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AMONG the many newspaper paragraphs inspired by the late destructive cyclone in Minnesota, it is a little singular that so few should contain any hint of the possibility of making dwelling-houses secure against such atmospheric disturbances. One writer, indeed, thinks that when "scientists" "work for defined objects instead of trusting so much to experimentalism" something may be done to prevent or moderate tempests, but he gives no indication of the processes by which so desirable a result is to be brought about. Without asserting that the winds will never be brought under human control, we may safely say that for the present scientific "experimentalism" will be more likely to lead to useful results if directed to the problem of securing buildings to the ground, rather than to directing the movements of the clouds; and the effect, so far as the citizens of the Western plains are concerned, will be practically the same. It is notorious that the frame buildings of the West are very generally of a construction so ingeniously light that perhaps no kind of human habitation, except a tent, presents so large a surface to the wind, with so little substance to keep it in place. Timber being scarce in many parts of the West, and labor and transportation dear, the intelligence of the early settlers soon modified the substantial structure of their ancestral homes into the "balloon-frame," light, cheap, and strong, so long as it did not have to resist the terrible local storms which have now proved their claim to be considered in planning such constructions, but this element once recognized, it is only fair to presume that the necessary further modifications will be easily made.

THE New Jersey State Board of Health has undertaken a work which bids fair to be extremely useful. New Jersey is one of the few Eastern States which still retains its annual State Fair, collecting a large number of persons from all the surrounding country; and the Board of Health conceived in 1879 the idea of popularizing certain elementary knowledge concerning sanitary appliances by exhibiting a collection of such as were available with the other attractions of the Fair. The attempt was so successful that it is to be repeated this year on a much larger scale, and the Board has issued a circular inviting exhibits of various classes of goods, including not only plumbing appliances but also heating and ventilating apparatus, food-products, disinfectants, gymnastic apparatus, school-room furniture, building-stones, concrete and other materials, wall-paper and decorations. Diplomas and medals are to be awarded in each class, and tests will be made in the presence of the judges of any objects which seem to require it. Foreign exhibits are particularly invited, and for such goods the cost of transportation from New York will be paid by the Board. Other exhibitors will pay their own transportation bills, but no charge will be made for entries or for space. If desired, the Board will accept any article exhibited, and place it in its permanent museum now forming at Trenton. The Fair is to be held at Waverly, near Newark, beginning September 19, and goods may be sent to that address, marked "care of New Jersey State Board of Health." A grand medal is to be awarded to the best plan for drainage on a large scale, and as New Jersey is already somewhat advanced in this science, an interesting competition under this head may be expected.

A LITTLE additional evidence upon the relative value possessed by the two systems of sewage disposal now in use at Coney Island is afforded by the report of Mr. La Fetra, Secretary of the Brooklyn Board of Health, who was called in as an expert by the Board of Health of the town of Gravesend to examine the drainage apparatus employed at Manhattan Beach, and ascertain whether the discharge of the sewage into Sheepshead Bay was likely to result in unpleasant consequences to the persons dwelling along its shores. Mr. La Fetra seems to have carried out his task with commendable thoroughness. After describing the sewerage system of the Manhattan Beach Hotel and its dependencies, with which we are already acquainted, consisting principally of an immense main drain, carried eastward to a point well out into the tide-way, and intended to discharge only on the ebb, so that suspended matters may be carried immediately out to sea, he observes that in practice there is more or less flow from the drain at all hours, and that appearances do not by any means indicate that the matters evacuated by the special ebb-tide discharge are carried away with the completeness which was hoped for. On the contrary, it was found that around the mouth of the sewer the sandy bottom is already covered by a deposit of fetid mud, extending some two hundred feet in all directions, and nearly a foot in depth at the middle. In other portions of the bay similar deposits have formed, and instead of the current being invariably outward, it is found that the lighter offal is brought upward by the returning tide, and deposited along the shores, giving rise to offensive and unwholesome exhalations. What steps the citizens of Gravesend will take to prevent further injury is as yet undecided, but it will do no harm meanwhile to call attention to this partial failure of a costly scheme, for the benefit of those who may be intending to adopt similar systems. The citizens of Boston, for example, are at this moment spending enormous sums of money in carrying out a project identical in every important respect with that of the Manhattan Beach Improvement Company, and those who will be called upon to pay the cost may well interest themselves in ascertaining the probable results.

A WEEK ago the passenger elevator at the Revere House in Boston fell, by the breaking of the ropes, to the basement, a distance of twenty-one feet. There were six passengers in the car, one of whom had an ankle broken by the concussion, while the others fortunately escaped without serious injury. The platform was suspended by two ropes, both of which, with the counterbalance rope, parted at the same instant. It cannot be too strongly impressed upon the minds of those who use elevators that the multiplication of suspension ropes affords little guaranty of increased safety. If a car could be sustained by two ropes at precisely the same tension, and in such a way that on the parting of one the weight would be shifted to the other without shock, there might be a great advantage in their use; but in practice this is never the case. If the ropes are attached directly to the car, the strain upon them varies continually, and the snapping of one is liable to throw almost the whole weight suddenly upon the other, with a shock far more destructive in its effect than a simple tensile strain; and if, as is sometimes the case, the car is suspended from the middle of a tilting bar, whose ends form the points of attachment for the ropes, the strain upon these is indeed equalized, but the breaking of one allows the car to drop through a distance equal to half the length of the bar before it is arrested by the other, and the momentum thus acquired is often quite sufficient to snap it instantly.

THE peripatetic committee of the City Fathers of Buffalo, appointed to search for an "eminent sculptor or architect" who could give them a design for a soldiers' monument better than any of those submitted in competition, has returned; or, as it seems, did not go away at all, but contented itself with inviting Mr. St. Gaudens of New York to visit the city, where he was kindly entertained, and after inspecting the various designs on exhibition in the City Clerk's office was shown the proposed

site of the monument, and finally, in consultation with two of the Aldermen, expressed his willingness, in association with an architect to be named, to furnish drawings of a monument to be approved of by the committee, and to cost not over fifty thousand dollars. "Upon this understanding," says the Buffalo *Express*, "it was arranged that a meeting should be called, at which a resolution should be offered rejecting the designs already submitted, and giving authority to the committee to engage the services of Mr. St. Gaudens." Which of the St. Gaudens brothers is the gentleman honored by this peculiar commission is not quite clear; but the monument will, in the hands of either, undoubtedly be interesting and successful. What the original competitors think of the transaction is another affair. We have ascertained the opinions of one or two of them, but forbear to quote them, inasmuch as they might be construed as reflecting upon the taste or fairness of the committee, which seems to be a hazardous matter, one member, a butcher, having already declared that if an editor who said that he could not select a monument as well as an architect would come to his store, "he would make him see something." We will, however, suggest to our own readers that professional honor has something to say in the matter, and that although it may have been wise for twenty-six architects to waste time and money in preparing designs without any prospect of adequate compensation or intelligent judgment, this does not put them beyond the pale of that mutual support and protection against injustice which should be, and is to a great degree, the pride of the profession; and we should have little respect for the architect who would consent to accept such a commission without insisting on proper recognition for those whom he had supplanted, not in fair trial of skill, but by the caprice of persons at whose hands, under different circumstances, he might have experienced the same treatment.

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The cause of better factory construction has been taken up in Cincinnati since the late terrible fires, and in the present state of public feeling it seems as if the "slow-burning" modes of building which are so rapidly coming into use in the East might find speedy and intelligent acceptance there. We commend the mill-owners of that city to the benevolent attention of Mr. Edward Atkinson and his colleagues, and promise such assistance as our own modest efforts can give. One sensible writer in the Cincinnati *Commercial*, after saying, what is undoubtedly true, that no fire has occurred there for a year which could not have been prevented by simple and perfectly available means, warns his readers that no insurance can make good the loss to a manufacturer by a destructive fire, which, independent of the mere loss of goods, buildings, and machinery, costs him the trade which will be taken from him and retained by his rivals while he is engaged in preparations for resuming business, besides the actual interruption of his profitable industry; and calls upon them, for their own interest, if not out of regard for their poor employees, who, even if they were always certain of escaping without bodily injury from fires, cannot insure themselves or their dependent families against the distress caused by the sudden loss of tools and employment, to take measures for diminishing the peril which daily menaces the manufacturing interests of Cincinnati. It is to be hoped that his warning will attract attention, and that at least the criminal carelessness which led to the last great conflagration will not be suffered again.

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The experiment made by certain members of the Sanitary Reform Association of New York, in constructing a block of tenements so planned as to secure light and out-door air for each room, privacy and convenience for each apartment, with pleasant and salubrious situation, at prices within the reach of the very poorest, seems likely to meet with complete success. The buildings, whose admirable plan has already been laid before our readers, are now nearly finished, and in about two months more will be ready for their fortunate occupants. They will contain two hundred and eighteen apartments, of from two to four rooms each, and ten stores fronting on First Avenue. Every apartment, whether of two, three or four rooms, will have its own private hall and water-closet, sink with Croton water, and chute for ashes, coal-bin in the basement, and space for drying clothes, plenty of light and air, and a share in the use of the two tenants' reading-rooms and of the pavilions on the roof, for cool breezes and recreation in hot weather; besides a right to the services of the janitor and his assistants in guarding the building and in keeping it and its entrance-ways clean, and the additional convenience, contrived with a happy appreciation of the wants and habits of tenants, that all the ten stores on the avenue can be entered from the court-yard, so that the inhabitants can procure their household necessaries, or send their children for them, without leaving the building, or being obliged to thread their way among the rough and careless crowds in the streets. That all these blessings, literally inestimable to those whose hard life admits of no relief or respite from the influences of their surroundings, will be within the reach of any person not absolutely dependent on charity is to our mind the crowning excellence of the undertaking, and the best evidence of the skill and care with which it has been carried out. At an average rent of eight dollars a month for the tenements and thirty dollars for the stores, the total annual rental of the buildings will amount to very nearly twenty-five thousand dollars. The cost of the land and buildings will be two hundred and fifty thousand dollars, so that even with a liberal allowance for salaries of janitor and assistants, and incidental expenses, a return of eight per cent on the money invested is practically certain. These rentals are low enough, lower, indeed, than those current in the most squalid parts of the city, and no attempt will probably be made to reduce them out of mistaken generosity; but by agreement among the owners of the property, the excess of income over five per cent is to be reserved as a fund for the erection of other similar structures.

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An apparatus is said to have been invented by Herr Meydenbauer, Inspector of Buildings at Marburg, which promises to be of some value in architectural drawing. No particulars are given, but the substance of the invention appears to consist in a device for reconstructing the perspective representation given by ordinary photographs, so as to exhibit the various parts in their true geometrical relation. This is not a very difficult operation, even without special apparatus, and most students of perspective have probably amused themselves by finding the two vanishing points of an architectural photograph, and retracing the perspective processes until the two geometrical elevations were regained. The studies so made have a very considerable value, and such exercises will do more to instruct the young architect in the proportions of a style than the study of a hundred sketch-books, whose authors generally care much more for effective drawing than exact representation of what they see, and often falsify their subjects to an incredible degree, either in the pursuit of picturesque effect, or from pure carelessness; and Herr Meydenbauer's method, if it shortens the labor of transforming converging into parallel lines, may meet with extended application. It has, according to the accounts, another use, in making it easy to obtain accurate records of inaccessible or perishing objects. During the stay in Persia of the German expedition which observed from that station the recent transit of Venus, one of the party took an opportunity to photograph an ancient mosque at Shiraz, dating to the ninth century, but guarded by fanaticism from infidel curiosity, and with the help of the new invention accurate plans and elevations were constructed from the photographic prints.

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It has long been rumored that Mr. Charles Brush, the inventor of the electric lamp which bears his name, had succeeded in the storage of electricity by a method somewhat analogous to that of Faure and Planté, but it is only within a few days that a definite announcement of the fact has been made. What are the means or methods which Mr. Brush employs, we are not yet informed, but it is claimed that the capacity of the reservoir is double that of Faure's. No one can doubt that in the present state of electro-chemical science the complete solution of the problem will be long deferred, and by its solution will be opened a new era in the application of natural forces to the service of man. If we could conceive a compact and portable steam-boiler without water or fire, under no tension, and therefore free from danger of bursting, needing no attention beyond the periodical filling from a public supply, furnishing light, heat, chemical force or power in a thousand forms at pleasure, and at any point, on the application of a silk-covered wire; such an apparatus would but feebly represent the secondary battery as we may hope before long to see it. It is true that Faure's lead plates are far enough from any practical application, but they have demonstrated an important and almost unsuspected fact of physics, in a way which will attract the attention, and engage the effort, of the whole scientific world.

## ARCHITECTURAL ASPECTS OF THE CHIAN EARTHQUAKE.

[THIS interesting letter was sent by Mr. Joseph Thacher Clarke, Corresponding Member of the American Institute of Architects, and Special Corresponding Member of the Boston Society of Architects, now in charge of the explorations in progress at Assos for the Archæological Institute of America, to be read before the Boston Society of Architects. Arriving too late for the last meeting of the season, it has seemed that the wishes of its author would be best served by publishing it here, instead of waiting until the first meeting of the next season. It is only to be regretted that the photographs sent to illustrate it cannot also be reproduced.]

ASSOS, May, 1881.

PERHAPS no part of Hellenic Asia, certainly none of the Sporades, had — before the late disastrous earthquake — a more peculiarly characteristic architecture than the Island of Chios. It is by an acquaintance with the man and his natural surroundings that one understands the exceptional features of his house; idiosyncrasies of building are always observable united to marked traits of race, and the ruined dwellings of cramped though extended plan, badly jointed masonry and delicate wood-work are as characteristic of the unhappy island as are the spare, long-headed and hook-nosed inhabitants, — now so homeless.

The Chiote is of different stock from his neighbors upon the western islands of the Archipelago, and differs greatly from the Peloponnesian Greek; so much more Oriental is his appearance that it is a popular belief in the East that a vessel containing a great number of Jews who were being transported to Rome, after the sack of Jerusalem by Titus, was wrecked upon the coast of Chios, and that these Israelites intermingled with the native population, altering the Ionian character and physiognomy. Be that as it may, the marvellous productiveness of the island, and consequent immunity of its inhabitants from great exertion of any kind, while living under a foreign despotic rule, has not been such as to encourage great energy or liberality of character, or to lead to a careful and monumental execution of the public buildings and extensive dwellings necessary for a numerous and, for Oriental conditions, exceptionally wealthy population. Under the most genial of skies, protected by the surrounding sea from extremes of temperature, and by steep cliffs which enclose the inland vales from the fierce winds which winter and summer disturb this part of the Ægean, the island has been so populous and fertile that Lamartine could truly say: "I know of nothing in Europe that presents an aspect of greater richness than Chios." Even in antiquity the capital possessed more slaves than any other Greek city except Lacedæmon[1] and the "*vita Chia*" of Petronius[2] was the height of sensual indolence. The favored demesne of the Sultana Mother, the island — which, from the superior gum-mastic[3] produced upon it, has, with poetical justice, become that of Turkish women — has enjoyed an almost entire freedom from commercial taxes, during the centuries of Ottoman supremacy. Yet this immunity from a financial oppression which has been sorely felt in neighboring provinces may in as great a degree be held accountable for the notorious closeness of the Chiotes in money matters as for the flourishing condition of trade upon the island during the seventeenth and eighteenth centuries. Every one familiar with the expressive gestures of the Levant will remember the twitching of the jacket-hem and the muttered "*χώτης*," by which the significance of extreme stinginess is conveyed.

While, on the one hand, indolence and the dislike of unnecessary outlay have long hindered the erection of wisely planned and carefully executed masses of masonry, on the other a love of luxury and a certain Semitic fondness for outward display, which well accords with their personal appearance, have led the Chiotes to erect extensive buildings with the least possible expense of time or money. The greatest prosperity of the island, since the Mithridatic wars, was experienced during the two hundred and fifty years of Genoese sovereignty, commencing shortly before the middle of the fourteenth century. The chief town of Chios, with its suburbs, has frequently been celebrated by modern travellers as a reminiscence of Genoa and its territory[4] in miniature.

Buildings constructed during the middle ages by the more energetic and thorough Europeans did not easily make way for the flimsy houses of modern times, and some Genoese dwellings even resisted the recent earthquake; but when they could no longer be preserved and new walls were required by the Turks and Greeks, the squared blocks of these earlier fortifications lay near at hand and were formed into masses of masonry of great thickness, without even the employment of mortar. Good limestone quarries exist upon Chios and were celebrated by Pliny,[5] who says that the first mottled marbles introduced into Rome were brought from Chios; but this natural deposit has not been greatly drawn upon; the marble remains of antiquity, never extensive upon the island, were soon exhausted by the mediæval lime-kilns, and the importation of lime from the Continent is an item of too great cost to find favor in the eyes of the Chiotes. Such uncemented walls of hewn stones, bedded in thick layers of dust, were among the first to fall before the trembling of the earth, and led to the greatest destruction and death.

It is a remarkable illustration of blind human trust in continuity that the citizens of Chios should keep on building in so untrustworthy a manner in view of the reputation of the island for earthquakes and the number of shocks which of late years have affected neighboring sites. The islands of the Ægean have always been more or less frequently visited by earthquakes; in them all the conditions are united which are usually regarded by geologists as favorable to such disturbances. At some places, like Santorino and its vicinity, there are active volcanoes which precede their eruptions by shocks upon the crystallized formations which it is necessary for them to break through. At others the mineral springs so common in all the Sporades have for centuries percolated the inner strata and washed away all the soluble materials: thus forming cavities in the depths of the earth, which at times fall in, and being situated at great depths, cause a concussion felt over a tract of considerable extent. And, finally, it appears natural that the universal shrinkage and cracking of the earth's crust should be felt with particular violence in regions which, like the islands of the Archipelago, are so deeply divided by arms of the sea that the projecting cliffs can offer far less resistance than, for instance, the broad plains of southern Russia. The geological character of Chios is, however, not volcanic in the strict sense of the word, older formations, like gneiss and crystalline slate, predominating, above which are tertiary limestones, sandstones and alluvial deposits. It is only upon the northern coast that there are some trachytic lavas and strata of hornblende; the principal chain of mountains which traverses the island from north to south being of a gray magnesic limestone. Still Chios has always been celebrated for volcanic disturbances. The fall of a school-house upon the island recorded by Herodotus,[6] where of one hundred and twenty boys who were learning to read only one escaped alive, may very plausibly be attributed to an earthquake, and at all events bears witness to a carelessness of building similar to that lately customary there. Thevenot[7] writes that for some years previous to his visit Chios was repeatedly subjected to tremblings of the earth. Nor have recent warnings been lacking. In 1868, serious damage was done to the town and island of Mytilene, but a few miles distant; and in July of last year (1880) considerable expense was entailed upon the property-holders of Smyrna and Phocæa by shocks which overthrew insecure walls, and cracked ceilings and plastering.

Viewed in this light, the heedlessness of the builders of modern Chios appears absolutely culpable. The most common precautions, of general arrangement as well as of detailed construction, — precautions which have long been universal in the building practice of Smyrna and Syra, — were in Chios neglected. The houses averaged much greater height than those of Mytilene; their walls, which were not rendered in any degree elastic by the introduction of timbering, were piled up without jointings of mortar, while the thick filling between the squared faces consisted often of rounded pebbles, washed up by the sea. Buildings wholly of wood, which alone can afford absolute protection against severe earthquakes, are rare in Asia Minor and the Archipelago, occurring only upon the outskirts of cities, as, for instance, upon the Smyrna quay, where coffee-houses and shops are built of the lighter materials, because liable at any time to be crowded from land of increasing value by more permanent structures of masonry.

The eastern coast of the Mediterranean produces little more timber than is required for the use of ship-builders and charcoal-burners, and since the deforestation (to coin a word) of the country for centuries, Chios is as badly off in this respect as any other district, although it was known in early antiquity as *Pityusa*[8] or Pine Island from its groves of evergreen. Even Mytilene, the best wooded of the Sporades, and on this account a modest centre for the ship-building craft of the northern Ægean, is obliged to import a great part of the boards and larger timbers employed for architectural purposes from Trieste, and from the Danube by way of the Black Sea. Styria and Carinthia furnish almost all the beams and joists used in Asia Minor, the tabulated report of imports to Smyrna showing that the value of the lumber introduced amounts to between one hundred and one hundred and twenty thousand dollars, yearly. European boards of good quality, measuring 10 feet by 18 inches, with a thickness of 1½ inches, obtain a wholesale price of 12 or 15 silver piastres (50 or 60 cents) each, while the miserable wood of the country, not obtainable in large pieces, is quoted at fully half that price. It may serve as an illustration of the scarcity of wood in the Levant, and its consequent expense as a building material, that the lumber brought into the port of Smyrna from 1863 to 1872, inclusive, exactly equalled in value the Turkish carpets and rugs exported during those years from that chief mart of the staple products of the East. It is thus evident that timber cannot be extensively employed in a land where the cost of a well-built dwelling-house of the upper classes seldom exceeds one and one-half Turkish pounds the square pik, — or less than seven dollars and a half the square metre, if of one story; and where a two-storied villa rarely costs more than half as much again for the superficial area covered.

The system of true half-timbered construction is known among the Turks under the name *Chatmàr*, and is employed in exceptional

[1] Thucydides, VIII., 40.
[2] Petronius, 63.
[3] For an interesting account of the ancient cultivation, price and employment of the gum-mastic peculiar to Chios, see Pliny, XII., 36; XIV., 1; and XIV., 74.
[4] Thus Chandler in his *Travels*, Vol. I., p. 108, says that the city of Chios and its environs, seen from the sea, resembles in miniature Genoa and its territory; while Choiseul-Gouffier in his *Voyage dans l'Empire Ottoman*, Vol. I., p. 143: "Scio est la ville du Levant la mieux bâtie. Ses maisons, construites par les Génois et les Vénitiens, ont une élégance et des agréments qu'on est étonné de rencontrer dans l'Archipel. . . . L'aspect de son port est très agréable, et ressemble infiniment à celui de Gênes." Compare also in this consideration Tournefort, *Voyage*. Vol. I., p. 370, etc.
[5] Pliny, V., 31; XXXVI., 5.
[6] Herodotus, VI., 27.
[7] Thevenot, Travels into the Levant, Vol. I.
[8] Pliny, V., 31; Strabo, 589.

instances, — usually when the client has too often been a sufferer from the destructive effects of earthquakes upon masonry to object to the considerably greater expense of this manner of building. But in the majority of cases when any precaution is taken to combine the elastic resistance of wood with crumbling stone-work, the *Chatmàr* is reduced to the *Frenghèh:* a method of putting into the masonry a few diagonal ties of wood, which form only a small part of the wall mass. This *Frenghèh* may, as its name signifies, have been introduced into the building practice of the Levant by the Franks, who for the last century have led the way in all matters of constructional improvement, but who, unfortunately, have not always accepted the existing architectural advantages of the Turks in artistic respects.

Such, however, have been the indolence and parsimony of the inhabitants of famed Chios, that neither of these combinations of wood and masonry, nor yet the practice of turning relieving arches of bricks, or thin stones, in the thickness of the wall, were commonly employed in the capital which has now become so complete a ruin. The sudden and entire downfall of Lisbon, one hundred and twenty-five years ago, is described by contemporary writers as in great measure owing to the practice of employing so inadequate a binding medium as kneaded clay (*pise*) in the place of cement for walls often seven stories high. And inasmuch as the absolute vibrations of the earth were not nearly so strong in the Chian as in the famed Portuguese earthquake, it may fairly be said that the insufficient strength of the building construction has, in the recent calamity, been answerable for a comparatively greater part of the demolition, and consequent loss of life, than in the case of Lisbon. Mytilene, because of its lower buildings, and Smyrna, because of its superior constructive methods of partial timbering and arching, could not have fallen so entirely from the effects of shocks equally strong.

The earthquake of April 3 was distinctly felt at Smyrna, though it cannot be said to have caused serious damage upon the mainland beyond the district of Chesmeh and Alatzata, the home of the Sultana rasjon, bounding the Strait of Chios on the east. The first shock was at quarter of two, one Sunday afternoon. The writer was walking in one of the narrow ill-paved lanes of Smyrna, and felt the ground sway beneath him; at the same time pools of water which stood in the middle of the passage slopped from side to side, as one is accustomed to see water in the fixed bowls of ocean state-rooms maintain its level in a heavy sea. The recollection of the before-mentioned earthquake of last July was still in the minds of the Smyrniotes, and numbers of them trooped out into the street, — like wasps whose nest has been shaken, — pointing excitedly to chandelier-lamps and other hanging objects, which were swinging vigorously from side to side. Many clocks stopped, the motion of the pendulum being counteracted by that of the earth; the time-keeper of the Imperial Ottoman Bank, for instance, was among these, and remained untouched, marking the hour of the catastrophe, until the occurrence of a second shock of almost equal severity, two weeks later, when it was again put in motion, independently of human agency. It was not until the evening of the third that news came to Smyrna of the terrible disaster which had befallen Chios, and no steps for the relief of the island could be taken until the following morning, when Midhat Pasha, the intelligent Governor of the Province (now deposed and on trial for his life, charged with complicity in the political murder of the late Sultan Abdul-Aziz), ordered a quantity of stores to be transported to the site by an Italian steamer that lay at the port. The day following was a busy one upon the quay, and unscrupulous Greek dealers in lumber and provisions profited accordingly. It was observed that professional thieves from Smyrna reached the site before the advent of any succor.

Busily employed at Mytilene and Assos, it was not until three weeks after the first shock that an unexpected opportunity allowed your correspondent to visit Chios. During that time ships of war of all nations had rendered every possible assistance to the wounded and destitute. Among these vessels was the *Galena* of the United States Navy, which came directly from Constantinople upon the telegraphic news of the calamity, and was among the first to reach Chios. These rescuers were themselves often injured by the constantly falling walls, five seamen of the French *Bouvet* being thus severely injured while working among the ruins. And only too frequently did the selfish and indolent inhabitants abuse the proffered help to dig out trifling household possessions from beneath the fallen rubbish, while pretending to lead the search for the bodies of relatives which they affirmed were there buried. It was daily evident how unwilling these Chiotes were themselves to lend a hand in the assistance of their fellow-sufferers, — they could only with difficulty be induced to carry the stretchers upon which wounded were transported to the improvised hospitals, and deserted at the first chance. Sometimes the master of a house in which a gang of European workmen had been employed in digging out the bodies of dead and wounded would demand to be paid for his direction and assistance.

The aspect of the city from the sea approach is as charming as that of almost all Levantine ports. The gray Genoese castle forms the most prominent feature upon a projecting headland; to the south of it lies the town, ascending the gentle slope of the hills, so that the houses appear grouped as in an amphitheatre. High above the town rise the steep cliffs of the mountain-range, outlined against the western sky with the beautiful sharpness and delicacy peculiar to the formations of the Ægean coast. At the time of my arrival, nearly all the wounded had been removed from the island, the remaining inhabitants were sheltered in tents and wooden barracks, and the principal street, parallel to the water's edge, was being freed from the fallen débris, which had not there reached the height of several feet that was quite general in the lanes of the inner town.

The small steamer which regularly made the passage from Smyrna to Chios carried nothing but boards for the construction of temporary dwellings, — provisions which would last the inhabitants until long after the gathering of the rich and uninjured harvest already having been sent to the island by the relief committees organized in every part of the world. Fertile Chios, second in productiveness to Mytilene alone among the islands of the Archipelago, could never long suffer from scarcity of food. The quality of its wheat was celebrated in the middle ages, although the soil is too rocky for the extensive culture of grain. There are endless groves of fruit-trees of every variety: lemons, oranges, olives, almonds, etc., while the figs have always been of so superior a quality that it was from Chios that this fruit was first introduced into Italy.[1] The wine of the island is famed by classic writers,[2] and to the inhabitants of Chios was even attributed the invention of the wine-press.[3] A certain *Vinum Arvisium*, produced upon the island, was the favorite wine of the great Cæsar, who may reasonably be supposed to have enjoyed the privilege of everywhere drinking the best. It may be mentioned as a curiosity, that celery is here indigenous, having been first introduced to Europe by a Chiote gardener employed in the Villa Albani at Rome. After the recent earthquake, much trouble was anticipated from lack of water, as the capital has never been well supplied with aqueducts; but the greater number of subterranean pipes of burnt clay which lead the water of mountain-springs to the chief streets and squares of the town were fortunately not often ruptured by the shocks, and still continue to give an abundant supply.

The first appearance of the houses was by no means that of a complete ruin; the façades upon the most prominent street, facing the water, having been exceptionally well built and anchored, and in the majority of cases remaining standing. A closer examination, however, showed that the front was left a mere shell: the roof-timbering, being started from its wall-plate by the upward motion of the first shock, fell upon the floors beneath, and carried all through to the very basement. The house of the British Vice-Consul, upon this chief street, is a particularly good instance of this manner of interior destruction. Viewed from the water, the building appears uninjured, but a glance from the street pavement upward through its broken windows shows the blue sky above. One incident, for the truth of which I can personally vouch, will illustrate this preservation of the outer walls of some Chian houses, as well as certain aspects of Levantine Greek character already touched upon. An elderly lady of wealth was sitting peacefully upon an iron balcony above the street at the time of the shock. All the floors and partitions of the house behind her were totally demolished, and falling into the cellar cut off her retreat. She thus remained uninjured upon the balcony in a paroxysm of fear, beseeching the crowd below, who were hurrying to the water's edge to throw themselves into boats, to come to her assistance by means of a ladder. This two passers-by consented to do on condition of her immediate payment of twenty Turkish pounds for the service, but the old lady firmly refused to submit to such untimely extortion, — doubtless in some measure silencing her fear by her indignation, — and, after long chaffering, finally descended safe and sound, having reduced the demands of the ladder-owner to five silver piastres. When one thinks of the continued shocks and the constantly falling walls, it is evident that the ruling passion of both rescuers and rescued was strong, notwithstanding the imminence of death.

While overhanging masses of masonry had been pulled down in this chief street, and the passage freely and safely opened, the inner quarters of the town remained, up to the time of my visit, just as left by the earthquake, even apparently unvisited by the inhabitants, who, having carried off all easily transportable articles of value, were literally afraid to enter the narrow lanes three weeks after the calamity. Not a single house of masonry was at that time inhabited. During the first seven days of the disturbance, over two hundred and fifty distinct shocks were counted, and of these at least forty were sufficient to overthrow a carelessly built wall. What was loosened by one vibration fell during the next. It was thus of constant occurrence for the excavators to find beneath the ruins bodies which were not yet cold and stiff in death lying almost side by side with those which were already in an advanced state of decomposition. I wandered for hours among the houses of the inner town, entering the deserted buildings at will through the open doors and shattered windows, and during an afternoon would see no human being, no animal, even, excepting gaunt and famished cats, who lingered among the ruins with the tenacious love of locality peculiar to their kind.

The vestiges of life still remaining to betray the confusion and terror which ruled on that unhappy Sunday afternoon were in some respects even more direct and tragic than the well-known classic remains which show the death-struggles of the inhabitants of Herculaneum and Pompeii, under the showers of ashes and streams of lava which destroyed their cities. In the little room of a low wine-shop, chairs and tables lay even as overturned by the frightened guests when hurrying into the street, — perhaps there to meet injuries or

[1] Varro, R. R., 41; Martial, VII., 24, 8; VII., 30, 2; etc.
[2] Strabo, 637, 657; Pliny, XIV., 9; XIV., 17; XXXIV., 22; Horace, Ode III.; Sat. I.; Virgil, Ec. V., etc.
[3] Compare Athenæus, 26.

death from falling walls, which would have been spared them had they remained within. Two men had been playing cards at the time; a slate, with the half-completed number of points still legible upon it, lying with the scattered pack. In several places walls and floors were stained with blood; the track of one wounded wretch across a hall and marble-paved court was distinctly marked by great clots, showing the laborious slowness of his advance, smearing with his blood the polished slabs as he crept along. In the cases where the greater mass of the masonry had fallen outward, the narrow lane was filled with rubbish to the height of the first-story windows, rendering it difficult to climb from place to place. In other instances the street was wholly free, all the superstructure of the house, with the timbering of roof and upper floors having sunk within the remaining enclosure, completely filling it with stones, lime, and beams, bits of broken furniture, — and too often with human corpses. On one of the days of my visit, more than three weeks after the catastrophe, fourteen bodies were extricated from these masses of débris.

The sight of such destruction is far more horrible than that of the occasional "burnt districts" of our great cities, because lacking the consuming and purifying element of fire. Owing to the rarity of wooden constructions, conflagrations were not of great extent, — perhaps the season and the hour of the earthquake may account for the few fires: the day had been warm, and almost no hearths were at that time lighted for the preparation of meals.

Emerging from the crowded desolation of the city, the orange-trees of the moat mingle the suffocatingly sweet breath of their blossoms with the pervading taint of the unburied bodies. Beyond the town lie fair suburbs, some of which, like the rich Campo, seem to have suffered even more severely than the closely built town. New and terrible ruins are now added to the moss-grown stones of those Genoese villas which attest the wealth and luxury accumulated here during the sixteenth and seventeenth centuries. Several of these mansions remain as left by the Turkish massacre of 1822, which reduced the population of Chios from thirty-two thousand to only ten thousand souls, — history thus repeating, after a lapse of twenty-three centuries, the merciless ravage of the island by the Persians, who in like manner overthrew the dwellings and public buildings of the Greeks, "burning the city, with the very temples," as Herodotus says. By an increased commerce in oil, mastic, southern fruits, etc., the population of Chios has since gradually risen, as nearly as can be ascertained in the entire lack of official statistics, to between seventy thousand and eighty thousand, of which number about one-quarter dwelt in the capital. The late earthquake is estimated by the most competent judges to have killed some five thousand human beings and destroyed fourteen thousand buildings.

In the villages of the southern part of the island, the loss is even greater in proportion to the population. It was at Calimassia, a place of twelve hundred inhabitants, that the shocks were the most severe: three hundred and twenty-eight of the villagers of this place had been buried on the 20th of April, one hundred and twenty still lay under the ruins, and seventy-two were mortally wounded, — nearly one-half of the inhabitants thus perishing in seven seconds. One case may be mentioned as illustrating the thorough sweep of the destruction in this region. On that fatal afternoon a surgeon was called from the capital to a village some miles south, to perform an operation. At the time of the earthquake, there were present in the patient's room fifteen persons: curious and condoling friends, a chief authority of the place, the local practitioner, and others. Of these fifteen human beings, only one — the consulting surgeon — escaped with his life. Instances fully as horrible were not lacking in the city. In one badly built hall within the enclosure of the citadel forty Turkish women were engaged at their devotions and entirely buried beneath the ruins. Were it the purpose of the present paper to recount the various scenes of human misery which were universal upon the devoted island for days after the calamity, few incidents in the long catalogue would be more touching than those connected with this fatal hall. Upon removing the debris during the evening of the next day, only one of the forty women was found alive, a beautiful girl of eighteen. After great exertions she was extricated from the confusion of fallen masonry, timbering, and dead bodies, but was only placed in the arms of her father to expire almost instantly. The man had worked and waited in the most anxious expectation for twenty-eight hours; when he became aware of her death he broke into the most heart-rending shrieks of laughter, and was from that instant insane. Of all this citadel enclosure the minaret alone remained upright and uninjured, to be looked upon by the Turks as a great wonder and mark of the will of God.

Yet it is with the villagers rather than with the citizens of the capital that one feels the greatest sympathy. Their pitifully small property has been more hopelessly destroyed, and their willingness to help themselves contrasts favorably with the inhuman apathy of the floating population now in the city. The more influential and wealthy inhabitants have been enabled to leave the island, or at least to take refuge in the northern districts, which have been comparatively free from disturbances. So general and sudden was this flight that it is natural to suppose the movement to have done much to swell the early reports of the mortality, which at one time rose to the number of fifteen thousand souls.

All the remaining life of Chios has been crowded together in the large square before the Conac, or Turkish town-hall, a building still standing, though in a state of dilapidation which prevents its use. Here, as everywhere in the immediate suburbs, the busy sound of hammers is heard, those inhabitants who were unable or unwilling to leave the town preparing for themselves temporary dwellings of boards.

Of the buildings destroyed upon Chios perhaps the only one individually known to architectural history was the Monastery of Nea Moneh, with a Byzantine church in the centre of its quadrangle which contained mosaics reputed to be the finest in the Levant.[1] These buildings were almost entirely overthrown, burying a great number of monks beneath their ruins. The plan of the church, which dates back to the age of the Empress Irene, was in many respects peculiar. To an irregular octagon, with three apses at the east, there was adjoined a narthex and an exonarthex, the ceilings of both being divided into domed compartments which were ornamented by the famed mosaics. A full consideration of this interesting structure would here lead to too great length, and might furnish materials for another paper; this arrangement of the vaulted interior being too complicated for explanation without illustrations.

The direction of the first shocks is everywhere evident from the ruins, as well as from the accounts of witnesses. A marked vertical upheaval preceded the usual lateral oscillations, which toppled over the masses of masonry thus loosened. The mechanical results of this upward movement are extremely remarkable. The heavy corner-stone of a roof-cornice was situated eight metres above the earth. Put in motion by the first shock, it jumped over the L of a building four metres broad, situated at a distance of three and a half metres from the cornice, and fell *twenty-one metres* from the spot where it would have dropped vertically. So at least affirms Prof. Dr. Christomanos, who was sent from the University of Athens to prepare a report upon the earthquake. The wooden upper story of a house in the suburbs of the capital was lifted off bodily, and stands upright in the garden, beside the original foundations, intact in all its constructive features. One man, who miraculously escaped without injuries of importance, was completely buried under the ruins of the local Casino by the first concussion, the débris above him being thrown aside by the succeeding shocks. The upright motion is further evident from its effect in chipping the rectangular edges of heavy and insufficiently cemented stones. The piers of the chief inn of the town were thus fractured upon all the lower corners from having been jolted up and down, while the balustrade and iron gratings between were sufficient to keep these supports from falling sideways.

It is by a consideration of such aspects of destruction that one is enabled to appreciate the marvellous perfection of stone jointing customary in the best constructions of Greek antiquity. The drums of the shaft, and indeed every block of the unrivalled Doric and Ionic temple structures, were not merely dowelled by upright pins, but were united as one stone by the grinding and polishing of each superposed cylinder. A fragment broken from the columns of the Parthenon by Revett severed elsewhere than at the joint between the drums, into which the point of the sharpest knife can nowhere be introduced. The earthquakes which have repeatedly tumbled Byzantine Athens to the ground, and have even overthrown columns of the Corinthian fane of Olympian Zeus, have not jarred a single stone of the three great buildings upon the Athenian acropolis from their normal positions. Some of the peculiar features of the later Greek wall-masonry here at Assos are only to be understood when compared to the ruins of Chios and referred to the great earthquakes during the reigns of Tiberius and Aurelius, which depopulated so many of the fairest towns upon this coast.[2]

Eugéne in the *Histoire d'une Maison*, who may doubtless be taken as an expositor of the views of one of the greatest architects of this century, — the best trained, if not the most gifted, designer, — describes ideal technical education as particularly furthered by a study of actual buildings, not those merely projected on paper. Especially did he "set himself to observe buildings that were crumbling to pieces, that he might discover *in anima vili* the causes of their ruin." And thus in Chios, though the destruction of the edifices has been brought about by a phenomenon of nature, the principles of resistance which find application in building construction are exceptionally evident and instructive. The jarring and pounding of our manufacturing machines produce much the same ultimate effects as the shocks of the Chian earthquake; that the ruinous agency is in the former case weakened in force, and extended in action over a period seldom shorter than five years, does not in principle alter the architectural aspects of the question. From this point of consideration the first and most striking evidence of the ruins affirms the resistance offered to vibrations by wooden constructions to incomparably surpass that of the best masonry with horizontal bed-joints. In some houses by the water-side the stone walls were almost wholly overthrown, but crumbling away had left intact within them those rooms which had been enclosed by light partitions of studding and by the lathing of the outer wall, upon which the plastering had been applied to obviate its continual cracking from the settling of the badly built masonry. It is further observable that the combinations of timbered construction with stone and lime in the building of walls everywhere insured good results, while, on the other hand, wooden floorings of beams or joists were frequently shaken from their bearings in walls of masonry, and fell, carrying destruction from floor to floor. Vaulted ceilings remained uninjured in almost every instance;

[1] Compare Dallaway, Constantinople ancienne et moderne, et description des côtes et isles de l'Archipel et de la Troade, Vol. II., p. 78; etc.

[2] "Eodem anno duodecim celebres Asiæ urbes collapse nocturno motu terræ." Tacitus, Annal., II., 47.

it was wonderful what poor and hasty constructions of this kind resisted the concussions. If, in the figurative language of the Orientals, "the arch never sleeps" it is the more alert against unforeseen shocks, and by its continual tension and the varied direction of its thrust better withstands a swaying movement, the wedge-shaped stones only being forced the more tightly together, so that the whole cannot fall as long as its supports remain unimpaired. In the lack of wood for the adoption of the *Chatmàr* and *Frenghèh* methods of partial timbering, the turning of blind arches of considerable thickness in the body of the wall is to be recommended. One façade of a Chian house, thus strengthened, had been erected upon insufficient foundations, and was thrown by the earthquake bodily across the narrow side street, where it leaned unbroken, having crushed the delicate wooden tracery of a Turkish bay-window. But when, as in these districts, lumber is so common that at least the floors are usually built of woods, it seems advisable to secure stability and safety from the constantly recurring vibrations of the earth by putting all the beams at disposal into the thickness of the wall, and arching and vaulting the ceilings with bricks or small stones.

It is dreadful to think, while looking upon the deserted and blood-bespattered ruins of this once populous town, of the results which would be occasioned in our great American cities by only one of the fifty or more shocks which have overthrown the low houses of Chios. To assume the possibility of a destructive earthquake in the Eastern States is of course to be regarded as a foreboder of impossible evils, — but it must not be forgotten that shocks of considerable force have been chronicled in almost every century of New England history, while lighter and almost unnoticed vibrations are of constant occurrence. We have been reminded that when a structure sways for some seconds in the same time and direction as the earth, the danger of overthrow from comparatively slight concussions is as great or even greater than from single severe shocks. No constructors have ever built with less regard for the possibility of altered statical conditions than the master-builders of our tallest edifices. In no country of the world does so much damage occur from the falling of buildings upon the stable earth as in the United States. Every architect knows the haste and short-sighted economy with which many of our largest and most pretentious business-blocks and dwellings have been put up, — and can picture to himself the result in Boston, New York or Chicago of an earthquake, which need be no more severe than that which visited us in 1775 to destroy hundreds of thousands in an instant.

## THE ILLUSTRATIONS.

COMPETITIVE DESIGNS FOR A COUNTRY HOUSE, BY MR. C. H. JOHNSTON AND MR. W. A. BATES, NEW YORK, N. Y.

We publish to-day two of the drawings of the fourth problem of the Architectural League; criticism being rendered upon them by Mr. F. C. Withers, architect. The problem was the planning and designing of a country house.

Mr. Withers said of the "mentioned" drawings: "I consider Mr. Johnston's design to be the most complete in arrangement of plan, and dignified in elevation, and, although there are some minor points in the plan which are open to criticism, should adjudge it the first place.

"Mr. Walker's design would require some modification to make it convenient for a country residence. The parlor and library are of good size, but the dining-room is unnecessarily large, and the proximity of the water-closet to the door of this room unpleasant. The use of the room in the rear of the dining-room, which opens from it, is not apparent. The exterior is picturesque, but if there is any scale in the perspective view, the rooms would be very low, and the library chimney could not come out on the *side* of the roof.

"In Mr. Bates's design the rooms are uncomfortably small. A dining-room only 13 feet wide would be very cramped, and a kitchen 17 x 12 too small. The exterior is extremely picturesque, and the drawing well rendered."

DESIGN FOR A CLUB-HOUSE, BY MR. AUGUST KLEEVES, BUFFALO, N. Y.

SCOTTISH SKETCHES BY MR. J. W. SMALL, F. S. A. SCOT.: — OLD WHITE HORSE INN, CANONGATE, EDINBURGH; EARLSHALL MANOR HOUSE, FIFESHIRE, SCOTLAND.

## THE WIND-PRESSURE OF CYCLONES.[1]

For a number of years past, whenever practicable, I have personally visited the tracks of destructive storms as soon as possible after their occurrence, for the purpose of determining the maximum force and width of the path in each case.

The most violent on my records are as follows: —

*First.* — East St. Louis, 1871: Locomotive overturned; maximum force required, 93 lbs. per square foot.

*Second.* — St. Charles, 1877: Jail destroyed; force required, 84.3 lbs. per square foot.

*Third.* — Marshfield, Mo., 1880: Brick mansion-house levelled; force required, 58 lbs. per square foot.

*Fourth.* — Havre de Grace, Md., 1866: Ten spans wooden Howe-truss bridge, 250 feet each, blown over; force required, 27 lbs. per square foot.

*Fifth.* — Decatur, Ala., 1870: Two spans of Combination Triangular truss blown over; force required, 26 lbs. per square foot.

*Sixth.* — Meredosia, Ill., 1880: One span wooden Howe truss, 150 feet long, overturned; force, 24 lbs. per foot.

*Seventh.* — Omaha, Neb., 1877: Two spans iron Post truss, 250 feet each, blown down; force required, $18\frac{7}{10}$ lbs. per square foot.

Also, sundry cases of train derailment caused by wind, the maximum force required being $30\frac{1}{2}$ lbs. per square foot.

In each of the foregoing cases I have given what appeared to be the maximum effort of the wind and the lowest pressure required to produce the observed result. It is therefore not unlikely that the real force of the wind in each example was greater than I have stated it. Some of the tornadoes were very destructive, — the Marshfield one, for instance, having cut a swath 46 miles long and 1,800 feet wide, and killed and wounded over 250 people. To the above-cited instances may be added the Tay Bridge disaster, in which case $20\frac{4}{10}$ lbs. per square foot on train and bridge were required to destroy the piers, through the rupture of the vertical bracing in the four bottom tiers of the pier over which the train was passing when failure began. My reasons for considering 30 lbs. per square foot sufficient for a working specification, when the above record shows much higher pressures, are these: —

*First.* — I very much doubt if a *direct* wind or gale ever exceeds 30 lbs. per foot; whirlwinds do exceed it, but the width of the pathway of maximum effort in these is usually very narrow, although the general direction is so erratic that the appearance of the débris is generally such as to produce the impression that the vortex was much larger than was really the case. With the exception of the Marshfield tornado, I have yet to find a storm swath where the width of pathway wherein the force exceeded 30 lbs. per square foot was more than 60 feet wide.

The St. Charles tornado is a case in point. This whirlwind cut a swath about 1,000 feet wide for 14 miles, and destroyed over 300 houses, exerting a force of over 84 lbs. per square foot at its point of maximum effort. It crossed the middle span of the St. Charles bridge nearly at right angles, and developed a pressure of $52\frac{4}{10}$ lbs. per square foot in picking up and crushing a barrel of tar, which stood on the bridge in the path of the vortex. The width of the vortex was distinctly marked on the span by the circle in which the tar was spun around, the wreckage left upon it, and the points at which it ceased to destroy the flooring. This width was thus shown to be slightly over 60 feet, and, guided by this, I was subsequently enabled to locate the path travelled by the central vortex throughout the entire length of the storm swath. The bridge itself was uninjured, although it was only proportioned to withstand 30 lbs. per square foot, with a strain of 20,000 lbs. per square inch on the braces. This span was 320 feet long, 30 feet in depth, and the top chord was 120 feet above the water. I consider it very unlikely that a bridge of over 200 feet span will ever be exposed to a wind force of more than 30 lbs. per square foot, acting *in the same direction* over its entire length.

*Next.* — A fully loaded passenger train and the heaviest possible freight train will leave the track at the respective pressures of $31\frac{1}{4}$ and $56\frac{1}{2}$ lbs. per square foot. If the braces are proportioned at 15,000 lbs. per square inch, with a wind-pressure of 30 lbs. per square foot, they will still be within their limit of elasticity at the moment when the train is blown from the track in either case. Destruction of the span will then take place, if at all, from the effects of derailment, to resist which greater strength in the wind bracing will be of no value.

*Next.* — If there is no tension in the pier columns until 30 lbs. wind-pressure is reached, and these columns are properly spliced and anchored, as per specifications, there will be an ample margin of tensile strength in any case where this pressure may be exceeded.

*Last.* — In view of the comparative rarity of these extreme strains and the consequent slight fatigue to which the iron is exposed, the high stresses imposed on the wind bracing are perfectly legitimate.

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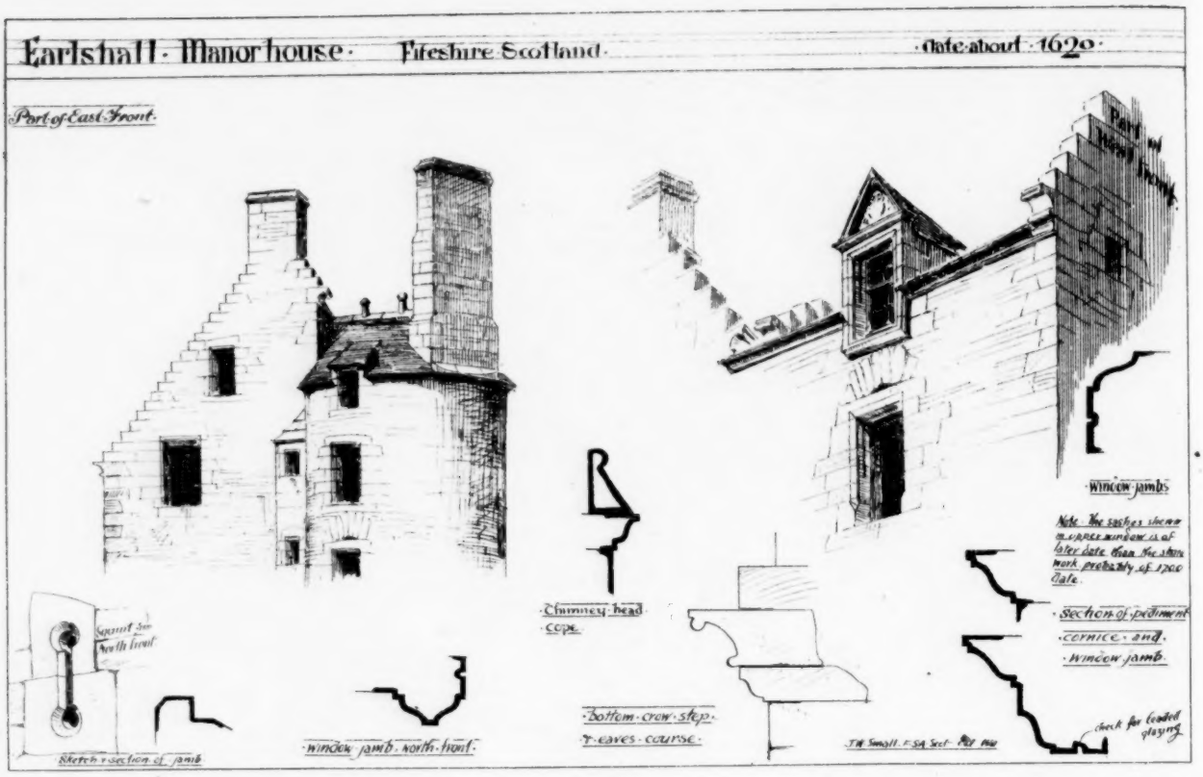
The following account of the St. Charles tornado was written for the *Cosmos*, a local journal of date of March 1, 1876, by a personal observer, Mr. C. C. Davis, and is published as giving, in the opinion of Mr. C. Shaler Smith, an accurate description of the commencement of the whirl: —

At half-past one o'clock on last Sunday afternoon, a heavy storm-cloud was observed directly south of the city, moving slowly due north. A few minutes later a similar cloud, but at a greater elevation, and with a much more rapid motion, appeared on the horizon, a few degrees south of west, its course being nearly east. The surface-wind at first was light and from the south-east. The clouds soon lapped. Discharges of electricity from the lower to the upper cloud became frequent, but not heavy, and with their junction the entire mass rapidly settled towards the earth. Patches of flying scud appeared moving in every direction, and small showers of rain or hail could be seen falling at various points. The storm nimbus by this time had covered all the upper part of the city, its normal cloud-tint being here and there flecked with dissolving spots of an unearthly green. Soon came signs of the fury which was to follow. The wind came in light, fitful gusts from every direction, succeeded by intervals of dead calm, the ominous stillness of the latter being especially marked. After a few short, sharp dashes of hail, interspersed with rain, a most singular phenomenon occurred, — a genuine shower of snow-balls, some of which, as they lay on the ground, could hardly be covered by a teacup. These were immense hail-stones, generated in the cold upper cloud, and softened in passing through the warm and water-laden cloud from the south. So large were they that their white shapes were seen several hundred feet in the air, their color placing them in bold relief against the murky, sullen blackness of their parent cloud. A few moments of oppressive silence followed, when suddenly the rival storm-

[1] From a paper on Wind-Pressure upon Bridges, read by Mr. C. Shaler Smith, A. S. C. E., before the American Society of Civil Engineers, December 15, 1880.





The Riverside Printing Co. 211 Franklin St. Boston

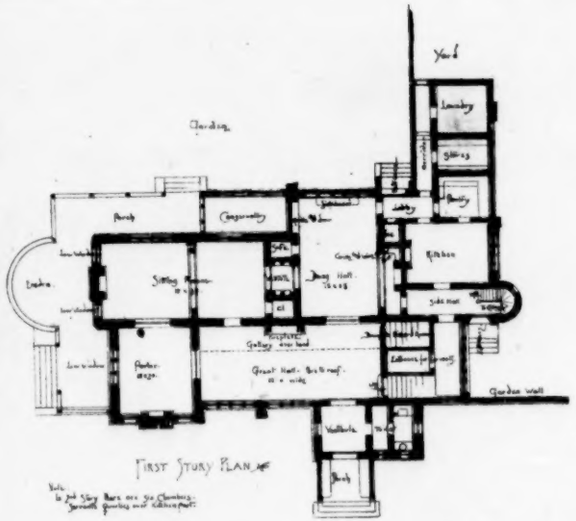
No. 292 AMERICAN ARCHITECT AND BUILDING NEWS JULY 30 1881.



Architectural League of New York.

Problem IV. A Country House.

Design Submitted by Clarence H. Johnston




FIRST STORY PLAN.

FRONT ELEVATION.

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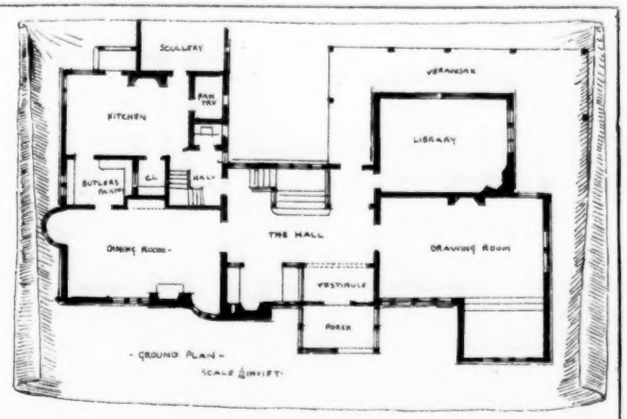
American Architect and Building News July 30, 1881. No. 292






The Heliotype Printing Co. 211 Tremont St. Boston.

A Country House to Cost $25000.

W. A. Bates. Nous Verrons.

Architectural League of New York.

fiends leaped into infernal life, the rapid wind-scud flew in all directions, and almost instantly the lurid brown of a cyclone column appeared in the south-west, about three miles from the upper end of the city. Moving eastward at first, until the river-slopes had been reached, the terrible cloud column followed them to the city, giving dreadful presage of its coming in a deep-toned humming roar, very similar in sound and disagreeable effect to the noise and earth-shaking properties of the steam-blower of a locomotive engine, but magnified a hundred-fold. In appearance it was the true cyclone cloud, — a brown, murky, vertical column, largest at its junction with the parent clouds, never more than 400 feet in diameter, reaching sometimes to the earth, where it destroyed all that it touched, and occasionally receding upwards, and passing harmlessly over those intervening spaces, where its powers were expended in the air above the buildings. Deliberately, but erratically, it moved through our devoted city, death in its roar, and destruction in its touch. The central vortex reached the spire of the German Methodist church, — a twist, a crash, and the spire went spinning upwards, but preserving its vertical position until near the top of its flight, when it was suddenly reversed, and came down point foremost. This vortex also touched the jail, the roof of which, together with the whole upper story, was twisted off, and to this hour the roof has not been found.

From this point the scene beggars all description. The total destruction of everything grasped by the tornado can be compared only to the wide-spread ruin produced by the explosion of a powder-magazine. The streets were filled with heavy timbers reduced to the merest splinters. Walls, where not laid flat, were in many cases punctured with holes by flying joists and bricks, projected with a force not much less than if shot from a cannon. Near the vortex, houses were destroyed by twisting and bursting; persons inside found it impossible to open the doors to get out, owing to the external vacuum and the pressure from within. On the circumference of the cyclone, houses were crushed and overturned by the external force, and those living in this part of its track had doors and windows blown in from without, as a preliminary to the destruction of the building.

After crossing the railroad track, the column became less in diameter, followed a very devious route, and moved so slowly that one observer, who had seen it pass when he was near Morgan Street, succeeded in repassing it while it was destroying the houses between Second Street and the river in Frenchtown, and reached the bridge some time before the tornado had finished its work of destruction on the west side of Second Street.

After having followed the two main streets of the city to within three hundred feet of the bridge, the cyclone turned suddenly eastward, moved parallel to the bridge, and then crossed it at the middle of span four. It was an anxious moment to the three bridge-men who were watching it. The whirlwind had destroyed everything it had touched thus far, and the deadly column was black with timber and other débris of the houses it had wrecked, while high above the rest sailed a large roof, moving with terrific speed towards the bridge, which it was now clear would be crossed by the very vortex of the storm. For a second the cloud obscured the span, the flying roof soaring fifty feet above it, but in another instant the grand old bridge loomed out clear and sharp, its outlines all unbroken against the black background of the defeated Storm-King who swept muttering away.

From the bridge the column crossed to the St. Louis shore of the river, destroyed a number of large trees on that side, and then turned and crossed to the west side again, raising the water nearly 200 feet high in its path, and reaching the St. Charles shore some two miles below the bridge. From this point it ceased to be a St. Charles institution, and we must rely on our country correspondents to tell us of its doings beyond our immediate ken.

At fifteen minutes past two the storm was over, and half an hour later the sun was shining, and the uncomfortable warmth of the morning had given place to a cold and chill atmosphere and western wind, which followed in the track of the higher and colder cloud, and which, in this battle of the elements, has proved victorious.

From the circular motion of the wind, it is difficult to measure its exact force, although there are several definite points where we are enabled to fix positively that the pressure exceeded a certain limit. One of these is the water-tank at the jail. This stood fairly where the wind could act both on the sides and bottom. With the water in it at the time, we are told that 699-10 lbs. per square foot upward and lateral force was required to overturn it, and it *was* overturned.

Another point fixed is the overturning force required to carry off a barrel half-full of coal-tar which stood on the bridge, and which was blown over and away. This needed 71 5-10 lbs. pressure to overturn it. The significance of these figures will be understood when we state that a wind with a speed of eighty miles per hour, giving a pressure of 31 1-2 lbs. per square foot, is defined by the authorities as a "violent tornado." We are perfectly satisfied with our experience in cyclones, and want no more of them.

## THE FOUNDING OF "BIG BEN."

ON the fourth day of the trial of the action of libel against Sir Edmund Beckett, for certain statements published by him with reference to the founding of Big Ben, of Westminster, further evidence was given in support of the plaintiff's case.

Mr. Gosselin said that he was foreman to Messrs. Warner, the founders of the first Big Ben, which was condemned. He described the process of casting in some detail. During the setting the rising of the tin can be prevented by measures, but the witness would rather not say what those measures were. He thought that the present Big Ben had not been properly cooled. He would have taken away the sand from the "cope" of the mould at an earlier stage.

Thomas Clark, a furnace-man of the plaintiff, said he had mixed the metals for the casting. Portions of the old or Warner's bell were put into each of the three furnaces along with the proper proportions of new metal, but in putting in the metal he acted under the orders of Mr. George Mears. He thought it would have been very unwise to have taken off the sand earlier.

Cross-examined: About ten tons of metal were melted in the principal furnace. The bell was ultimately thirteen and a half tons, but more metal was used, to allow for settling and for gutter. It was in the furnace for about sixteen hours. He did not think that the metal of Warner's bell had been analyzed before being used for Big Ben.

George Simons, another workman at the plaintiff's foundry, gave similar evidence. A clergyman and a ship-captain then gave general evidence of the excellence of the great Montreal bell, which was cast at the Whitechapel Foundry.

At one o'clock the Court adjourned for an hour in order that the jury might ascend the clock tower and enjoy a personal inspection of Big Ben.

Mr. Stainbank, the plaintiff, was the next witness. He joined the firm in 1861, but his name did not appear in the style of the firm till 1865. He had in his possession a continuous history of his firm since 1570. He frequently got letters addressed to him as "Mears & Co.," "Messrs. C. & G. Mears," and was often personally addressed as Mr. Mears. The proportion of tin to copper in Big Ben was higher than he would have wished, but it was fixed by the contract.

Cross-examined: The proportions generally used by Mr. Mears were 22 to 6½. The witness was especially aggrieved at these libels because they were reiterations of statements made twenty years ago, and they were injurious to himself and the foundry of which he was the owner.

Sir J. Holker then addressed the jury on behalf of the defendant. He said this was a matter of great public interest. The controversy of 1878–79 was not raised by his client, but by the Rev. Mr. Haweis, who expressed his opinion in trenchant terms, and yet was not subjected to an action. He would submit to them that there was nothing libellous in the letter of October 31, 1878. Nothing was there said about the plaintiff. The defendant did say that the bell is a disgrace to its founder, but its founder was Mr. Mears.

At this point a discussion took place as to the questions to be left to the jury in reference to this letter of October 31, 1878, and his lordship intimated that so far as he saw at present the questions would be (1) whether the letter was published of the plaintiff, and (2) whether it was injurious to him in his business. There was not the same difficulty in the case of the letter of November 20, 1878.

The case was again adjourned.

Sir J. Holker continued his address to the jury on behalf of the defendant. They had not by their verdict to find why Big Ben had cracked, but it was of some importance to go into that question in order to see what was in Sir E. Beckett's mind when he wrote the letters in question. The learned counsel then briefly sketched the history of Warner's bell and the arrangements made for the founding of the present bell. Three furnaces had been used for melting the metal, and as much as ten tons of metal was put into one, and smaller quantities into the others. This of itself was imprudent, and the metal so cast would not be so likely to be homogeneous as if it had been melted in equal quantities. Now it was possible to cast a bell whose metal was homogeneous; in fact, it was admitted that Warner's bell had been almost entirely free of cavities. The plaintiff affected to hold that cavities were unimportant: he would show them that this was not so; at any rate, these cavities ought not to have been filled up before the bell was seen by the defendant and Mr. Taylor.

Dr. Percy said he was for many years at the Royal School of Mines. He had, at the request of the Government, made several reports upon Big Ben. His analyses showed that great differences existed in the metal in different parts of the bell. He had no practical experience, but expected that there was great difficulty in obtaining homogeneity, especially in a large casting, where some of the metal cools before the rest. It was most important that there should be an opportunity of examining the holes in the surface of a casting.

Cross-examined: He was not aware that all the holes could be filled up with the metal of a penny, and did not believe that it was so, as the holes went through.

By the judge: He would call this a porous bell. Resin and bell filings would conceal these holes from a superficial observer. It was a common thing to conceal cracks in bronze castings. In the bas-reliefs at the foot of the Nelson column, no less than nineteen hundred-weight of pig-iron was found at the back of the bronze, and the founders were prosecuted and convicted at the old Bailey. It was a common thing to fill up small holes on the surface, — that might be seen in the paws of the lions of the Nelson column.

Mr. Taylor, bell-founder, of Loughborough, stated that he had cast bells of six and a half tons without any difficulty, and was now preparing to cast one of fourteen tons for St. Paul's. It was quite possible to cast a homogeneous bell. Porosity was very prejudicial to tone.

Cross-examined: He knew that the Manchester bell of six and a half tons was cracked. That was due to the weight of the hammer, which was four hundred-weight. There was no fault in the casting. It was possible to conceal holes, unless they were suspected and scratched for.

Sir Edmund Beckett, the defendant, was then examined. He said that he had great experience in bells, and was consulted about the first Big Ben, and, with Mr. Taylor, was appointed to approve the present Big Ben when cast. Without their approval there was, according to the contract, to be no payment to the founder. Many experiments had been made by him, and at the School of Mines, to discover the best proportion of tin to copper. Portions of Tom of Lincoln, and other old bells, were analyzed, and finally the proportion of 7 to 22 was fixed upon as likely to give sufficient softness to prevent cracking, and sufficient hardness to ensure a sonorous tone. In the old bells there was more of tin in proportion. He was not present at the casting of Big Ben. He had waited long in order to see it. Afterwards it was taken out of the mould before he saw it, — viz., on May 10, 1858. He examined it as well as he could, and got up onto the top by means of a ladder, but found no holes; none were then visible. It was found that a hammer of less than six hundred-weight did not bring out the sound of the bell. This was determined by experiment, and not by theory. Mr. Mears never objected to a heavy hammer; a clapper of the same weight would inflict much greater punishment upon the bell. When he saw the

bell in November, 1856, the holes were visible. There were about forty of them, and the largest had been filled with zinc. He should have rejected the bell if he had seen the holes. It would have made no difference whether cracks were opposite the hammer. In his experience bells crack where they are struck, and not on the opposite side. His letter to the *Times* in October, 1859, was written after the discovery of the holes, but before the analyses of the metal. When the damages were being assessed in the action of Mears *vs.* Beckett he was asked to stipulate that he would not write any more about the bell; and secondly, to admit that Mr. Taylor and he would have approved the bell if they had known of the holes; but he declined to do so. He did write about the bell again in his book published in 1860, the year after the action. Mr. Mears did not renew it. The visible holes in Big Ben might be filled with nine-tenths of an ounce of copper. It was possible to cast bells without such holes, and homogeneous. In this metal there was three per cent of difference in specific gravity in different parts of it. Good bell-metal is of much the same specific gravity as copper, although tin is lighter. The hammer in this case was not of an improper weight. Thick bells, relatively to their diameter, require a heavier hammer. This hammer was one-fortieth of the weight of the bell; those of the quarter-bells are relatively greater. This hammer is heavier than usual for a bell of the size, as very few clocks can raise hammers of this weight. In the letter of October 31, 1878, "its founders" does not refer to the plaintiff, but to Mears.

Cross-examined: Warner's bell had been twice melted, and the new metal in Big Ben was to be twice melted too. He examined the bell at the foundry and frequently at Westminster, and was satisfied with it, and especially with its tone. Before he wrote the letter of October, 1859, he did not write to Mr. Mears; he was not going to communicate with a man who had stopped up holes to get a certificate. He did not consider whether that was done fraudulently or not. If he had known what was disclosed in Dr. Percy's report he would not have withdrawn his pleas of justification in the former action. He did so under advice, not understanding the dodges of common-law pleadings, having been brought up in equity.

Re-examined: Sir Charles Barry had been quoted as having said that Big Ben was hung too rigidly, and cracked in consequence. That was not so; the bell is hung less rigidly than usual. There is no harm in melting up old metal again; it is usually done.

Mr. Ford, the defendant's solicitor, deposed that he had met the plaintiff's solicitor, and had on Sir Edmund's behalf offered to publish in any way the plaintiff might desire his disavowal of any intentional reference in these letters to the plaintiff. In cross-examination the witness said that he had offered only a disavowal, not an apology.

Mr. Jeune then summed up the defendant's case. They had had a most protracted inquiry into the founding of Big Ben, the whole of which he had all along considered to be irrelevant. But the gauntlet having been thrown down, Sir Edmund Beckett had no hesitation in taking it up; and he accepted the full responsibility of everything he had said against Mr. Mears, but what was said was said against him only. His client, with Mr. Taylor, had undertaken on behalf of the nation, the task of passing the bell. The proportions of tin and copper — viz., 7 to 22 — were actually approved by Mears. Then it was alleged that Mears had thought the hammer too heavy; but in the contract a clapper of the same weight was actually provided for, and such a clapper would have dealt a much more severe blow. Then there was no question that the holes had been filled up at the foundry with the intention of concealing their existence, and this with Mears's knowledge. For, undoubtedly, if the holes had been visible the defendant and Mr. Taylor would not have passed the bell. Then, as to the former action, it came on for trial before all the facts were known or could be known. No one then knew of the internal porosity; the bell had not been cut into, and Mears had declined to join in an application to Government to permit a cutting to be made. The defendant had refused to bind himself not to write again against the bell, and he had, in fact, used his reserved right to the amplest extent in his book published in 1860, and all the important statements of the edition of 1860 appear in the last edition of the book. These statements Mears had never dared to challenge, though he lived thirteen years after their publication. What the defendant had said of the bell — viz., that it is unsound, porous and unhomogeneous — was exactly what Dr. Percy said of it, and no opinion was entitled to greater weight.

Mr. Russell then replied on behalf of the plaintiff. He directed the attention of the jury to the fact that, although in the 1860 edition of his book Sir Edmund had spoken of the casting as not a good one, he had not then made the charge which appears in the later editions, that the holes had been filled up designedly by Mr. Mears. But as years went by, the result of the former trial had rankled in his mind, and this grave charge was then made. He quoted the words used by the learned judge in the well-known action of Whistler *vs.* Ruskin: "A critic must confine himself to criticism, and not make it the veil for personal censure, nor allow himself to run into reckless and unfair attacks merely from the love of exercising his power of denunciation." That was a statement of the law which was applicable in every way to the present case. With these preliminary observations, he proceeded to observe upon the contract for Big Ben and the composition of the bell-metal. Sir Edmund must be mistaken when he said that Mears had approved the proportions of copper and tin; for, in the first place, the witnesses from the foundry — men of long experience — stated that they had never before used the proportion of 22 to 7, and in the next, while the matter was still fresh in his mind, Mears had written a letter in which he said he thought the composition too brittle, and had told Sir Edmund so. However, the bell was cast, and was it likely that in the casting Mears should not have taken the greatest care and every precaution, if for nothing else, for his own reputation as a bell-founder? It was suggested that the melting should have been done in one furnace; but was there the slightest evidence that the melting in three had made any difference? This was a unique bell. No one concerned had any practical experience of all the details, but this, at least, was certain — that Sir Edmund never objected to the mode of melting in three furnaces. Then, as to the holes, they were undoubtedly little holes, and the defendant said that if he had seen the holes he would not have passed the bell; but he also admitted that the holes did not cause the cracks, and that with the holes he was satisfied with the tone of the bell. Big Ben was hung in 1858, and before being used in 1859 it was subjected to frequent and close examination and to numerous tests. The result was that its tone was considered to be highly satisfactory, and that opinion was long afterwards repeated by the Astronomer Royal, and Mr. Turle, the organist, who asserted that the cracks had not worked any practical deterioration of tone. But cracks did develop themselves. The defendant was assailed in the press. He retorted upon Mr. Mears, and the action of 1859 was brought. They had heard the result of that action, and by it Mears had assuredly vindicated his character. Sir Edmund had retracted his charges against Mr. Mears, and though it was true that, in the later editions of his book, he had retracted that retractation and reiterated the charges, they would find that nothing had subsequently come to Sir Edmund's knowledge to justify such conduct. The only information subsequently divulged was in the report of Dr. Percy, which disclosed the want of homogeneity, — a defect which neither Mears nor the defendant could possibly have known or discovered by a superficial examination. The defendant had admitted that the cracks were not due to the holes, and that the want of homogeneity was due to no lack of good faith on the part of Mears, and yet the charges previously withdrawn were reiterated in the edition of 1868 and in the present libels. The learned counsel then discussed in some detail the several reports of Professor Tyndall, Dr. Percy, and the Astronomer Royal, and contended that the cracks in the bell could be clearly traced to the following causes: — (1) The proportion of copper and tin; (2) the recasting of the old metal, which affected its specific gravity; (3) the size of the hammer; and (4) the spring of the hammer, which gave a double blow when it fell instead of being held back after the blow. After commenting on the evidence as to homogeneity, and the very great difficulty in obtaining it which undoubtedly existed, the learned counsel called upon the jury to find that these libels were severally libels upon the plaintiff. The question for them was not what the defendant meant when he wrote the letters in question, but what they implied to the minds of reasonable men reading them. The plaintiff did not ask large or heavy damages, but only such as would give the defendant a much-needed lesson in moderation, and consideration for the feelings of others, and would vindicate his own character.

Baron Huddleston then summed up the case to the jury. His lordship went fully and carefully into the history of the bell, its casting and defects; likewise into the history of the former action and of the present. There were three several letters or statements which the jury would have to consider, — viz., (1) the letter of October 31, 1878, in which the defendant had said that Big Ben was a disgrace to its founders; (2) the letter of November 20, 1878, in which the expression "oldest and worst of the foundries in England" occurred; and (3) the letter of January, 1879, in which the defendant repeated his charge against Mears, but disavowed any intention of referring to the plaintiff. As to each of these he would put three questions to the jury: — (1) Were the words libellous in themselves? (2) Were they libellous of the plaintiff? (3) Did they exceed fair comment upon matters of public interest?

The jury, after an absence of about three-quarters of an hour, returned an affirmative answer to these questions in respect of the letter of November 20, 1878, only, and awarded to the plaintiff damages £200. — *The Architect.*

## THE PRESENT STATE OF THE SEWAGE QUESTION.

At the monthly meeting of the Sanitary Institute of Great Britain, held at 9 Conduit Street, W., on Tuesday evening, an address was delivered by Professor W. H. Corfield, M. A., M. D., on "The Present State of the Sewage Question." Dr. Alfred Carpenter, of Croydon, occupied the chair. That the removal of refuse matters was a highly important matter for consideration was very evident, the lecturer thought, from the fact that wherever a district had a slow system of removal or none at all, the death-rate was very high, and just in proportion as the removal was expedited the number of deaths and cases of enteric disease decreased. The results of the non-removal of refuse matters was shown by the spread of black-death, Oriental plague, cholera, and enteric fever. The entire depopulation of many ancient cities was, he believed, due to the injurious effects of the accumulation of filth. Having pointed out that utilization, though no doubt important, was a secondary matter, and indeed was what an athlete would call "a very bad second," the reader of the paper proceeded to consider the systems of sewage removal and treatment at

present in use under the two heads of conservancy systems and water-carriage. In the former, — which might have been so named by their bitterest opponents, instead of the title being one adopted by their advocates, as the very object of the sanitarian was "removal," not "conservation," — the refuse matters were either collected unmixed with anything else, or mixed with ashes, earth, etc. The first of these plans was now being adopted in several large towns, as Birmingham, Rochdale, etc., and it might be said to be the only successful one among the conservancy systems. It was certainly the only one from which a profit had been obtained; the manure in all the other plans was nearly valueless, and the results obtained by the Sewage Committee of the British Association showed that the earth compost, after having been used in the closets six times, was only as rich as a good garden soil, and would not bear the cost of carriage. The total manurial value of human excreta had been estimated at 7*s.* 3*d.* per year for the liquid refuse, and 1*s.* 3*d.* per year for solids, but all chemical analyses of manures placed their value at a higher rate by about one-half than they possessed to a farmer. A summary was given of the results obtained by the conservancy systems, in which they were shown not to be solutions of the questions, especially as they leave the liquid sewage still to be treated, but in which it was admitted that under certain circumstances, as where it was necessary to reduce the bulk of the sewage, they might with proper precautions be adopted. The recent improvements had been in the direction of reducing the size of the receptacles, so that they had to be removed at shorter intervals, in making them water-tight, and in ventilating them. The interest of a local authority, and still more of its contractors, was to empty the pails as seldom as possible, — a radically bad principle. The water-carriage system was considered somewhat in detail; its advantages in the continuous removal of refuse from houses pointed out, its disadvantages shown not to be inherent in the system, but to be mistakes made in carrying it out, as for instances sewers pervious to water, or too large, or not ventilated, or without sufficient fall, or with a blocked outlet, or discharging into rivers, house-draining not properly disconnected. The folly of turning surface-water and, in many instances, even springs and streams into sewers, and so increasing the difficulty of dealing with the sewage at the outfall, was insisted on. The various chemical processes for the treatment of sewage were passed in review, and all shown to be quite inadequate to cope with the difficulty, though some might be useful as preliminary aids to purification. Filtration through soil and wide irrigation were next treated at some length, and the results obtained by them described. Certainly the sewage had been satisfactorily purified in many cases, the conditions for satisfactory purification in winter being that the sewage pass through the soil and not merely over it. Crops of all kinds had been grown by means of it, and in soil that would otherwise bear nothing; and the British Association's Sewage Committee had shown at Britton's farm, Romford, during five years' daily investigation and analysis, that as great a percentage of the manurial constituents, 33 per cent, of nitrogenous compounds had been utilized as was on an average utilized of the best commercial manure. Although, for various reasons, it had seldom been found to be remunerative, the reader adhered to his opinion, formulated ten years ago, that sewage irrigation would ultimately be remunerative in many instances, and that opinion was shared by the committee appointed by the Local Government Board in 1876 to inquire into modes of treating town sewage. An irrigation farm should be supplemented by a filter-bed to receive and purify sewage when it is not wanted on the farm. The supposed dangers from the proximity of such farms, or from the spread of entozoic disease, were found to be purely imaginary; it was on the whole a better solution of the question for a large number of places than any other, and if, as was very likely, we had a series of dry years, its adoption would receive a great impulse. Where towns could not make sewage utilization pay, they must be content to be taxed to a slight extent to get rid of a most serious nuisance, and to secure a low death-rate.

A short discussion followed, in which Mr. Sillar advocated the Aylesbury precipitation process, in which he was, he said, pecuniarily interested; Mr. Douglas Onslow, managing director of the Coventry sewage-purification works, defended the operations there carried out; Mr. Bailey Denton, jr., spoke of the intermittent downward filtration works carried out for many years past by his father; Mr. R. W. P. Birch agreed with the lecturer, that no fine line should be drawn between irrigation and intermittent filtration, but that on the sewage farm both plans should be adopted as the season demanded; Mr. Jeumain described Lord Warwick's sewage farm at Leamington, and asserted that sludge had a manurial value; and Mr. Thos. Wilson Grindle suggested that as Hillé's system, which he was carrying out at Edmonton, was practically the same as the Aylesbury and Coventry processes, a conference should be convened to arrive at an amalgamation of the several sewage companies.

The Chairman said this was attempted at the Leamington congress 16 years since without any result. A long experience in the working of the Croydon sewage farm, which was situated in a somewhat densely populated area, had shown him that this was the best means of sewage disposal, and that it was absolutely no nuisance or danger to the neighborhood. Forty tons of vegetables could exhaust the manurial qualities imparted to land by irrigation with 5,000 tons of sewage, so that its fertilizing properties had been overrated. The practical difficulty was to get an intelligent farmer to occupy such a farm under so changing and occasionally so arbitrary and ill-informed a body as a "local authority."

Dr. Corfield replied upon the discussion, ridiculing the notion that any plan of "fortifying" sewage could pay. Doubtless sand could be made to pay for carriage and treatment if gold-dust were sprinkled over it; but no one would assert that the enrichment with gold-dust, to be subsequently extracted, was a remunerative or wise enterprise. The simile held good with all additions to sewage; the stuff itself was worth, on a favorable computation, about 2*d.* per ton, and the cheapest chemicals that could be added to it would not make the compound worth carriage, plus their original cost to the farmer. A vote of thanks was passed to the lecturer on the motion of Mr. Rogers Field and Professor Symons. — *The Building News.*

## THE ELECTRIC LIGHT IN ONE OF NORMAN SHAW'S HOUSES.

THE application of the electric light to the interior of Cragside has already been the subject of public comment. The disposition and manner of placing the lights is most pleasing; as for the lighting itself, it has been very satisfactory so far, there being no disagreeable glare from the light, and the heat and smell arising from the use of gas being entirely avoided. The following, taken from Sir William's own description of the lighting process, will be found very interesting, I think.

"The producing power is a neighboring brook — the brook, in fact, lights the house, and there is no consumption of any material in the process.

"The generator used is one of Siemens's dynamo-electric machines, and the motor is a turbine which gives off 6-horse power; the distance of the turbine and generator from the house is 1,500 yards. The conducting wire is of copper, and its section is that of No. 1 Birmingham wire gauge. A return wire of the same material and section is used, so that the current has to pass through 3,000 yards of this wire to complete the circuit. The number of lamps in the house is forty-five, but as I can switch off the current from room to room, I never require to have more than thirty-seven in light at once. For this number of lamps 6-horse power proves to be amply sufficient, notwithstanding the great length of the conducting wire.

"The library, which is a room of 33 feet by 20 feet, with a large recess on one side, is well lighted by eight lamps. Four of these are clustered in one globe of ground glass, suspended from the ceiling in the recess, and the remainder are placed singly and in globes, in various parts of the room, upon vases which were previously used as stands for duplex kerosene lamps. These vases, being enamel on copper, are themselves conductors, and serve for carrying the return current from the incandescent carbon to a metallic base in connection with the main return wire. The entering current is brought by a branch wire to a small insulated mercury cup in the centre of the base, and is carried forward to the lamp by a piece of insulated wire which passes through a hole in the bottom of the vase, and thence through the interior to the lamp on the top. The protruding end of this wire is naked, and dips into the mercury cup when the vase is set down. Thus the lamp may be extinguished and re-lighted at pleasure merely by removing the vase from its seat or setting it down again.

"The dining-room is also lighted by eight lamps, six of which are grouped together in one glass shade suspended over the centre of the table, and the other two are used singly as bracket lamps, one at each side of the room.

"A picture gallery, which is also used as a drawing-room, is lighted by twelve overhead lamps; but when the eight lamps in the dining-room are no longer wanted, the current supplying them is shunted to the gallery for lighting eight additional lamps, making twenty in all. The gallery is agreeably lighted even with the twelve lamps, and with the full illumination the pictures are seen as distinctly as in daylight.

"In the passages and stairs the lamps are for the most part used without glass shades, and present a very beautiful star-like appearance, not so bright as to pain the eye in passing, and very efficient for lighting the way.

"Each single lamp is about equal to a duplex kerosene lamp, well turned up, and this, I believe, is equivalent to 25 candles, so that my 6-horse power, in supporting 37 lamps, gives me an illuminating effect equal to 925 candles. The same power applied to the production of light by the 'electric arc' instead of by incandescence, would give vastly more light, but the arc light, being only divisible to a small extent, could not be made nearly so serviceable for the distributed lighting of a house. Besides, the light produced by incandescence is free from all the disagreeable attributes of the arc light. It is perfectly steady and noiseless. It is free from harsh glare and dark shadows. It casts no ghastly hue on the countenance, and shows everything in true colors. Being unattended with combustion, and out of contact with the atmosphere, it differs from all other lights in having no vitiating effect on the air of a room. In short, nothing can be better than this light for domestic use.

"I have not yet had sufficient experience of Mr. Swan's lamps to judge of their durability, but with the exception of a few that failed by over-heating in my first trials, I have lost none since I began to use them (December, 1880). They have not, however, been in constant use during that time, and the test of their duration remains incomplete. But whatever their durability may be at present, it is almost certain to be increased by progressive improvement in manufacture, and when they are systematically made in large numbers, the cost of renewing them will probably be small.

"The lamps are connected with the main leading wire by branch

wires, in what is called 'multiple arc,' so that if one fails the others are unaffected. To connect them in 'series' would have some advantages, but would require a much greater electro-motive force to drive the current through, and this would probably involve some difficulty.

"It is important to the preservation of the lamps that the amount of motive power applied should always be proportioned to the number of lamps in light at one time. In my case I escape the necessity of varying the motive power by using a resistance coil to represent the resistance of each section of lamps which it is desirable to have the option of throwing out of use. By means of these coils the number of lamps in light at one time may be greatly varied without affecting the work of the generator, because the resistance to the current is the same, whether it passes through the coils or the lamps. This method is wasteful of power, but I can afford to waste that which costs me nothing, and is always sufficient in quantity. If steam or gas engines were employed, the case would be different, and there might be difficulty in effecting such momentary adjustments of power as would save the lamps from disturbance, where the number in use was liable to great and sudden variation.

"In the daytime the turbine and generator are occasionally used for the transmission of motive power to a second dynamo machine acting as a motor to drive a sawing machine. This it does with good effect, but I am not prepared to say how much of the original power is realized, or what should be the proportions between the generator and the motor to give the best effect."

## WHITEWOOD AND COTTONWOOD.

Whitewood (*Liriodendron tulipifera*), sometimes known as the tulip tree and as yellow poplar, is a large tree reaching from 70 feet to 100 feet in height, with a trunk 4 feet to 70 feet in diameter, and is one of the largest and most valuable trees of the Atlantic forests, being found from Vermont south to Florida and west to eastern Kansas. Its wood is light close-grained, strong, easily worked, and extensively used for interior work, carriage panels, etc.

Another variety, the *Tilia Americana*, otherwise known as the lime tree and as the basswood, is found from New Brunswick to the northern shores of Lake Superior, Manitoba, through the northern States to Virginia, along the Allegheny range to Georgia, and west to the Missouri River and eastern Texas. Its wood is white, tough, pliable, and easily worked; is largely employed in interior work, turning, and the manufacture of wooden ware. It grows from 60 feet to 80 feet in height, and from 3 feet to 4 feet in diameter. It is very common in the forests of America. Still another variety (*T. pubescens*) is found from North Carolina to Florida, usually near the coast in swamps and low ground, and is a smaller species. Of the species *Tiliceæ*, we may also mention the variety *Tilia heterophylla*, or white basswood, a medium-sized tree, rarely exceeding 50 feet in height, found principally on the Allegheny Mountains, from Pennsylvania to Georgia and westward to the valley of the lower Wabash River. These comprise all the varieties of the whitewood as classified by the Forestry Department of the United States Government, which also marks as a distinct species several varieties of the poplar under the head *Salicaceæ*. Of these we have the *Populus balsamifera*, the popular names of which are balsam poplar, tacamahac, and balm-of-Gilead, found from the Mackenzie River and the Great Slave Lake, through British America, New England, and west to Wisconsin. This is a large tree, common in Arctic America, and claimed to furnish the bulk of the drift timber on the shores of the Arctic Sea. Then we have a variety classed as *Populus fremontii*, found in the valley of the Sacramento River of California, and also in Nevada and southern Utah; this is a large tree. The *Populus grandidentata* found in Nova Scotia, New Brunswick, Canada, the northern States, along the Allegheny range to North Carolina, and west to Wisconsin and Iowa, is rare at the South, but common at the North. Its wood is white, soft, and very light; it is extensively used in certain manufactures. It is a medium-sized tree, reaching from 70 to 80 feet in height, with a trunk of 20 to 30 inches. The variety *Populus heterophylla* is found from Long Island, on the east, to the valley of the Ohio River, south to Cape Fear River, North Carolina and southern Arkansas. Its wood is soft and but slightly esteemed; it has a trunk 36 inches to 48 inches in diameter, and is usually found in swamps and river bottoms. The *Populus monilifera* is found from western New England to the Rocky Mountains, and south to Florida and Louisiana. It is known as cottonwood, necklace poplar, and as Carolina poplar. Its wood is white and soft, and is of but little value. It grows to a height of 80 feet to 100 feet, and has a trunk from 4 feet to 8 feet in diameter. This is the common cottonwood of the Western plains, and is found upon the borders of all the streams flowing east from the Rocky Mountains.

Another of this family, *Populus tremuloidus*, known as the American aspen or quaking ash, is more highly esteemed, having a white, soft wood, which is easily worked; somewhat used in flooring and turnery, and in New England for paper-making. It is found from Arctic America to Pennsylvania, New Mexico, and to the Sacramento River of California. It is common on all the northern ranges from the Rocky Mountains west and north, and in moist slopes and bottoms. It is the most widely distributed of any of the North American trees. This is probably the wood which is often classed with the whitewood proper, which it much resembles.

## ARCHITECTS' SUPERINTENDENCE.

New York, July 25, 1881.

To the Editors of the American Architect: —

*Dear Sirs,* — In your issue 23d inst., you publish an inquiry as to what constitutes superintendence. In the light of your editorial note, I recall an English instance, not more than four or five years old, in which an architect was made to foot the bills for re-covering a church roof with six-pound lead, because it was proved that he had specified that weight, that the contractor had received his pay on the architect's certificate of due performance, and the lead turned out to be only three or four pound. Suit against the contractor was dismissed, and judgment given against the architect, who had to save what he could out of the old lead in substituting what his specification called for, and his loss amounted, I believe, to more than his commission. I regret that I cannot refer you to the number of the *Building News* in which this report occurs, but contribute this statement of fact to the discussion, feeling that all reputable architects would gladly have the same standard of responsibility established in America, as adding a clearly defined commercial value to professional services. Yours truly, A. F. Oakey.

## THE CHEAPNESS OF ARCHITECTURAL TALENT.

Bridgeport, Conn., July 25, 1881.

To the Editors of the American Architect: —

*Gentlemen,* — We enclose herewith copy of a letter received a day or two ago, and we thought you might not think it out of place to publish it.

We replied that we have an office-boy with us now a week whose services we would let them have for one week for five dollars, in making a plan for their church, and that we would guarantee he should do his best to meet their views, requirements, etc., and we would convey to him all ideas possible to embody in the work.

Yours faithfully, Palliser, Palliser & Co.

Hartleton, Union Co., Pa., July 18, 1881.

*Gentlemen,* — We wish to build a Presbyterian church on the southeast corner of Market and Pennsylvania Streets. Market Street extends east and west, Pennsylvania Street north and south. The lots surrounding are occupied by buildings. Hartleton is a borough containing a population of three hundred. We think of building with bricks, about 30 x 70, with a ten-foot vestibule, and twenty foot off the other end for a lecture-room. Propose building with low walls and very steep roof. No ceiling inside. Steeple to start from the ground at one corner. Proposed cost, about $2,000.

The Committee of Church Erection furnish plans and specifications for five dollars. What will you charge us for the same? Make it as reasonable as possible. Yours truly, Calvin M. Hayes.

P. S. — Church is to front on Market Street. The lot is 60 feet on Market, and 200 on Pennsylvania Street. C. M. H.

## GAS-BURNING GRATE.

East Providence, R. I., July 5, 1881.

To the Editors of the American Architect: —

*Dear Sirs,* — Can you inform me whether there is any gas-burning grate with incandescent coke-burning attachment in the American market, such as is mentioned in the *American Architect*, Vol. IX., No. 264, page 33, under the heading, "A New Stove," and whether it is, or would be, as desirable as the common grate? C. D.

[Nothing of the kind has yet appeared in this market to our knowledge. — Eds. American Architect.]

## CARVING BRICK.

New Haven, July 22, 1881.

To the Editors of the American Architect: —

*Gentlemen,* — I wish to build some panels into the walls of a brick house, of a sort of brick (which I understand is much used in Boston lately) that can be carved after the building is otherwise entirely finished. If you can tell me, through your correspondence column, what is the proper kind of brick to specify for this purpose, you will greatly oblige A Subscriber.

[The carving bricks made for the purpose by the Peerless Brick Co., Philadelphia, are the ones generally used in Boston and elsewhere. — Eds. American Architect.]

## NOTES AND CLIPPINGS.

The American Institute Fair. — Of the many fairs and industrial exhibitions to be held this fall, there will probably be none more interesting than that organized by the American Institute to celebrate its semi-centennial anniversary, — a circumstance which of itself will form a powerful attraction both to exhibitors and to visitors. Situated as it is in the metropolis, within easy reach of everybody and everything, it of course stands a better chance of securing an attractive exhibition than any other of the institutions engaged in a similar work at this time.

Vandalism at Venice. — A correspondent writes to the *Athenæum*, from Venice: "To give you a notion of the care taken of works of art here, let me say that I saw to-day in the Ducal Palace, on the floor, face downwards, one of the large pictures, with two or three carpenters at work on the stretcher or wooden frame on which the canvas is extended, hammering it together with the picture in it. There was no custodian present to watch the proceedings."

ACTION OF FROST ON GAS-PIPES. — The winter of 1879-80 will long be remembered throughout Central Europe as one of comparatively great and long-continued cold. The *Journal für Gasbeleuchtung*, 1880, contains an article on the "Action of Frost on Gas and Water Pipes," being the experience of the engineer at the Carlsruhe gas-works. At these works there are six gas-holders, the three largest of which are provided with small boilers for heating the water. In the present instance, however, this was insufficient to keep the tanks free from ice, which began to form in the interior of the small holders, while the water on the outside was several degrees above freezing. This certainly is a very unusual occurrence, for the circulation of the heated water from the outside, together with the higher temperature of the gas, would seem to be sufficient to prevent the formation of ice. The difficulty at Carlsruhe was obviated by passing a pipe into the holder and blowing in steam, which after two days removed the ice. A plan commonly employed in other works is to place in the tank outside of the holder a steam-pipe from three-fourths of an inch to one inch in di ameter. This is arranged parallel with and about two inches below the surface of the water. The steam produces a circulation of the water around the tank, and keeps everything free from ice during the coldest weather. The holder cups are kept clear by passing into them a small steam-pipe provided with joints which allow a rising and falling with the holder. The article referred to also states that 4.8 per cent of the gas-metres fixed in private houses were stopped by the frost, but were made to work again by the addition of glycerine or alcohol. The choking of service-pipes with naphthaline is one of the difficulties generally experienced in the distribution of illuminating gas. At Carlsruhe it was easily removed by means of the force-pump. This treatment is not always effective, however, and in many cases it is necessary to use a little methyl alcohol or some other solvent to remove it entirely from the services.

EFFECT OF SALT WATER ON IRON. — The effects of saline vapors upon iron structures within the sphere of their influence are worthy of notice. For warehouse purposes and for pier sheds iron is growing in favor. The Union Ferry Company, whose first iron ferry-house was built in 1863, at the Fulton Street landing, in this city, have just completed their plans for a more extensive structure at the Wall Street ferry-landing in Brooklyn. The new building will be of wood, sheathed with galvanized-iron, special care being taken that not only the rivets, but the perforations to receive them, are fully protected by an anti-corrosive metal. The Fulton Ferry building was not galvanized, and in consequence it became necessary several years ago to renew the roof. The experience of the company in the use of iron boats is not altogether decisive, there being many advantages which are offset by corresponding objections. One of the senior officers most familiar with the subject says it is necessary to remove the iron boats from the water at least once a year to renew the paint, and their original cost is nearly double compared with wood. On the other hand, it is possible to divide iron hulls by means of bulkheads which retain their place, whereas wooden bulkheads shrink, and are forced from their position by the violent surging of the boats against the bridge and fenders. The iron boat does not strike so heavily, but this fact disqualifies the boat in contending with ice, for she lacks the momentum requisite to carry her through against a resisting body. Weighing the relative advantages and disadvantages of wood and iron when employed in the construction of boats for ferry purposes, it is difficult to say which has superior claims. — *Iron Age.*

THE BRITISH MUSEUM. — Parliament has just received from the British Museum authorities the report and accounts of the year which closed on the last day of March, 1881. The total number of persons admitted to view the collections, exclusive of readers, was 655,088, with a total of 133,842 readers, making in all 839,374 visitors to all departments of the museum. The British Museum had calls during the year for 802,135 books, of which number 410,824 were in the General Library, 11,989 in the Royal Library, and only 437 in the Grenville. That so few were taken from the Grenville collection is due to the character of the Grenville books. They are rare and choice ones, the collection of a famous collector, and which in few cases would be called for, and probably in fewer still would be given out. The number of volumes and pamphlets added to the library was 27,543, of which 2,379 were presented, 8,857 were received in pursuance of the copyright law which the late Sir Anthony Panizzi fought so long to get established, and 15,361 were acquired by purchase. Vast quantities of other printed matter were, of course, received during the year. Stamps were placed upon 263,922 articles.

STEEL. — The scientific newspapers, for months past, have been explaining the meaning of the different names applied to steel. An exchange sums up as follows: Blister steel is made by causing the carbon of charcoal to penetrate iron in a heated state. German steel is blister steel rolled down into bars. Sheet steel is made by hammering blister steel. Double shear steel is made by cutting up blister steel and putting it together and hammering again. Crucible steel is made by melting in a pot blister steel and wrought iron or unwrought iron and charcoal and scrap. Bessemer steel is made by blowing air through cast-iron, burning the silicon and carbon out. Open hearth steel is made by melting pig-iron and mixing wrought-iron, or scrap steel or iron ore to reduce the silicon and carbon.

PRICE OF GAS. — A painstaking German statistician has collected the prices for gas in all the leading cities of the world, and collated them, reckoning by the pfennig per cubic metre. London and Ghent are the most cheaply lighted cities in the world, rating at from 12 to 13 pfennigs; next come Amsterdam, Berlin and Brussels, at 16; Bordeaux, Antwerp, and Rouen, at 16 or 17; up in the twenties we find Paris, Lyons and Marseilles: all these in countries where coal is so dear as to be a luxury. Then with one tremendous jump comes New York 32, Boston 34, Chicago 42, and so on. Coal sells in London at $5 per ton, and in Philadelphia at $4 per ton, and the price of gas is precisely three times as much in the latter city as in the former.

TRIPOLITH. —German physicians and builders after a series of practical tests speak very highly of the properties of tripolith, a substance manufactured to replace plaster-of-Paris for surgical operations, and for stucco plaster and other work in the building trades. It is manufactured by Messrs. Gebrüder von Schenk, of Heidelberg, and is remarkable for the rapidity with which it sets, its lightness, strength and polish. It is said to resist the action of water very well. It is made of impure gypsum, three parts of which are ground together with one part of silicate of lime, nine parts of the mixture being ground together with one part of coke. The material is then heated and stirred, without the addition of water, at a temperature of 248 degrees Fah. As soon as the water of crystallization of the gypsum has been expelled, the temperature is raised to 500 degrees Fah., the product being a gray powder. The color of the dry mass is silver-gray, and besides setting in a pure state in four to five minutes, it can be made to harden after five to six hours by the addition of water in which some glue has been dissolved. By comparative test it was found that after setting, it took plaster-of-Paris 147 hours longer to dry than tripolith. The latter is also 14 to 16 per cent lighter, an important advantage for surgical operations and for use in stucco-work. After it has been given a coat of oil it holds color very well. As it grows older, set tripolith becomes firmer. Plaster-of-Paris has a tensile strength of 7 to 8.25 tons per square inch, while a sample of tripolith, after two months, had a tenacity of 15.2, after four months, 15.91, after six months, 17.5, and after eight months 17.5 tons per square inch. It is reputed to be 30 per cent cheaper than plaster-of-Paris. — *The Iron Age.*

OHIO WOODS. — In the office of the Secretary of the Ohio State Board of Agriculture there is a collection of specimens of the various kinds of woods found in Ohio. There are about eighty-eight different varieties, as many as there are counties in the State. This wood was cut and prepared for exhibition at the late State Fair, and is being preserved on account of the novelty of the collection. As a matter of curiosity a list of the names written on the respective pieces are given, with the exception of three that could not be deciphered. They are classed as unknown. The names are: Spice, black haw, lilac, balsam, poplar, sumac, whitewood, balm-of-Gilead, iron-wood, witch-hazel, button-bush, wild plum, long-leaf willow, prostrate cedar, spruce, cedar, cherry (common), sassafras, quince, white hickory, pin-oak, dogwood, Lombardy poplar, poplar, black locust, red oak, butternut, June berry, soft maple, damson plum, red haw, catalpa, snowball, weeping-willow, peach, tamaracks, shellbark hickory, water-beech, gum, hackberry, common apple, cucumber, water-willow, wahoo, white elm, osage orange, white ash, hard maple, box elder, black oak, blue ash, mulberry, cherry, laurel oak, crab-apple, white bush, black walnut, silver-leaf poplar, burr-oak, sycamore, horse-chestnut, white oak, chestnut, basswood or pumpkin wood, stag-horn sumac, black willow, pear, red or slippery elm, pine, buckeye, black hickory, elder, wild cherry, swamp-willow, prickly-ash, sweet-oak, thorn-apple, coffee-tree, black ash, grape, honey locust, apricot, red paw-paw, and three or four that are unknown. — *Mechanical News.*

ERRORS IN SETTING AND SUPPORTING IRON BEAMS. — In a paper recently read on "The Proper Use of Iron for Building Purposes," by Mr. E. T. Bellhouse, of Manchester, the author remarked: One class of error occasionally committed by designers not thoroughly versed in iron construction should be specially avoided. I have seen a rigid cast-iron beam, in one piece, resting at each end upon the main walls of the building, supported in the centre by a column. If there should be any settlement or sinking in the foundation of walls, or of one of them, and the pillar stone should remain firm, the beam would have its back broken over the column. If, on the other hand, the pillar foundation gave way, and the walls remained firm, the superincumbent weight would, in all probability, be too much for the beam to bear. In such a case there should have been two castings, with such a joint over the column as to admit of a slight deviation from the horizontal line, if any such should occur. In using wrought-iron beams — as in the case of timber — the elasticity of the material will admit of considerable deflection without any danger, so no special provision need be made for the contingency. We may add that we have seen in a very large structure cast-iron employed in tension and wrought-iron in compression. Needless to say, this was in accordance with an architect's specification.

ANOTHER SWISS VILLAGE BURNED. — The London *Times* has the following despatch from Geneva: The destruction by fire of Israehle is so complete that the only building left is the church. Three hundred houses and châlets which were built tier above tier on the steep mountain-side were destroyed, but as the cattle were pasturing in the Alps at the time, the loss, though severe, is not so great as it might have been. Israehle, though absolutely unknown to the tourist, was one of the most interesting places in Switzerland. Its inhabitants, like those of two or three villages on the Valley d'Anniviers in the same neighborhood, are a people apart, and are believed to be descended from the Huns who deserted from Atilla's army when it passed through the valley of the Upper Rhone in the fifth century. This theory is borne out by the Mongol type of countenance which is found among the people of these villages, and the exotic words still existing in their vocabulary.

FRENCH BUILDING "SHARPS." — A short time back three French bricklayers, unable to pay their rent any longer, hit upon the idea of constructing a house for themselves with stolen materials on a piece of ground not belonging to them, on the plain of St. Denis. Another case as remarkable has come to light. Two years ago a gentleman residing at Melun let a house which he had at Nogent to a man from whom he had received satisfactory references. For eighteen months his tenant paid his rent punctually; but six months ago the proprietor, who usually received the amount of the rent by post, received no remittance from his tenant. He wrote several letters, which remained unanswered. His suspicions being aroused, he went in search of his house at Nogent. Nothing, however, was to be seen but the site. His tenant had had the house pulled down, and then sold the materials.

# BUILDING INTELLIGENCE.

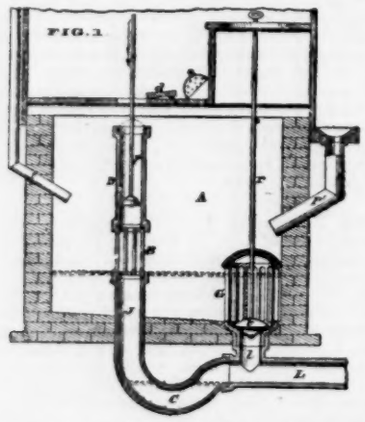
(Reported for The American Architect and Building News.)

*[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.]*

242,849. Sewer-Trap and Screen for Catch-Basins. — Jeremiah A. Sullivan, Cincinnati, O. The traps heretofore in use have been constructed of a number of joints, varying from three to six, and sometimes more, all having more or less curvature. When from any cause the pipes became clogged and it was necessary to remove the obstruction, or desirable to entirely empty the catch-basin, difficulty was encountered by reason of the many curved joints of which the trap was constructed, the obstruction or sediment, notwithstanding the force applied, being unable to pass through the pipes to the sewer, and when the force was removed it would return again to its former place in the pipes or be forced into the catch-basin. To remedy this has been constructed a trap which consists of a joint having but one simple curve sunk some distance below the bottom of the catch-basin, one end communicating with a pipe leading to the main sewer, and the other end attached to an upright joint which projects into the catch-basin and rises some distance from the bottom of the catch-basin. The bottom of the trap contains water which rises to a level with the bottom of the joint communicating with the sewer, thus preventing any gases from rising and entering the catch-basin. A is the catch-basin; B an ordinary grating for preventing obstructions from passing into joint J, leading to trap C. Over this grating is rigidly secured a pipe, D, into which, when it is desired to cleanse the trap or the pipe leading to the sewer, a plunger, *p*, is inserted. This plunger being removed




when not in use, the screen *s* is placed on top of the pipe D, thus preventing any obstruction from passing in at the top, and also allowing an additional outlet for the fluid in case the screen B should become clogged. The door *d* is then closed, which prevents any stench arising from the catch-basin. The joint J is made to rise somewhat above the bottom of the catch-basin in order that some water may remain in basin. G is a grating, which prevents any obstruction from entering the pipe L, communicating directly with the main sewer. The lower end of this grating is level with or sunk a little below the bottom of the catch-basin, and a valve, *v*, with an appropriate rod, *r*, is inserted in it. P' P' are waste-water pipes from the house. When it becomes necessary to cleanse the trap C, the plunger P is forced down into the pipe J and the sediment or other obstruction forcibly ejected into the sewer through L, the valve *v* being in the mean time firmly secured, so that it cannot be forced up and the obstruction from the trap passed into the catch-basin by means of duct *l*. From the simplicity with which the trap and its attachments are constructed, it will be seen that very little labor is required to effectually force the contents into the sewer, and that a great deal of expense heretofore incurred in the construction of these articles, and also their complexity, is done away with. If occasion requires that the catch-basin itself should be entirely emptied, all that is necessary to be done is to raise the rod *r*, connected to the valve *v*, and the contents flow out through duct *l* into pipe L, and from thence to the main sewer. The bottom of catch-basin is inclined to G, so that no force is necessary for the liquid to pass into sewer.

244,370. Power-Hammer. — Alexander Beaudry, Boston, Mass.

244,377. Soldering-Iron. — John Carroll, New York, N. Y.

244,381. Urinal. — Robert P. Daggett, Indianapolis, Ind.

244,390. Detachable Saw-Handle.—James Hilton, Newark, N. J.

244,391. Crosscut-Saw Handle.—James Hilton, Newark, N. J.

244,397. Fire Screen and Fender.—James C. Matthews, Canton, Tex.

244,405. Sash-Holder.—Levi C. Strong, Albany, N. Y.



## BUILDING INTELLIGENCE.

244,418. Door-Hanger.—Alonzo C. Arnold, Norwalk, Conn.

244,425. Sewer-Trap.—William Bedell, New York, N. Y.

244,455. House.—Benjamin R. Hawley, Chicago, Ill.

244,468. Air-Vent for Plumbers' Traps.—William McElroy, Brooklyn, N. Y.

244,471. Filter.—Geo. H. Moore, Norwich, Conn.

244,472. Draught Mechanism for Chimneys.—Jacob G. Müller, Buffalo, N. Y.

244,477. Reversible Latch.— John A. Owens, Baltimore, Md.

244,488. Combined Anvil, Punch and Shears.—Hans A. Schneekloth, New York, N. Y.

244,497. Pump.—Henry C. Taylor, Mount Vernon, Ill.

244,507. Planing Machine.—Solomon A. Woods, Boston, Mass.

244,513. Sash-Balance.—Andrew Anderson, Burlington, Io.

244,535. Water-Closet.—William Blackwood, Jr., Detroit, Mich.

244,536. Apparatus for Removing Snow and Ice from Streets.—Oscar F. Boomer, Brooklyn, N. Y.

244,539. Spring-Hinge. — Elbridge Boyden and William H. Brown, Worcester, Mass.

244,584. Spring-Hinge.—William Gilfillan, Brooklyn, N. Y.

244,594. Artificial-Stone Pavement.—Richard H. Guyer, La Fayette, Ind.

244,608. Rock-Drill. — Sylvanus Hussey, Gowanda, N. Y.

244,621. Lock-Hinge.—John A. Klein, Joanna Station, Pa.

244,629. Portable Steam-Auger. — William F. Leach, St. Clair, Mich.

244,685. Wrench.— John H. Strickler, Pickerington, O.

244,701. Filter.—Parker Wells, Lynn, Mass.

244,711. Skylight.— Frank M. Campbell and Anthony C. Dunlevy, St. Louis, Mo.

9,816. *(Reissue.)* Self-Closing Cock and Faucet. —Mary Broughton, Brooklyn, N. Y.

## SUMMARY OF THE WEEK.

### Baltimore.

Building Permits. — Twenty building permits have been issued since the last report, the following only being of sufficient importance to be mentioned: —

Louis Grebb, one-st'y brick building (packing-house) in rear of Nos. 25, 27, and 29 Lee St., between Charles and Light Sts.

Frederick Becker, three-st'y brick building, s w cor. Mosher and Carey Sts.

Wesleyan Home Missionary Society, one-st'y brick chapel, n e cor. Eden St. and Eastern Ave.

J. M. Cone, 6 three-st'y brick buildings, commencing s e cor. Arlington Ave. and George St.

Henry Rieman, five-st'y brick warehouse, German St., near Howard St.

## BUILDING INTELLIGENCE.

Levy Z. Condon, 5 three-st'y brick buildings, n e cor. Tenant St. and Vincent Alley.

Levy Z. Condon, 5 three-st'y brick buildings, on Tenant St., s w cor. Vincent Alley.

Heen & Hagerty, addition and improvement to warehouse, s w cor. Water St. and Hollingsworth Alley.

August W. Yokel, three-st'y brick building, on Madison Ave., between Biddle and Eutaw Sts.

Henry Strandt, two-st'y brick building, in rear of 289 Paca St., between Sterrett and Hamburg Sts.

Houses. — Mr. Jackson C. Gott is preparing drawings for the following dwellings: —

Two dwellings for Mr. H. H. Keedy, at Hagerstown, Md., 41' 6" x 50', three-st'y, of brick.

Dwell. for Mr. Chas. C. W. Heater, Middletown, Va., 54' 8" x 67' 2", three-st'y, of brick, with stone trimmings; cost, about $10,000.

Messrs. Dixon & Kennedy are preparing drawings for a dwelling for Mr. J. C. Stonebumer, on Eutaw Place, near Dolphin St., 25' x 80', three-st'y, of pressed brick, with white marble and terra-cotta finish; cost, about $12,000 or $15,000.

Church. — The First Congregational Church of Baltimore is about to erect a handsome addition to their present church on Eutaw St., near Dolphin St., to be 64' 6" x 64' 6", of Falls Road stone, with red sandstone finish; Messrs. Dixon & Kennedy, architects; Mr. John Haswell, contractor.

### Boston.

Building Permits. — Since our last report the following permits have been issued from the office of the Inspector of Buildings: —

*Brick. — Marlboro St., No.* 179, for Horatio G. Curtis, four-st'y dwell., 24' x 62'.

*Marlboro St., No.* 184, for Thos. B. Curtis, four-st'y dwell., 25' x 62' 3".

*Harwich St.*, near Dartmouth St., for John S. Lamprey, tenement-house, 26' x 36'; tenement-house, 36' x 49'; Thomas R. White, builder.

*Warren St.*, near Woodbine St., for Wm. Donaldson, 4 three-st'y dwells., 20' 6" x 34'; Wm. Donaldson, builder.

*East Dedham St.*, near Albany St., for Hugh Leonard, three-st'y dwell. and store, 25' x 40'; Locke & Co., builders.

*Commonwealth Ave., No.* 198, for Mrs. D. M. Spooner, four-st'y dwell., 26' x 70'; D. Connery & Co., builders.

*Roxbury St.*, cor. King St., for John J. Soren, three-st'y family hotel, 33' x 66'; Sampson, Clark & Co., builders.

*Marlboro St., No.* 171, for Geo. B. Upton, four-st'y dwell., 27' x 64'; B. F. Dewing, builder.

*Marlboro St., No.* 173, for Geo. B. Upton, four-st'y dwell., 24' x 64'; B. F. Dewing, builder.

*Commonwealth Ave.*, rear of, near Exeter St., two-st'y stable, 23' x 51'.

*Newbury St.*, near West Chester Park, for E. Rollins Morse, two-st'y stable and dwelling-house, 30' x 76'; Weston & Shepard, builders.

*Wood. — M St.*, near East Sixth St., for Wm. T. Eaton, two-st'y dwell., 19' 6" x 32'; Wm. T. Eaton, builder.

*(Continued on next page.)*