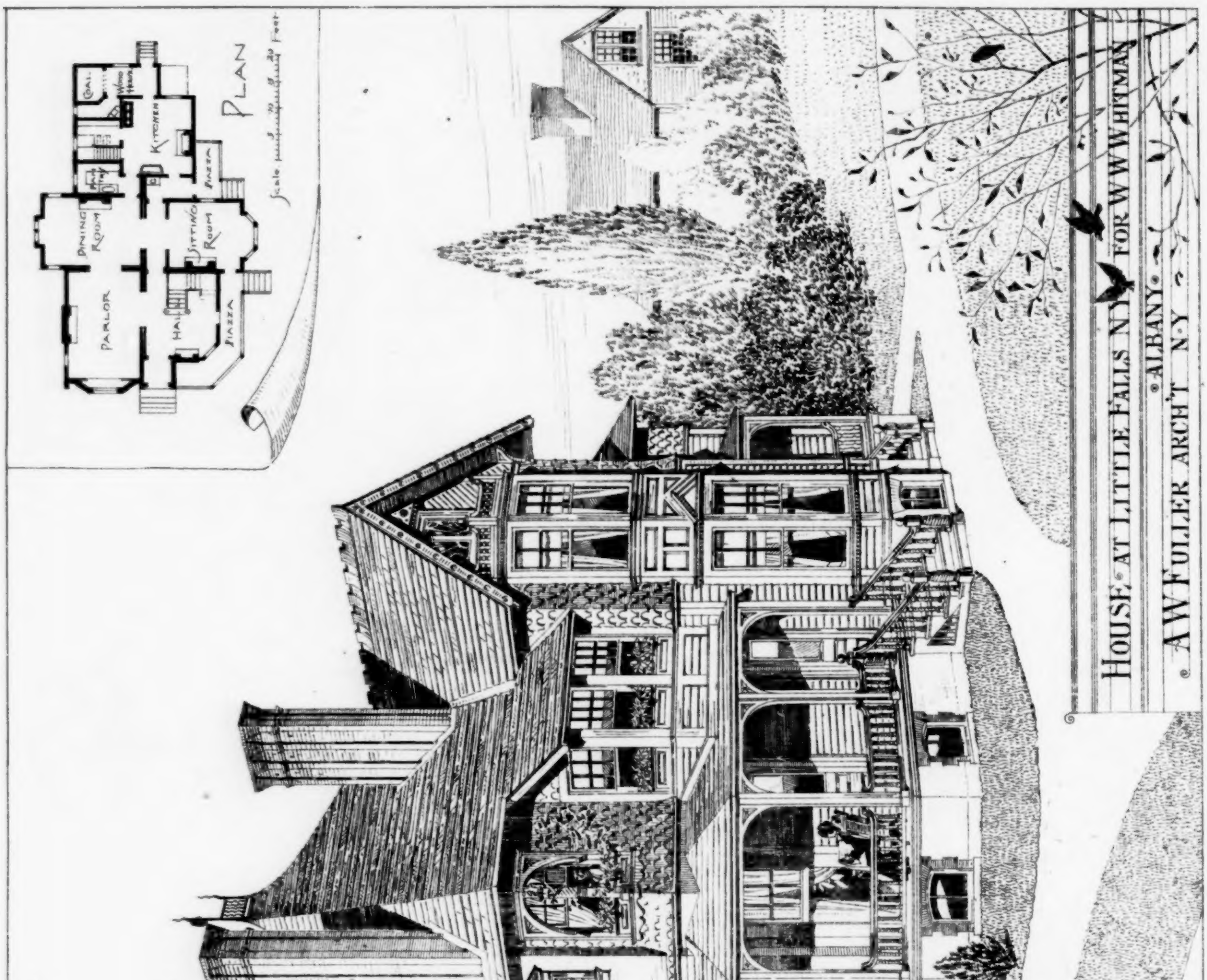
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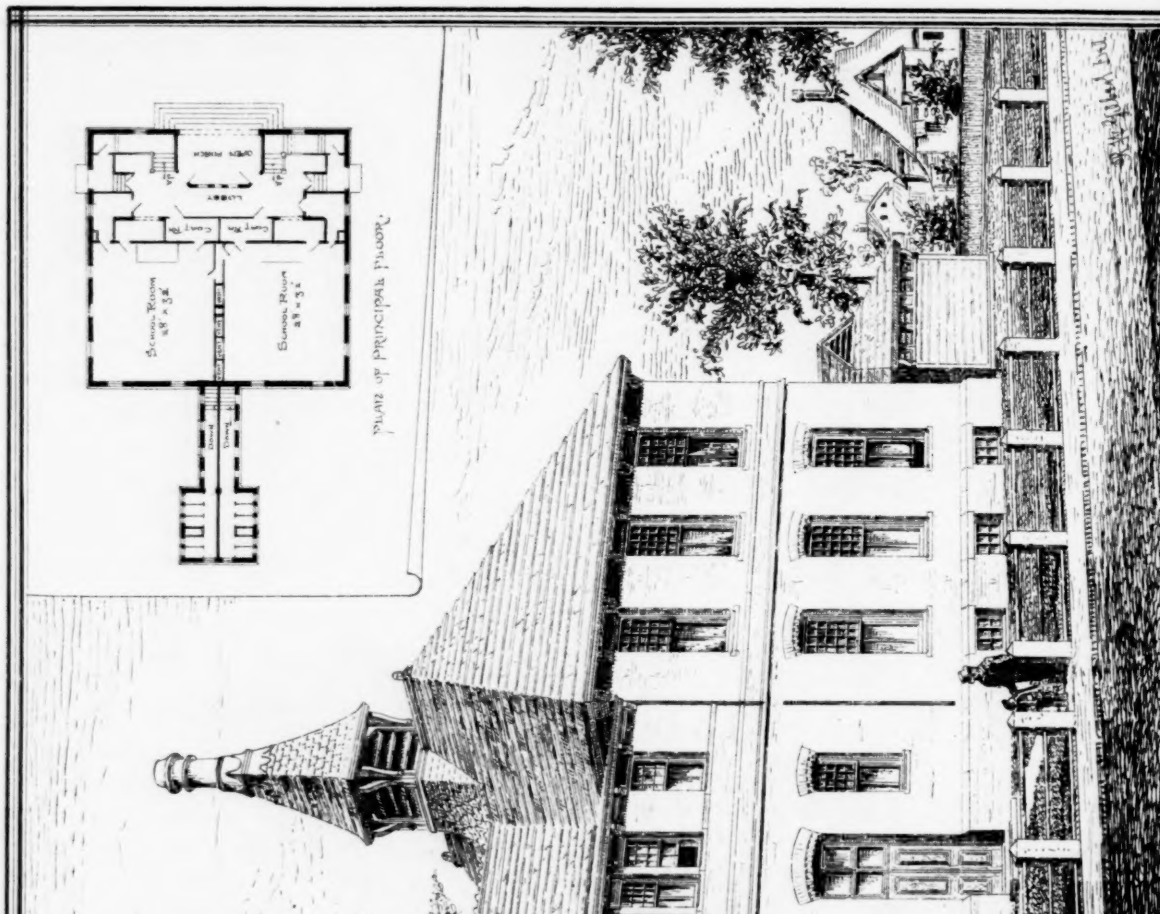

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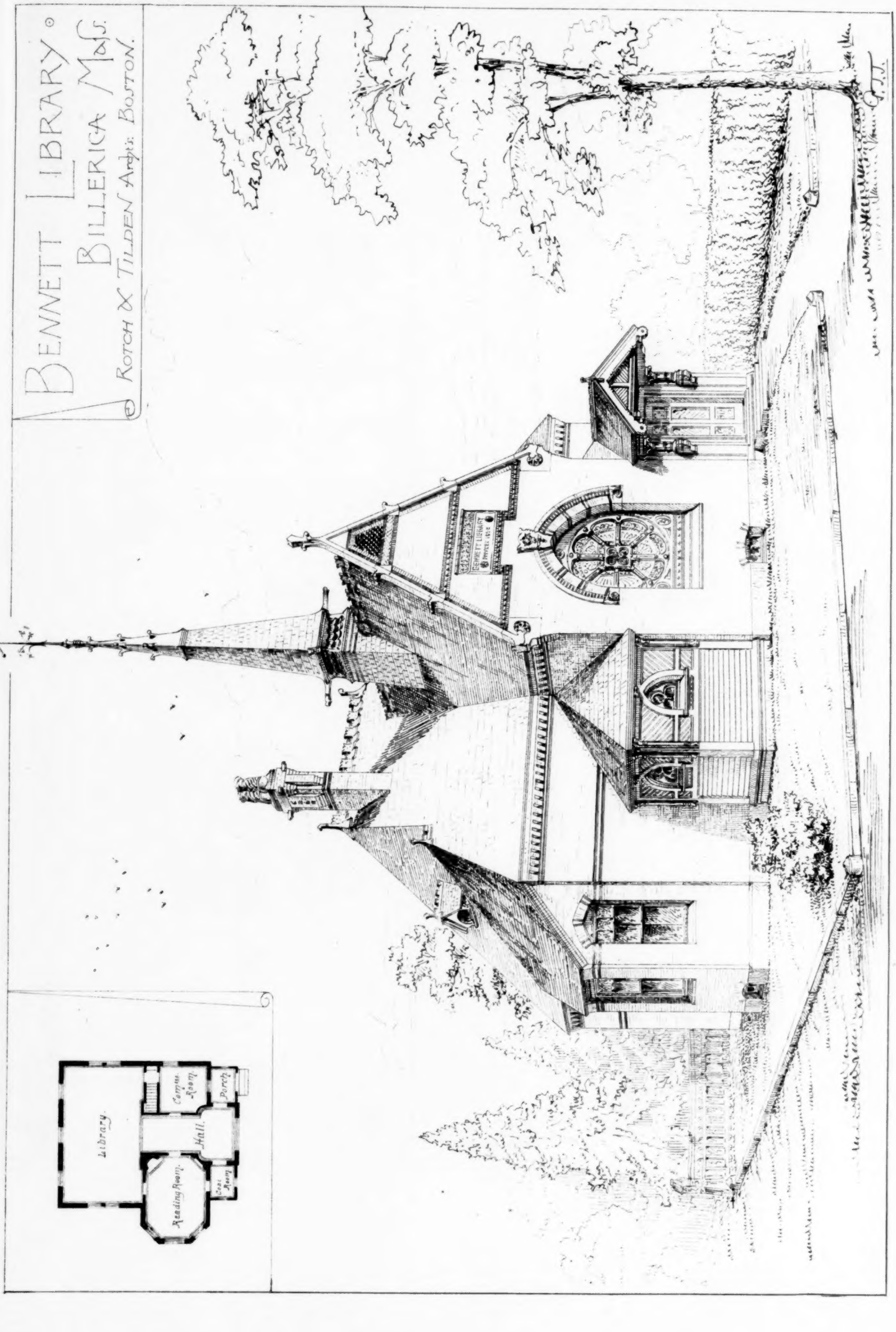
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THE MANUFACTURE OF GLASS FOR DECORATIVE PURPOSES.[1]

"THE manufacture of glass for decorative purposes" is a subject of considerable extent, and requires more time to do justice to it than is at present available. The subject may conveniently be divided into three parts: 1. The development for decorative purposes of the natural properties of glass; 2. The production of decorative forms, or decorative material, by the manipulation of glass in a plastic or viscous condition; 3. The treatment of the surface of glass with a view to supplement the effects due to its form or its nature.

I.—NATURE OF GLASS.

Glass is defined as an amorphous transparent solid, and the existence of devitrified glass, which is both crystalline and opaque, and of other opaque glasses to which I hope to allude, need not materially damage this definition. There are many different glasses, but all agree in being built up of compounds which are called silicates, a silicate being formed by the union of the oxide of silicon, or silica, with another oxide. The large family of silicates may be divided into two groups, the one being composed of alkaline, and the other of the metallic, silicates. It is only necessary to mention a few individuals belonging to each of these groups; namely, those of the first group, which respectively contain the oxide of potassium and the oxide of sodium, and those of the second, which contain the oxide of lead, the oxide of calcium and the oxide of barium. Every glass must contain at least one silicate belonging to the group of alkaline silicates, as well as one silicate belonging to the group of metallic silicates. Manufacturers have practically nothing to do with silicates as silicates, but knowing that the nature of a glass depends upon the natures of its constituent silicates, they put into their crucibles materials of such a nature, and in such quantities, as will produce the silicates and, consequently, the glass which they require. The raw materials are, as a rule, oxides or carbonates, a carbonate being a compound of an oxide with the oxide of carbon or carbonic acid. The most important materials are sand (an impure form of oxide of silicon), red lead (a mixture of the oxides of lead), and the carbonates of potassium, sodium, barium and calcium. The whiteness of the resultant glass depends upon the purity of the raw materials, and especially upon the absence of iron, whether as an oxide or as a metal. The silicate of lead is formed by the direct combination in the crucible, under the influence of intense heat, of sand with the oxide of lead. The silicates of potassium, sodium, barium and calcium are also formed in the crucible by the indirect action of the sand upon the respective carbonates. This indirect action consists in the expulsion of carbonic acid gas from the carbonate by the intensely heated oxide of silicon, and the consequent union of the latter with the residual oxide. Given the alkaline and metallic silicates required to form a certain glass, the necessary raw materials for the required silicates are simultaneously thrown into the crucible, and the silicates will be simultaneously produced by the action of the heat of the furnace in which the crucible has previously been "set."

The simplest form of a glass furnace is a circular base, covered by a flattened dome. In the centre of the base is a comparatively small grate, and round the grate, under arches formed in the wall of the dome, the crucibles are placed. Flues pass through the dome at the side of each arch, which direct upon the crucibles the heat and flame reflected from the surface of the dome. The arches serve for the introduction and removal of crucibles as well as for the removal of glass from the crucibles when required for manipulation. Crucibles are built of fire-clay, roll by roll, and their shapes are regulated according to the nature of the mixtures which they are intended to hold. If the mixture for a glass contains oxide of lead, it must be protected from the reducing action of flame, and the crucible must be closed on all sides except where no flame can reach. Mixtures containing no oxide of lead are exposed in large open fire-clay bowls to the full action of the flame and heat of the furnace.

Different glasses possess different qualities, according to the number and nature of their constituent silicates. As a general rule, a glass containing two silicates is less fusible, but considerably purer in color and texture, than one containing a larger number. A homogeneous glass is more easily obtained when its constituent silicates are of similar or approximate specific gravity. Plate and sheet glass, composed of the silicates of sodium and calcium, are generally homogeneous, but possess a green tinge, due to the silicate of sodium. Crown glass is white, owing to the replacement of the sodic silicate by silicate of potassium. Flint glass, consisting of the silicate of lead and silicate of potassium, is both white and brilliant. The brilliancy of flint glass is due to the density of the lead silicate, but this very density is frequently the cause of striæ and irregularities in the substance of the glass. It is almost as difficult to obtain a clear mixture with the silicates of lead and potassium as with water and oil. The silicate of barium is used for pressed glass, as a cheap substitute for the silicate of lead. Venetian glass contains three silicates,—namely, those of sodium, calcium and potassium. It is therefore fusible, and its density is trifling. To these two properties the lightness and intricacy of Venetian work are to be attributed. Venetian glass is generally devoid of brilliancy, and very far from being either white or homogeneous, but these very deficiencies give that horny effect which is looked upon as a characteristic beauty. Bohemian glass, in addition to the silicates of sodium, potassium and calcium, contains traces of the silicates of magnesium and aluminium. It is fusible, easily manipulated, and develops, with the sub-oxide of copper, a ruby color, which cannot be attained with a glass containing silicate of lead.

When fusion and purification are complete, the glass in the crucible is in a condition closely resembling that of very glutinous treacle. It can be withdrawn from the crucible by pouring, by ladling or by gathering. Gathering consists in thrusting the heated end of a hollow iron rod, measuring from five to six feet, into the molten mass, and turning it so as to collect a coil of the semi-liquid material. It requires some skill and practice to collect the exact weight of glass required to reproduce a given pattern, especially as a mistake in this, as in all processes of glass manufacture, is irrevocable. The molten glass, as it comes from the crucible, may be considered to be physically porous, as heat produces mutual repulsion between the molecules of a body. These physical pores have to be closed by a very gradual process of cooling, for if the process be hurried, the outer crust will be solidified, whilst the interior remains in a porous condition. So-called toughened glass has failed, because, however hard the surface may be rendered by the violent contraction caused by sudden cooling, the interior remains porous, and the unnatural tension excited between the interior and the surface generally ends in the destruction of both. Gradual cooling, or "annealing," is practically effected by placing the glassware, immediately after manipulation, upon movable trays, and slowly removing them in a continuous train from a constant source of heat, or by placing the ware in a heated oven or kiln, and allowing the source of heat to die out.

The effects produced respectively by the refraction, transmission or reflection of light by glass may in many cases be utilized for decorative purposes. If a beam of light be transmitted through a glass prism or lustre, a more or less extended spectrum is formed in proportion to the density of the glass. If white light be transmitted through glass containing the oxide of uranium in solution, rays otherwise unseen become brilliantly conspicuous. If certain metallic oxides be introduced into a crucible together with the mixture for transparent glass, and be dissolved throughout the mass, the resultant glass acquires the power of sifting the incident rays, and of transmitting effects of color, according to the nature or quantity of the oxide introduced. Different permanent transmitted colors are obtained (1) by the oxides of different metals, (2) by the different oxides of the same metal, (3) by different quantities of the same oxide, or by different thicknesses of the resultant glass. The characteristic colors of the oxides of gold, silver, copper, manganese, iron and cobalt are, respectively, pink, yellow, peacock-blue, violet, dull green and purple-blue. Copper and iron possess two oxides each,—namely, a peroxide containing a large proportion of oxygen, and a sub-oxide containing a smaller proportion. The peroxide of copper gives a blue or green color, and the sub-oxide a ruby-red. The peroxide of iron gives a yellow, and the sub-oxide a dull green. Certain oxides are valuable for their power of respectively increasing or diminishing the oxidation of other oxides. Thus, to obtain an iron yellow, which is the characteristic color of the peroxide of iron, it is necessary to add to the mixture oxide of manganese, which at a high temperature parts with its oxygen and its coloring power simultaneously. The oxygen thus set free goes to the assistance of the peroxide of iron, which has a tendency to part with its oxygen, and to produce a green color. The sub-oxide of copper has a great tendency to rob oxygen from any convenient source, and to produce a blue or green instead of a red. It is therefore necessary, when a red is wanted, to mix with it some substance which absorbs oxygen with greater avidity. The oxide used for this purpose is the sub-oxide of tin. It often happens that in preparing the pink from the oxide of gold, and red from the oxide of copper, the reductive action is carried too far, and instead of having the oxide in solution, the metal is found suspended in the glass in a state of extremely fine division. The glass in this condition reflects a red color, but transmits an opalescent blue. If the particles of the metal be sufficiently large to reflect the characteristic color of the actual metal, the well-known effect of avanturine is obtained. The different colors produced by the same oxide are best observed in the case of copper and cobalt. A small quantity of the peroxide of copper gives a blue, and a larger quantity a green. In the same way, a strong dose of the oxide of cobalt gives a red, a smaller dose a violet, and a comparatively minute quantity the characteristic blue; or a thick layer of cobalt glass transmits red rays, a thinner layer violet rays, and a still thinner one blue rays. Opacity may be produced by devitrification, by the semi-fusion of pulverized white or colored glasses, and by the addition to transparent glass of some infusible material. Devitrification has never been pressed into practical use; the semi-fusion of pulverized glass places at the decorator's disposal a material of great strength, possessing a granular and irregular surface, together with the power of developing almost every tint of color in an absolutely permanent condition. The process is also valuable to the manufacturer, as supplying a means of utilizing waste. Opaque black glass or black enamel is formed by the addition to transparent glass of an excess of an infusible or partially fusible black oxide, as, for instance, that of iridium, of cobalt, of manganese or of iron. White and colored enamels owe their opacity to the oxide of arsenic, the

[1] A paper read before the Society of Arts by H. J. Powell, B. A.

oxide of tin, the phosphate of calcium, or to cryolite, a compound of sodium, aluminium and fluorine, and their colors to different metallic oxides. It is cryolite which gives the opacity to the well-known hot-pressed porcelain.

II.—MANIPULATION.

The molten glass gathered on the end of the hollow blowing-iron may be placed in a mould, and by the pressure of a workman's breath on its inner surface may be forced to adapt both its internal and its external surface to the form and surface of its environment. By this means the glass may not only receive the actual form of the interior of the mould, but may also be imprinted by any depressed or raised ornament wrought on its inner surface. If, instead of being expanded by the workman's breath, it be forced to adapt itself to the mould by the descent of a plunger, it will assume on its outer surface the internal form of the mould, together with any decoration which may be wrought upon it, and on its internal surface the form and surface of the plunger.

The molten glass may also be fashioned by the breath and the simple tools of the glass-blower. The arms of the chair in which the workman sits, and the hollow and solid rods by which he holds and rotates the glass with his left hand, constitute the entire mechanism of his lathe. His principal tools are what may be called the sugar-tong spring tool, the shears, the battledore or flattening tool, together with a variety of simple clips, measure sticks, and calipers. However simple the tools may be, the variety of form which a blown bulb may be forced to assume is inexhaustible. The molten glass, when gathered from the crucible, is too fluid for immediate manipulation, and requires to be partly solidified by rolling on a polished iron slab, or by insertion in moistened wooden cup-shaped moulds, from which the glass may assume a rough outline of its ultimate form. The first process in every case is blowing through the hollow gathering-iron until the mass of glass be expanded into a bulb. If the iron be held vertically, with the bulb downwards, the bulb is elongated by gravitation, and expanded at the same time; if the bulb be raised and blowing be continued, it increases in circumference only. The bulb may also be elongated by gravitation alone, assisted by a swinging motion. Whilst the bulb is being shaped with the spring tool, it must be kept in constant rotation by rolling the rod to which it is attached upon the arms of the chair, as otherwise it would collapse. If the end of the bulb, remote from the blowing-iron, be opened, and the bulb be rapidly rotated and heated simultaneously, it will suddenly fly open by centrifugal force into a flattened disk. If the disk be re-heated, and the iron held perpendicularly with the disk downwards, the disk will gradually crumple and collapse. The heat required to renew the plasticity of glass essential to manipulation is obtained by inserting the bulb or vessel into the mouth of a heated crucible, or into a furnace adapted to the purpose. If to the end of a solid mass or hollow bulb of glass a second working rod be attached by a seal of glass, and the workman recedes whilst retaining the blowing-iron, and an assistant recedes carrying the second rod, the bulb or mass which unites them may be indefinitely extended. If a connection be formed between a source of molten glass, and the circumference of a heated wheel, and the wheel be caused to revolve with speed, a thread is coiled upon the wheel in an extreme state of tenuity. This thread may be spun into a decorative fabric.

III.—TREATMENT OF SURFACE IN ORDER TO SUPPLEMENT EFFECT DUE TO NATURE OR FORM.

Decorative surface obtained by blowing into moulds.

Venetian sheet glass.
Ribbed and diamond moulded table glass.

Decorative applications to surface by heat.

1. Colored and metallic gems, seals, and frills.
2. Etchings in gold-leaf.
3. Sections of variegated cane.
4. Threading, imitation leaves and feathers, and various forms of threading.
5. Reticulated enamel ornament, with bubbles.
6. Metallic, colored, and scale decoration.
7. Frosted glass.
8. Iridescence.

Decorative applications without heat.

1. Iridescence by corrosion and decay.
2. Cutting.
3. Engraving.
4. Sand-blast process.
5. Acid.
6. Carving. (The origination of the process is due to Mr. Northwood.)
7. Enamel painting and gilding, fixed by heat.
8. Mosaic transparent glass.
9. Mosaic opaque glass.
10. Stencilled opaque glass.

Such are a few of the processes now employed in the manufacture of glass for decorative purposes. Additional and improved processes will constantly be introduced as long as the demand for decorative glass continues. The style of the products of our flint-glass manufactories has so completely changed in the course of a few years that it is difficult to foresee upon what lines the manufacture of the future is likely to run. The change is clearly indicated by the fact that whereas flint glass was almost entirely sold by weight, sale by weight is at the present time an exception. This change indicates a loss of a staple product, namely, the heavy ware of medium or common quality. The majority of this ware is now produced on the Continent; the remainder has been retained in England by the perfection of the material of pressed glass, and of the mechanism by which it is produced. Pressing glass is a manufacture by itself, and the loss remains to the workmen and manufacturers of flint glass. Decorative glass has taken the place of that which has been lost, but it is doubtful how long it will be possible to produce it with profit, considering the increase of foreign competition. English flint-glass manufactories are now mainly turning out the best quality of table glass and decorative glass, and their chief profit depends upon the invention of a succession of novelties. The only safeguard of these two branches of manufacture is to adopt an English style and an English standard. The style should be determined by consideration of the utility of the vessels produced, and of the nature of the material. It is, for instance, undesirable to expend prolonged labor upon the decoration of glass which is essentially fragile. The forms and decoration of the wares produced must be elegant and simple, and every care must be taken to develop the effects due to the natural properties of the material. The standard must be the highest possible, and no vessel should be allowed to leave the sorter's hands which is not perfect both in material and workmanship.

Effectual assistance in the competitive struggle may be derived from the adoption of improved methods of working and the application of improved knowledge and of greater economy throughout all the processes of manufacture. Above all, it will be advantageous if workmen and manufacturers can discover that their true interest is identical. The Flint-Glass Makers' Society makes, and has made, mistakes; but these mistakes form no valid reason for antagonism, and to the society are due the increased sobriety, intelligence, and productive capacity of the workmen.

THE ADVENT OF A PERIOD OF EARTHQUAKE.

No terror to which man is exposed is greater than that caused by earthquake. As a general rule, there is none that can be compared with it. Of the effects on the nervous system produced by a bombardment, we cannot speak from experience, although there are now alive but too many who can. Of the consternation caused by a volcanic eruption, more especially when it commences by one sudden and violent explosion, as was the case with Vesuvius in 1860, and of that resulting from the discharge of a mine, or the explosion of a powder-magazine, experience is not uncommon. But in these cases, alarming as they unquestionably are, the very visibility of the danger after a time deadens its power to affect the mind. The risk is felt to be localized, and thus, it is hoped, to be avoidable. But such is not the case with earthquake. The bravest man, on being exposed to the first experience of this phenomenon, sudden and unexpected as its occurrence always is, will be impressed with a sense of solemn awe. And if shock succeeds shock, earth heaves like a ship at sea, crevices yawn in the soil, vast waves rush on the shore, and tower and spire totter and fall, little wonder that the frenzy of fear takes the form of temporary or even of permanent madness.

One great peculiarity of the earthquake is its recurrence in cycles, or after long intervals of rest. Many places where earthquakes are now unknown were formerly rent and shaken by oft-repeated shocks. This is the case with many districts in Great Britain, at so remote a period of time as to be remarked especially in strata that are older than the great North of England upheaval, which is considered by D'Orbigny to have intervened between the deposit of the grit-stones, or upper members of the carboniferous system, and that of the Peneen beds, or Lower New Red Sandstone. Among the Cambrian strata of Pembrokeshire are found many deposits of sandstone which promise on first appearance to yield excellent building-stones, but which, on opening a quarry, prove to be so shaken throughout as to be quite unfit for architectural use. The same thing may be said of some of the porphyry and serpentine of Cornwall, noble and very beautiful stones, equal to marble, if they could be procured in large blocks, but shaken throughout. It may be questioned how far the lay and the strike of the great Welsh slate-field itself is not the result of action of the nature of earthquake.

In many parts of the world earthquakes are common. In Zante, for example, it has been said that they are of daily occurrence. It is in certain well-known zones, which for the most part are dotted with volcanoes, that earthquakes are now most common; and their energy is generally found to coincide with some change in the activity or the slumber of the volcano.

There seems evidence that, at all events in a certain district of Europe, a period of unusual seismic activity has recently commenced. What is most remarkable and, we may add, most alarming in the matter is the wide area of country over which serious shocks have been felt. We have long been acquainted with local earthquake activity, but something much more than this has characterized the March and April of 1881. On the 26th of February the series commenced with violent shocks at Agram, in Hungary, repeated on the following day. That town (lat. 46°, long. 16° about) is divided by the valley of the Save from the Carnic Alps, to which system, running in an easterly and south-easterly direction, the movement may be thought to belong. The Alpine upheaval is one of the latest in geological time. On the 28th a shock was felt at

Kirschberg, in Austria, and on the same day in the district of the Puy de Dôme, in France, still on the same parallel of latitude, but at a distance of 13° of longitude, and divided from the upheaval district of the Alps by three successive upheavals, of which the lines of force run in a northerly instead of a westerly direction. On the 3d of March shocks were felt at many places in Switzerland, again on another upheaval system. The shock extended to Alsace and the Black Forest, on the line of the upheaval of Monte Viso. On the 4th of March occurred the destruction of Casa Micciola, in the island of Ischia, a spot supposed to be connected with the volcanic system of Vesuvius, Stromboli and Ætna, and quite distinct from any of the formerly mentioned centres of disturbance. And as we write, on the 14th of April, arrives the intelligence of a second and most destructive earthquake at Scio, overthrowing most of the buildings spared by the shocks of the 3d inst. This island, which is an outlyer of Asia Minor, lies, we apprehend, on the line of upheaval of Tænarus, the last of those great elevations of mountain chains and large districts of country which have produced the actual physical conformations of the Old World.

During the fifteen days from the 26th of February to the 12th of March, no fewer than nine distinct earthquakes have thus been recorded in Europe, composed of twenty-three distinct shocks. This, however, is nothing compared to the seismic activity of other parts of the globe. In 1856 there were one hundred and eight shocks in Honduras in a single week, and at Hawaii, in the Sandwich Islands, two thousand shocks are said to have been counted in a month. But in Switzerland, where the subject of earthquakes is now carefully studied, the frequency of the phenomenon is said to be on the increase. In 1876 six shocks are known to have occurred; in 1877, five; in 1878, eight; in 1879, seven; in 1880, seventeen; and in ten weeks of 1881, eight. The last period of seismic activity in Switzerland commenced by a shock in the high Valais, on July 1, 1855, of such intensity that it was felt at Paris. Shock followed shock, though with decreasing intensity, for four months, but the movement did not finally cease until 1857, in the December of which year the centre of disturbance seems to have been shifted to Calabria.

The great earthquake of 1755, in which a portion of the quays of Lisbon, covered with terrified inhabitants of the city, suddenly sank beneath the water of the Tagus to an unfathomable depth, was the latest great terror of the kind to which Englishmen were wont to refer in the first half of the nineteenth century. So profound was the impression created by this calamity (of which the results are visible in unrepaired ruins at Lisbon to the present day) that a foolish prediction that a shock would occur on the centenary of the earthquake of Lisbon sent numbers of the inhabitants of London from their dwellings on the night in question. The alarm was very great, of course chiefly among the most ignorant.

Perhaps the first thing that deserves to be called study of the phenomena of earthquake is to be referred to the effects of the Calabrian earthquake of December, 1857, by which as many as thirty thousand people were said to have been killed or injured, chiefly in the province of Basilicata. An expedition was sent by the Royal Society into the interior of the Kingdom of Naples to investigate the circumstances of this earthquake. The report, by R. Mallet, was published in 1862, in two volumes, illustrated with plates, maps and cuts, and the work develops the first principles of observational seismology. The same author published, at Dublin in 1854, a "Notice of the British Earthquake of November 9, 1852," and an account of experiments made at Holyhead upon the transit velocity of earthquake waves through rock formations.

In Italy, subject as it is to earthquake, the study of the phenomena has been carried to a high degree of precision. An observatory has been established on the flank of Mount Vesuvius for the purpose of watching the indications of threatened eruption from the mountain, which are usually accompanied by local earthquakes. This observatory has long been presided over by Professor Palmieri, who (as we believe) was the inventor of the seismometer, seismoscope and seismograph, instruments for measuring and recording the force, duration and direction of earthquake waves. In these instruments the agitation or change of level of a mercurial column sets to work a delicate electric apparatus, which records the time of the first shock, the intervals between the shocks, the duration of each, their nature, whether vertical or horizontal, the maximum intensity, and, in the case of horizontal shocks, the direction in azimuth. These instruments are sufficiently sensitive to be affected by any violent shocks occurring in the Mediterranean basin. On the occasion of an eruption in the Greek Archipelago, Professor Palmieri announced the occurrence of a great disturbance long before the news reached Naples. Shocks occasioned by disturbance of Mount Ætna are readily observable by the seismometer on Vesuvius. We have not heard how far observations have been made at the dates of the Hungarian, Swiss, Italian and Ischian earthquakes of the present year, or that of the terrible catastrophe at Scio.

The point which seems to us at this present moment to be most deserving of attention in this country is the indication of either the deeply seated or the widely spread cause of activity of which we have had such disastrous proofs. It is probable that the seventeen distinct lines of upheaval which have been referred by D'Orbigny to geological date form but a small portion of the natural seismographic records which may hereafter be discovered impressed on the surface of the globe. But in the mean time it is instructive to refer both to these lines of direction, and to their comparative dates, as evinced by the unconformability of the strata deposited before and after their occurrence. The upheaval of Tænarus, the last of these great movements, is indicated as having occurred since the deposit of the modern alluvium. The upheaval of the Côte d'Or, in the direction W. 40° S., is the eleventh of the series of D'Orbigny, and separates the deposit of strata contemporary with our Purbeck beds from that of the upper member of the oölite, the Portland stone. Intermediate between these two disturbances lie upwards of four thousand feet of strata, grouped in twenty-six different beds. The Wealden, with its monstrous reptiles, the green-sand, and the enormous system of the chalk, are all later in formation than the upheaval of the Côte d'Or, the upheaval of Monte Viso being intermediate between the upper green-sand and the lower chalk. Thus a group of disturbances ranging from Auvergne, the Black Forest and the Great St. Bernard, to Foligno, Perugia, Ischia and the shore of Asia Minor, shows a connection with centres of geological action of enormous activity; and the phenomena demand a special study with regard to their geological relations.

As to this, the neglected aspect of the city of Lisbon affords a lesson which may afford much information. We should conclude that the valley of the Tagus was of or about the date of the upheaval of the Pyrenees, which marked, according to D'Orbigny, the close of the chalk period. Lisbon itself stands on four distinct geological formations. These are basalt, limestone, sand and what are called the Almada beds, thin strata of clay intermixed with sand. In the earthquake of 1755 nothing that stood on the two more ancient strata was seriously injured. The great Alcantara aqueduct, which crosses the valley to the north-west of Lisbon, was completed by the Marquis de Pombal in the very year of the earthquake. It is two hundred and twenty-five feet high over the deepest part of the valley. It consists of thirty-two arches, ranging from fifty feet to one hundred feet in span, and is very narrow. It was uninjured by the earthquake, though it is said to have been seen to rock, and one coping or cornice stone was said to have been thrown down. The Church of St. Gioachimo, at Belem, on the sand, was injured. But every building reared on the Almada beds was thrown down. To this hour (unless recent and unmentioned improvements have been effected) the visitors to Lisbon may trace the surface geology of the city by the lines of ruin effected by the earthquake of 1755.

The question arises, Was it to the different conducting power of the different strata, as regards the seismic waves, that the difference of safety is attributable, or was it to the depth or internal position of the centre of disturbance, and its relation to the upper portions of the different strata, that it is to be ascribed? The question is, we think, virgin. It is one of no small importance. And as relates to the possible return of earthquake activity in Europe, it is a question of primary importance as relating to the safety of the buildings of Great Britain. London, in any case, would fare ill in case of earthquake. The houses are not raised with any view of resisting such shocks, and the alluvium of the Thames valley would probably suffer as much as did the Almada beds of the valley of the Tagus.

We hardly yet can be said to have framed any intelligible theory of earthquakes. That there is an actual movement of the surface of the earth, there is no doubt. The writer, in the great Neapolitan earthquake of 1857, had to hold on to an iron railing in order to keep his feet, while the terrace on to which he had stepped in order to look at the volcano and see whether it was in eruption rocked beneath his feet just like a ship at sea; and in this same earthquake, — some thirty shocks occurring in the same night, — the whole circuit of the Bay of Naples was raised eight inches above its former level. But the shock felt is far more intense than that due to any observed movement. It is rather of the nature of the shock produced in the secondary circuit of the battery. In fact, as far as the nervous system can be depended on as a judge of the nature of shock, the effect of the two phenomena is identical. Thus the question of the conductivity of strata becomes one of very serious importance. What we want to know, in order to form any anticipation of the effect of greater activity in the internal force of the earth on the buildings of this country is, first, How do different strata comport themselves under given shocks? and, secondly, How far is such difference due to the position of the centres of disturbance, and how far to the conductivity of the stratum? —*The Builder.*

EXTRACTS FROM MINUTES BOARD OF TRUSTEES, A. I. A., MAY 23, 1881.

. . . MR. WARREN R. BRIGGS, of Bridgeport, Conn., was elected an Associate, and an application for membership was received from Mr. Gordon W. Lloyd, of Detroit, Mich. . . .

The secretary called up the question deferred from the last two meetings as to the best methods of increasing the membership and efficiency of the Institute. After some remarks, the secretary was requested to prepare a circular for distribution to architects, and to present the same at the next meeting.

The secretary read a report from Mr. T. M. Clark, Secretary for Foreign Correspondence, stating that he had received from the Chevalier da Silva, of Lisbon, honorary member of the Institute, a letter requesting him to convey to the Institute his gratitude for the resolution of approval of his efforts in the cause of architecture and archæology passed by the Board of Trustees January 20, 1881. Also a copy of his paper, read before the French Association for the Advancement of Science, on the Megalithic Monuments of Portugal, illustrated with a map; and likewise a copy of an official report on the National Monuments of Portugal.

The secretary also presented a letter from Mr. Clark, of same date, May 7, 1881, to himself, announcing that an exhibition of building appliances was to be held in Boston in September and October, in connection with the triennial fair of the Massachusetts Charitable Mechanic Association, but under the charge of a committee of nine members of the Boston Society of Architects. Mr. Clark suggested that the Board, instead of appointing the next convention of the Institute to be held in Washington, as requested at the last convention, should hold it a month earlier than usual, and in Boston, so as to give those in attendance an opportunity of visiting this interesting exhibition. Some discussion ensued, in which the facts were recalled that the Institute had already twice held its convention in Boston, while Washington, the capital of the nation, and containing some of the most prominent buildings in the United States, had not been visited; also, that the desire that the next convention should be held there had been strongly expressed at the last one, and resulted in a vote — published in its printed Proceedings and widely distributed — to that effect; as likewise that such a vote had always hitherto been conclusive with the Board. Mr. Clark's letter was then laid on the table.

Thanks were tendered to Mr. Robert Briggs, C. E., of Philadelphia, corresponding member of the Institute, for copies of his paper on the Ventilation of Halls of Audience, read in part at the last convention of the Institute, and published by the American Society of Civil Engineers. . . .

SOME INSTANCES OF INGENUITY.

A SPANISH steamer while crossing the Bay of Biscay in a severe storm gave such indications, by an unusual noise at the stern, as led the English engineer to suspect that there was something wrong with the screw-propeller or its shaft outside of the ship, — that is, in the open space between the stern and rudder-post where the screw revolves. There was no dry-dock in any of the ports on the coast where the ship could go to be examined; and on arrival at Vigo, it appeared as if there was no alternative but to remove the cargo from the stern, and by placing it forward, thus lift the screw-propeller and shaft to the surface of the water. The alternative, simple as it was, meant a serious delay and great expense. Before commencing to remove the cargo another consultation was held. It was then decided to put the stern of the ship over a bed of light-colored sand, and as the water was very clear there might be a possibility of ascertaining the extent or cause of the mishap. For two days after the vessel was so placed the wind caused a ripple on the water which effectually prevented anything being seen. It was then suggested by some on board to try the use of oil on the surface of the water around the stern of the ship. The effect was most satisfactory. The water was becalmed as if by magic, and it was then seen that the wedge or key which keeps the propeller in its place on the shaft had come partly out, and thus left the screw loose on the shaft, which caused the noise. By continuing the use of oil for a few hours, the wedge was ultimately driven into its place and secured. In this instance, many days of detention and the use of costly appliances and labor were thus saved.

Instances of a more complex character frequently occur where a knowledge of natural laws or forces may be brought into operation to assist in surmounting difficulties. Thus, a few years ago an iron bridge of considerable length, the weight being about two hundred tons, was constructed in England, and erected in a remote part of Germany. By some mishap, the bridge when finished was found to be some distance "out" to one side, an error which the proprietors insisted should be rectified. To take down and re-erect the bridge would be simply to ruin the contractor. But necessity is the mother of invention, and so it proved in this case. It was summer-time, and the contractor proceeded to find the amount of expansion which was caused by the heat of the whole length of the bridge. He next ascertained what contraction took place in the night by cooling. Armed with these data, he thought it might be possible to bring the bridge to its proper position in a few days. The bridge, of course, in its ordinary condition expanded from the centre, pushing its two ends outward, or further apart, and again contracting toward the centre. Taking advantage of these conditions, one end was made fast in the morning, and the bridge was forced to expand from that immovable point, instead of from the middle, as formerly. When the iron composing the bridge had expanded to its full length in the direction intended, that end was released, and the opposite end made fast. The bridge then contracted toward its true position. Thus, whatever was gained by the day's expansion was secured by the subsequent contraction when the metal was cooling at night; and the process being renewed day by day, the work was successfully accomplished.

A knowledge of the laws and extent of the expansion and contraction of metals opens up a wide field of usefulness in this connection, and is capable of very extensive application. We see large guns built up in this manner, which could not possibly be made in any other way by the appliances that we possess at present. The tires of wheels, as every one knows, are also fixed in their places by being first heated and then left to shrink. An ingenious application of this quality in metals was made use of in France, and has frequently been taken advantage of since. The walls of a large building in Paris were observed to be giving way by bulging outward, and the problem was to bring them back to their vertical position. For this purpose a number of bars of iron having screws and nuts on each end were let through the opposite walls, and across the intervening space between them. The nuts and screwed portion of the bars were outside. The bars were now heated by a number of lamps suspended below them, until they had expanded as much as possible, and the nuts screwed up against the outsides of two opposite walls. The lamps were next removed; when the heated bars, in cooling, gradually contracted in their length, bringing the walls very gently, but with irresistible force, into their normal position.

Still further, in relation to this subject, we are indebted to Captain Saxby of the Royal Naval College, of Woolwich, for a remarkably ingenious application of a very common instrument to the solving of a difficult but important problem. It is well known that in working iron, such as welding two pieces together, and even in its manufacture, hollow places occur, with merely an outside skin over the defective parts, which any test but a destructive one would fail to discover. Nor would it be difficult to point out numerous examples of disaster thus occurring. To test the homogeneity of the metal, Captain Saxby takes a bar of iron and places it on the equatorial line. He next passes a compass with a very sensitive needle along in front of the bar of iron, the needle of course pointing at a right angle to it. If the bar is perfectly solid through its whole length, the needle will remain steady. If, however, there should be a flaw or hollow place in the bar, the needle will be deflected as it passes from the solid to the hollow place backwards toward the solid iron; passing on over the hollow place, the needle will come within the range of the solid iron at the other end of the flaw, and will again be deflected forward. If the bar be cut through anywhere between these two points of deflection, a flaw will invariably be found. Many thousands of pieces of iron — some prepared for the purpose of testing this method of trial, others in the ordinary course of business — have been operated upon with the same unvarying result. Captain Saxby has called to his assistance Nature, who never makes mistakes in her operations. — *The Iron Age.*

NOTES AND CLIPPINGS.

BURSTING OF A WATER-TANK AT CINCINNATI. — A water-tank 100 feet in diameter and 48 feet high, situated on Price Hill and to be used for supplying the Western Hills with water, burst at 10.30 o'clock P. M., on June 29. It was made of twelve heights of plates, each plate of the following thickness: first height, 5-8 thick; second height, 9-16 thick; third height, 1-12 thick; fourth height, 7-16 thick; fifth and sixth heights, each 3-8 thick; seventh height, 5-16 thick; the others, each 1-4 thick. The tank was stiffened by four rows of angle and channel irons. The bottom was composed of 3-8 inch plates. All the plates were riveted together with 5-16 rivets 2 1-2 inches from centres. There was nothing on the inside in the way of tie-rods. The capacity of the tank was about 2,810,000 gallons. It was being filled for the first time, and about 2,300,000 gallons of water had been pumped in (or within 8 feet of the top) when the rupture took place. It seems that a section of one side, measuring about 30 x 40 feet, was torn out with a loud and sudden explosion, and hurled some 200 feet from its original position, and the entire balance of the tank was wrenched from its foundations and floated about 200 feet in another direction. The tank was commenced about three years ago, when iron was cheap, the total cost being about $35,000 without the foundations. It will cost to rebuild it at least $50,000. It is astonishing that no lives were lost, and that so little damage was done to adjoining property, for it is stated that $3,000 will pay all such losses. We are told that all the iron used was subjected to and stood a test of 65,000 pounds to the square inch. Of course there is to be a scientific investigation, and we shall hear all about the thickness of metal and the relative merits of Bessemer steel, homogeneous iron, etc. It is to be regretted that the engineer (Mr. James E. Bell) who prepared the plans and specifications is dead, for his testimony would be of much value.

STATUES FOR THE SCOTT MONUMENT AT EDINBURGH. — The vacant niches in the Scott Monument in Edinburgh will be filled with statues in the course of a year. In the competition which has been just settled about seventy sculptors took part. The Corporation on Tuesday last decided upon giving commissions for eight large statues at £52 10s. each, and twenty-four small statues at £25. The following are the subjects of the statues and the names of the sculptors who have been selected: Large niches, — Balfour of Burleigh and Knight Templar, W. Birnie Rhind; Rob Roy and Ivanhoe, John Rhind. Small niches, — Peter Peebles and Montrose, D. W. Stevenson; Julia Mannering, George Webster; Effie Deans, Lady Avenel, and David Deans, J. S. Burnet; Percy Shafton, Clark Stanton; Dougald Cratur, Charles Macbride; Weyland Smith, J. S. Gibson; Gurth, W. Sherriffs; Queen Elizabeth, W. Walker; the Abbess, W. G. Stevenson; Caleb Balderstone, W. G. Stevenson; Rose Bradwardine, D. Buchanan; Dirk Hatterick and Claverhouse, W. Birnie Rhind; Dugald Dalgetty, Ravenswood, Lady Rowena, Richie Moniplies, and Lucy Ashton, J. Rhind; Constance, Fraser Tytler. It was also arranged in addition that Mr. Brodie should be entrusted with the characters of Helen Macgregor and Cromwell, in large statues, and Madge Wildfire in small statue, and that Mr. Hutchison be entrusted with the characters of John Knox and Charles I in large statues, and George Buchanan in small statue. All the statues are to be delivered by March 1, 1882. — *The Architect.*

SLUMGULLION. — The Gold Hill *News* thus addresses itself to the definition and illustration of this word: "Slickens" is a granger word used in California to designate the slimy deposit or sediment which settles upon farming lands irrigated with the dirty water from hydraulic and other mining operations in the mountains. The original and only proper and appropriate term for that stuff is "slumgullion." That was always its legitimate name, from the earliest times down, among the old miners. Here in Nevada, what is known as "slums" or "slimes" is the sediment from quartz-milling operations, and carries a considerable amount of silver in the form of chloride. Caught and settled in dams or ponds, some of these slums or slimes pay well for re-working. It is of a similar nature and consistency as the California slumgullion. "Slickens!" What grass-headed cow-boy gave it that name there in California? Anybody who ever waded through, shovelled, or had anything to do with a deposit of that familiar old material knows the only natural word which fully expresses its character is "slumgullion." The substitution of the word "slickens" simply shows degeneracy, and the degree to which California has become grangerized.

ARTIFICIAL SEASONING OF TIMBER. — Mr. C. René, pianoforte manufacturer, of Stettin, Germany, as reported in *Engineering*, has devised a plan by which he utilizes the property of oxygen, particularly of that ozonized by the electric current, to artificially season the timber used for the sounding-boards of musical instruments. The first impulse to experiments being carried out in this direction was given by the well-known fact that wood which has been seasoned for years is much more suitable for the manufacture of musical instruments than if used soon after it is thoroughly dried only. Mr. René claims that instruments made of wood which has been treated by his oxygen process possess a remarkably fine tone, which not only does not decrease with age, but as far as experience teaches, improves with age as does the tone of some famous old violins by Italian masters. We are further told that the sounding-boards made of wood prepared in this manner have the quality of retaining the sound longer and more powerfully. A number of pianos manufactured at Mr. René's works, and exported to the tropics several years ago, have stood exceedingly well, and seem in no way affected by the climatic dangers they are exposed to. While other methods of impregnating woods with chemicals generally have a deteriorating influence on the wood fibres, timber prepared by this method, which is really an artificial ageing, becomes harder and stronger. The process is said to be regularly carried on at Mr. René's works, and the apparatus consists of a hermetically closed boiler or tank, in which the wood to be treated by the process is placed on iron gratings; in a retort, placed by the side of the boiler and connected to it by a pipe with stop-valve, oxygen is developed and admitted into the boiler through the valve. Provision is made in the boiler to ozonize the oxygen by means of an electric current, and the boiler is then gently fired and kept hot for forty-eight or fifty hours, after which time the process of preserving the wood is complete.

REMOVING SNOW FROM LONDON STREETS. — A somewhat unseasonable report in the present weather has just been issued, namely, that of the Engineer to the City Commissioners of Sewers, Col. William Haywood, on the removal of the snow after the great storm of January 18. Mr. Haywood says the superintendent of street-cleansing considers the fall of snow to have been from eight inches to nine inches during the 18th and 19th; but, to avoid exaggeration, he takes six inches as the depth. On this assumption, there were, before compression of the snow by traffic, on the entire area of the city, about half a million cubic yards, of which about 133,000 were on the public ways, and fully 70,000 of that quantity on the main lines. The 350 men and boys in the employ of the Commissioner were set to work immediately the snow commenced falling to keep the crossings and the carriage-way channels clear, and 233 extra hands were taken on during the day. During the night the men were allowed to rest; but on the second day a total number of 1,287 men and boys, and 288 horses and carts, were employed as a cleansing staff. The work was carried on night and day continuously till the 26th, the average number employed being 1,429 hands, 502 horses, and 490 carts; the extra hands were nearly all adults, and were engaged for six hours and then paid off, that being the amount of continuous labor that could be done in the snow. The rate of pay was 6*d*. per hour for the first seven days, and subsequently 4*d*. per hour. Supervision was difficult, but was carried out by the foreman of street-cleaning, the inspectors of pavements, and foremen of paving contractors, and masons from the city stone-yard. The greater portion of the snow was carted to London and Blackfriars bridges, and there thrown over the parapets into the river Thames. Large quantities were deposited upon the vacant lands, nearly two acres in extent, at Golden Lane and Petticoat Square. Snow was deposited on the open spaces at Smithfield, Finsbury Circus, and the vacant land at Whitefriars, and in all very wide streets. Attempts made to melt the snow by sprinkling it with rock-salt failed, owing to the severity of the frost. Clarke's apparatus for melting snow by gas, constructed in 1870, and used from time to time from that date, was brought into operation, and upwards of eight hundred cubic yards of compressed snow were melted by it. In Finsbury Circus additional apparatus of a similar character was temporarily fitted up, and two hundred and thirty-eight cubic yards were melted by it. The total cost of the removal of the snow was £4,254 1*s*. 3*d*. — *Building News.*

GROWTH OF TIMBER. — As the result of observation, and from the testimony of reliable men, the following is about the average growth in twelve years of the leading desirable varieties of timber, when planted in belts or groves and cultivated: white maple, one foot in diameter and 30 feet high; ash, leaf maple, or box elder, one foot in diameter and 20 feet high; white willow, one and a half feet in diameter and 50 feet high; yellow willow, one and a half feet in diameter and 35 feet high; Lombardy poplar, 10 inches in diameter and 40 feet high; blue and white ash, 10 inches in diameter, and 25 feet high; black walnut and butternut, 10 inches in diameter and 20 feet high. — *Scientific American.*

SNOW IN CITY STREETS. — "There have been various devices described for thawing the snow by artificial heat, one of which was alluded to on page 162 of your present volume. Their absurdity becomes evident when we look into the actual quantity of heat required, and the amount of fuel needed to supply it. In the latitude of Boston, many snow-storms bring an accession of snow equivalent to two or three inches of rain. If we call it only two inches, the quantity falling on a single mile of street sixty feet in width, besides what is brought from back-yards and slides from roofs, would be 3,294,720 lbs., or over 1,600 tons. It is well known, though perhaps not so well appreciated by all your readers, that ice or snow cannot be melted without supplying to it 142 degrees of heat, on Fahrenheit's scale; that is to say, as much heat as would be required to raise the same water after the thawing from 32 degrees to 174 degrees, or within 38 degrees of the boiling point. This 142 degrees of heat is absorbed by the water in the process of thawing, without any increase of its temperature, for the ice water is just as cold, as shown by the thermometer, as the ice or snow itself. The only apparent effect of this accession of heat is in the fluid condition of the water, which before was solid. It was proposed, in the article above referred to, to get rid of the snow in the streets by shovelling it into the sewer man-holes, where it was to be thawed by gas-burners. Suppose a force of men and teams to be employed adequate to dump the 1,600 tons of snow per mile of streets into the man-holes, how much gas would be required to thaw it by the heat evolved in its combustion? The combustion of a cubic foot of ordinary street gas evolves about 700 heat units. Although it is not practicable to utilize in melting the snow nearly all the heat so produced, a good deal of which will in spite of us escape into space, we will, for the sake of the argument, suppose it to be all saved and used. The snow from a mile of street would then require for its melting at least $\frac{3,294,720 \times 142}{700} = 668,357$ feet of gas. I will leave it for your readers to determine how many gas-burners, consuming four feet per hour each, would be needed to deliver and burn this amount within such a period as would be considered reasonable for removing the snow, and how many man-holes of the ordinary size and style would be required within the mile, to give room for these burners. The coal required to produce this quantity of gas is easily estimated. Modern gas-works turn out about five and two-tenths feet per pound of coal, so that it would need about sixty-four tons of coal to thaw in this way the snow from a mile of length of street. Possibly the parties who devised this system would find themselves, before finishing the job, in a similar position to that described by Swift where the Lilliputians undertook to provide for the bodily wants of their visitor, Captain Gulliver. They would certainly find that gas is but a poor substitute for sunshine in more ways than one." — *E. S. Philbrick in the Sanitary Engineer.*

THE VALI AND THE LIGHTNING-ROD. — Spiridion Gopcevich, in his amusing book upon Upper Albania, accounts for the dilapidated state of Scutari Castle by the following narrative, the authenticity of which he guarantees: "In the spring of 1874 the Vali of Scutari happened to hear that a hundred years or so ago a Giaour named Franklin had invented an instrument by the judicious use of which lightning strokes might be rendered harmless to human life and property. Forthwith he resolved to become possessed of one of these wonder-working contrivances; but upon inquiring its price he found that the resources of his exchequer would not avail to defray the cost of a complete apparatus. He therefore ordered from abroad the superficial portion of a lightning conductor, deeming its subterranean complement of wires superfluous, and when it arrived, caused it to be set up exactly over the powder-magazine of the castle in order to insure perfect immunity from electrical dangers to the explosive contents of that repository. An unusually long spell of fine weather succeeded the erection of the instrument, much to His Excellency's vexation; but at length, one sultry day, heavy clouds gathered rapidly over Scutari, and the exultant Vali, fortunately for himself, hurried down from the citadel to the town in order to watch the effect of the first flash from a window of his serai, commanding a fine view of the lightning conductor. He had not long to wait for a *coup* that surpassed his wildest expectations. A fiery streak darted from the sky, followed by a tremendous concussion, and when the smoke cleared off it was the Pasha's melancholy privilege to behold his beloved citadel in ruins. The Vali's mortification may be better conceived than described, especially when it reached his ears that a leading notable of Scutari, commenting upon the result of his scientific experiments, had observed: 'God is great, and the Vali is an ass! He has swallowed the Giaours' dirt and paid them for it to boot. His face is blackened forever. Allah's will be done!'" — *London Telegraph.*

THEORY OF LUMINOUS PAINT. — Light is supposed to be the vibration of an extremely elastic fluid called ether, which is supposed to fill the whole of space, and which, set in motion by the vibration of the luminous source itself, produces upon our eyes the sensation of light. Now, it is thought that the waves of light communicate their motion to the particles of the paint, which start into energetic vibration, continuing long after the exciting cause is withdrawn. When we ring a bell, the blow of the hammer communicates its motion to the particles of the bell, which start into action, imparting their motion to the particles of air, which transfer the vibrations to the drum of the ear and produce the sensation of sound, which grows fainter and fainter and fainter, until at last it dies away, when the particles of the bell are once more at rest; so it is with the luminous paint and all other phosphorescent bodies, the particles of which, when disturbed by the waves of ether, yield light for a time, which decreases in brilliancy as the particles grow less and less; they, too, like the particles of a bell, require periodical renewals of the force that affords them their motion. — *Progress of Science.*

THE NATURAL BRIDGE BOUGHT. — It is reported that the Natural Bridge tract in Virginia has recently been purchased as part of a general scheme, which is not yet fully developed, but which contemplates the laying out of an extensive park, and possibly the establishment of a school of forestry.

BUILDING INTELLIGENCE.

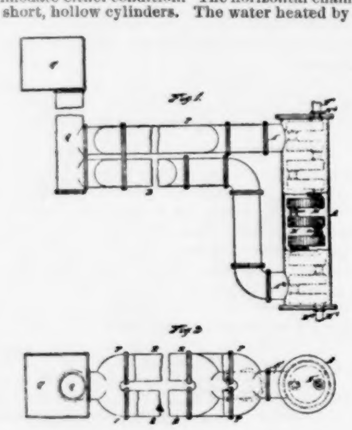
(Reported for The American Architect and Building News.)

[Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.]

BUILDING PATENTS.

[Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.]

237,508. HOT-WATER APPARATUS. — Thaddeus Fairbanks, St. Johnsbury, Vt. This invention is of that class in which the heat is received in the form of steam from a steam-boiler, and is communicated through metal chambers to a quantity of water, which latter circulates through suitable pipes, and forms a means for warming the air. A difficulty sometimes serious in this class of apparatus — the difference of expansion of the steam-pipe and of the water-vessel through which it passes — has been overcome. An upright water-vessel of liberal height and sufficient cross-sectional area is provided, with rigid connections at the top and bottom. There need be no stuffing-boxes or any kind of slip-joint, and all adjustment, attendance, and risk of leakage are thus avoided. Expansion and contraction of the steam apparatus within the water-vessel is allowed for by the construction. Instead of a direct pipe, there is a series of short pipes and horizontal connecting-chambers, so that the steam-passage is sinuous. The construction allows springing. When the whole is cold, the metal of the sinuous passage may be at rest or slightly stretched. When steam is admitted, heating up this metal above that of the outer case, the metal expands and endeavors to assume a greater length. This expansion leaves the metal at rest if it was before stretched. It cramps it or subjects it to a compressive strain if it was before at rest; but the construction allows it to spring enough to accommodate either condition. The horizontal chambers are short, hollow cylinders. The water heated by this



sinuous construction rises actively in the water-chamber and circulates through the system of warming pipes arranged in horizontal series. Only two pipes in the outward flow and two a little shorter in the return flow are shown; but the number may be increased indefinitely. The expansion-box for the storage of the surplus water is placed at the part of the apparatus farthest from where the heat is received. A is an upright water-vessel, of boiler-iron, with removable ends, and with capacious nozzles A′ A². The upper nozzle, A′, connects with a set of pipes, which are extended to any required distance and branched into any number of pipes P, which are again gathered at the other end into a single pipe, which is joined to an upright pipe, Q, carrying a liberal expansion-box, Q′, at its upper end. From a lower point in the pipe Q extends a horizontal pipe, which is branched into any number of pipes, R. These are gathered together again at the end nearest A, and joined to the lower nozzle, A². Within the upright vessel A are mounted a series of stout, hollow disks, M, of cast-iron, placed horizontally one above another, with liberal spaces between, connected at alternate ends, as shown by short lengths of pipe, *m*. To the uppermost of these disks M is connected a pipe, N′, which receives steam from the boiler. To the lower of the series of the disks M is connected another pipe, N², which may lead back to the boiler. The arrangement of the pipes P R in horizontal series is especially successful in greenhouses. The arrangement of the expansion-box Q′ at the end of the apparatus farthest from the heating-vessel, A prevents the interruption to the circulation of the air which is produced when such box is mounted, as usual, on the hottest end of the apparatus, and avoids the inconvenience in examining and replenishing when, as is sometimes the case, the water is being worked very hot. It is always sufficiently cool to avoid a generation of vapor. The box Q′ can be left open or simply provided with a loose cover of metal or wood.

243,365. MANUFACTURE OF IRON. — Charles M. Du Puy, Philadelphia, Pa.

243,391. HYDRAULIC ELEVATOR. — William H. Milliken, San Francisco, Cal.

243,397. REVERSIBLE LATCH. — Henry Pickford, Chelsea, Mass.

243,398. BENCH PLANE. — Samuel A. Piper, Newton, Mass.

243,405. DOOR-SPRING. — John T. Rush, Tyrone, Pa.

243,447. GLASS WATER-CLOSET BOWL. — George E. Hatch, Meriden, Conn.

BUILDING INTELLIGENCE.

243,448. VENTILATING APPARATUS. — James F. Hoyne, London, Eng.

243,465. CURTAIN-FIXTURE. — John Shorey, Lowell, Mass.

243,504. BRICK MOULD. — George Cornell, Philadelphia, Pa.

243,505. BRICK-MACHINE. — George Cornell, Philadelphia, Pa.

243,508. WINDMILL. — Oliver T. Chamberlain, S. D. Straw and A. J. Signor, Elkhart, Ind.

243,509. WRENCH. — Luke Chapman, Collinsville, Conn.

243,518. HEAT-ALARM. — James Curran, New York, N. Y.

243,532. ELEVATOR-HATCH DOOR. — George M. Eames and Jeremiah Stever, Bridgeport, Conn.

243,533. MITERING MACHINE. — Wm. E. Eastman, Worcester, Mass.

243,541. SPRING-LATCH. — Edwin H. Frost, Dover, N. H.

243,548. HOT-AIR STOVE. — Egbert C. Goodrich, Pontiac, Mich., and J. W. Johnson, Moravia, N. Y.

243,552. AUTOMATIC STOP FOR ELEVATORS. — Gustav F. Hemmer, Cincinnati, O.

243,574. BOILER-FLUE SCRAPER. — John L. Kelley, Erie, Pa.

243,577. MITER BOX. — Nathan J. Kruch, Walton, N. Y.

243,582. DOOR-HANGER. — Herbert M. Landers, Whitney's Point, N. Y.

243,590. PIPE-HANGER. — John F. Mellingrodt, Denver, Col.

243,592. JOINTED PITCH-BOARD FOR SQUARES. — Frederick M. Mervick, Palatka, Fla.

243,613. TRANSOM-LIFTER. — Francis V. Phillips, Chicago, Ill.

243,630. LIGHTNING-ROD. — Jas. H. Schoonmaker, Winona, Minn.

243,641. EARTH-AUGER. — Edward A. Smith, Greeley, Col.

243,648. SINK-STRAINER. — John M. Stimpson, Boston, Mass.

243,649. HYDRAULIC ELEVATOR. — Samuel E. Stokes, Philadelphia, Pa.

243,652. COMBINATION TOOL. — Jno. Straszer, Manchester, Mo.

243,653. COMBINATION HAMMER. — The same.

243,665. COMPOSITION FOR GRAINING AND FINISHING WOOD. — Adelmer Wells, Coopersville, Mich.

9,779. (*Reissue.*) DEVICE FOR MAKING PLUMBERS' TRAPS. — Robert Cunningham, Chicago, Ill.

9,780. (*Reissue.*) FIRE EXTINGUISHER. — Harry S. Parmelee, New York, N. Y.

7,782. (*Reissue.*) DOOR-HANGER. — Geo. H. Kidder, Armeda, Mich.

SUMMARY OF THE WEEK.

Boston.

BUILDING PERMITS. — *Brick.* — *Newbury St.*, near West Chester Park, for John A. Burnham, dwell. and stable, 27′ x 75′, two-st'y.

Washington St., near Dudley St., for G. W. Meserve, family hotel and store, 59′ x 100′, four-st'y; G. W. Meserve, builder.

BUILDING INTELLIGENCE.

Wood. — *Forest St.*, near Adams St., for John I. Gurney, greenhouse, 32′ x 80′; John I. Gurney, builder.

Centre St., near Wise Pl., for Geo. Becker, dwell., 23′ x 31′, two-st'y; J. L. Dakin, builder.

Perry St., near Decatur St., for James Meade, stable, 37′ x 62′, two-st'y; Murphy & Shea, builders.

Delle Ave., near Burney St., for Ellen Donnelly, dwell., 22′ x 31′; Jacob Luippold, builder.

Spring Garden St., near Crescent Ave., for James Higgins, dwell., 26′ x 29′; Jas. G. Allright, builder.

Dyer St., near Evans St., Rollin Caud, dwell., 20′ x 26′, two-st'y.

Euclid St., near Washington St., Joseph M. Pike, dwell., 20′ x 30′; Eben F. Browne, builder.

Cambridge St., rear of, near B. & M. R. R., for Frederick R. Cutter, trunk factory, 40′ x 100′, four-st'y; D. A. Gilchrist, builder.

STORE. — A store and office-building is being built on Washington St., near Bromfield St., for the Boyle heirs. It will be a four-st'y brick, stone and iron front, 23′ x 65′.

Brooklyn.

BUILDING PERMITS. — *North Eighth St.*, s s, 150′ e Fourth Ave., 2 three-st'y frame tenements; cost, each, $4,000; owner, Peter Koelch, 361 Fourth St.; architect, J. Platte; builders, B. Rauth & Bros. and C. Wieber.

Monroe St., n s, 375′ e Ralph Ave., 3 two-st'y brownstone dwells.; cost, each, $3,800; owner, P. Butler; architect and builder, W. Walsh.

Waverly Ave., e s, 325′ s Greene Ave., 3 three-st'y brick dwells.; cost, total, $10,000; owner, Thomas Read, 440 Washington Ave.; architect and builder, H. J. Smith; mason, J. K. Bentzen.

Prospect Ave., s s, 200′ w Fifth Ave., 5 three-st'y brick flats, 20′ x 45′, felt roofs; cost, each, $4,000; owner, D. Doody, 598 Fifth Ave.; architect, H. R. Searle.

Concord St., s e cor. Adams St., 5 four-st'y brownstone flats; cost, each, $8,000; owner, Thos. H. Brush, Fourth Ave., near Bergen St.; builder, J. M. Brown.

Greene Ave, n s, 100′ w Throop Ave., 3 three-st'y brownstone dwells.; cost, each, $4,800; owner, M. A. De Revere, 436 McDonough St.; builder, J. De Revere.

Hancock St., s s, 220′ e Nostrand Ave., 3 three-st'y brownstone dwells.; cost, each, $8,000; owner and builder, H. A. Weed, 243 Putnam Ave.; architect, M. J. Morrill.

Hudson Ave., w s, 161′ 5″ s Concord St., three-st'y brick factory; cost, $3,700; owner, A. Levy; carpenter, Mr. Rae; mason, P. R. Kelly.

Clinton St., w s, extending from Atlantic St. to State St., six-st'y flat of 8 stores and 40 suites of apartments; cost, $275,000; owner, E. Fougera, Seventh St., near Sixth Ave.; architect, M. J. Morrill; builders, Drummond & Jones.

Third Pl., e s, 100′ e Court St., 2 four-st'y brick apartment-houses; cost, each, $12,000; owner, E. H. Kellogg, 452 Henry St.; builders, Blaisdell & Co.

Eighth St., n s, and w Second Ave., rear of First Basin, two-st'y frame factory; cost, $4,250; owner, U. S. Animal Oil Refining Co., 30 Water St., New York; builder, D. E. Harris.