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In a recent address before the Society of Arts, which we quote elsewhere, Mr. Edward Atkinson cited in illustration the famous chapter on Snakes in Ireland, and pointed the moral that the proper relation between architects and underwriters is wanting. We have more than once insisted on the desirability of some relation, or, to speak more precisely, of some common action, between them. The relation which really exists, though commonly forgotten, is that of the men who suffer loss if buildings burn with those who are to design them so that they will or will not burn. The actual connection between these two classes of men, which might turn their relation to profit, does not exist. Instead of it we have the interposition of a third party, who has a connection with both, — the owner, who controls the building without suffering the loss if it burns, and who simply interrupts the reaction that would occur if the underwriter and the architect came together. The architect has a professional interest in making his buildings as substantial and enduring as he can; the underwriter has a pecuniary interest in making them incombustible; but the owner, who controls the architect, and on whom the underwriter's business depends, has many interests that conflict with these, and lead him to neglect them, or even to discard them altogether. The disadvantage follows which always occurs where the losses belong to one person and the precautions against them to another. That the actual loss to the community from fires is very largely increased by the practice of insurance companies there can be no doubt. So long as it is cheaper for an owner to pay his premium and transfer his loss to a company than to build a house that will not burn, he will be likely to secure himself in that way, though by doing so he endangers his neighbor and inflicts loss upon his community. The effect of the system is to give every man the right, in return for a small payment, to draw very largely on the general treasury in time of need, and, as might be expected, the general assessment is increased beyond reason. It has led to the development of a system of construction that entirely ignores the danger of fire, and is consequently more hazardous than is in use in any other civilized country; which, instead of improving in this regard as people grow richer and towns more compact, has grown more dangerous with the increase of speculative activity.

It is difficult, then, to provide any effective connection between the underwriter and the architect, while the owner stands between, excepting through the owner. That the underwriter and the architect should consult together and work in concert for an end which they both, more than any other persons, feel to be necessary, and for which it is the special interest of the one and the professional care of the other to provide, is very desirable. But the owner holds the key to the situation. The insurance companies can influence him by combining to raise their premiums, or to reduce their risks. The keen competition between them, however, leads them to take unsafe risks, and undermines their controlling influence. Practically they seem to do little to check the mischief which their assumption of the losses encourages. The inattention of companies, at

least until very lately, to any provisions for the safety of buildings against fire, their contented acceptance of whatever they find to be usual, are known to whoever has dealt with them, and have left them almost entirely without effect on the prevailing habits. A letter which we published a while ago from the architect of a theatre (see *American Architect*, September 13, 1879) was a conspicuous exhibit of their indifference in this matter. The experience described by Mr. Atkinson, which led to the formation of the Manufacturers' Mutual Companies, is still more striking testimony to it. The greatest obstacle in the way of improvement at present seems to be the divergence of interest between the individual owner and the insurers. The effective way to overcome this obstacle would be to bring the precaution and the loss home to the same persons, as in strictly mutual insurance, which might, perhaps, be more characteristically named a common insurance. Under the present system no class has so much power to influence precautions against fire as the insurers, and none apparently make so little use of it. If Mr. Atkinson's computation is right, that fifty per cent of premiums paid is covered by losses, and seventy per cent consumed in the expenses of some companies, it shows two things, — that the cost of administering the system is absurdly extravagant, and that the system itself leads straight to bankruptcy. When a large proportion of the companies have come to the failure that seems inevitable on this showing, the community may be brought to its senses, and led to attack seriously the underlying evil of bad building.

We have received the report of the Supervising Architect of the Treasury Department for 1879. It contains the usual clear and concise statement of the condition of the architectural work in charge of Mr. Hill, including custom-houses, post-offices, and most of the other buildings now undertaken by the General Government, comprising an account of the progress of the buildings under construction, with the appropriations assigned to each, a list of outstanding contracts, the recommendations of the Supervising Architect for the coming year, and the customary schedule of all the buildings in charge of the Department, with their dates and total cost to this time. The sum total of the unexpended balances of appropriations in hand is nearly three millions (\$2,835,989.10), including about twenty thousand in remnants of appropriations for buildings that have been finished within the year. The principal sums outstanding are (in round numbers), for the Chicago Custom-House, \$594,600; for the St. Louis Custom-House, \$318,800; for the Boston Post-Office, \$240,400; for the New York Barge Office, \$197,000; for the Cincinnati Custom-House, \$135,000; for the Bureau of Engraving and Printing at Washington, \$126,000; for the Memphis Custom-House, \$113,500; for the Kansas City Post-Office, \$109,500; for the Albany Post-Office, \$98,000; for the Harrisburg Post-Office, \$96,000; and for the Philadelphia Post-Office, \$84,500. The buildings finished during the year are the Charleston Custom-House, the Evansville (Ind.) Custom-House, the Helena (Mont.) Assay Office, and the post-offices at Raleigh (N. C.), Covington (Ky.), and Lincoln (Neb.). The San Francisco Appraisers' Stores are to all intents completed. The work on the Barge Office in New York has been retarded by the danger of putting in the foundations before the sea-wall is finished, and will be begun in the spring. The walls of the Boston Post-Office extension have been carried up to the top of the second story, and the iron-work for the first and second stories is nearly ready. The St. Louis Custom-House has been delayed by the difficulty of providing the very large stones needed for the main cornice; but this is done, and the stone-work of the attic is almost finished. As usual, inadequate appropriations of Congress have caused more or less trouble. The stone-work of the Cincinnati Custom-House has been delayed by this cause, which gives occasion for the remarks of our correspondent in another column, and in this building and in two others, the post-offices at Philadelphia and Hartford, a suspension of work must soon follow.

THERE is encouragement for those who wish to see appropriations reduced in Mr. Hill's statement that the large granite contracts for several very important buildings with which his office has labored for some years are nearly carried out, and that the completion of the stone-work of a number of these buildings

and the finishing of several others will reduce the estimates for the coming years very largely. We may hope, however, that Congress will not make this an occasion for still keeping the appropriations for current work at the lowest limit, but rather an opportunity for providing money fast enough, which can then be easily afforded, to carry on the work which remains on hand with the steadiness and vigor that a true economy demands, and avoid the waste of such interruptions as are mentioned in the report. This has been on the whole an advantageous year for the Government, says the report, and the low range of prices has given a chance for favorable contracts. The sudden revival of the iron trade, however, has been unfavorable to the work, having not only raised prices, but made some firms decline to offer bids for work at all, and others refuse to fix a time for delivery. Mr. Hill returns to the subject of a document building, urging that, although the housing of the Bureau of Engraving and Printing in a separate building will leave more room in the Treasury for storage of papers, the construction of the building does not allow of any distribution by which such storage can be made altogether safe. The report contains perspective drawings of three buildings which have not appeared before, the post-offices at Harrisburg, Kansas City, and Topeka (Kansas). They have the more than semi-classic character that prevails in the work of the present Supervising Architect, with a solidity and a dignity of design that well becomes public buildings, an air of reserve and simplicity in detail that will be an agreeable contrast to the exuberance and ostentation that we are apt to find in our private architecture, especially in that of our newer cities.

THE remonstrances of the International Exhibition Company at Philadelphia against the revocation of their license and the removal of the Main Exhibition Building from Fairmount Park, their delays, and their efforts to put their undertaking on a sound footing do not seem to promise the crown of success. The Park Commissioners held a meeting on Saturday to consider the question of recalling their notice to quit, and the report then submitted by their Executive Committee is a pretty strong indictment of the management of the Exhibition thus far, and looks like a fair justification of the decision of the Commissioners. The terms of the license granted by the Commissioners at the request of the City Councils to allow the Exhibition Company to maintain permanently an "exposition of arts and manufactures and industries" are cited, and require that the buildings and grounds shall be kept in good order, and restored, upon due notice, in their first condition; that the building shall only be used for an exhibition for pleasure and instruction of the public, and not for the sale of goods; that none of the existing rules for the government of the Park shall be violated or set aside, nor shall any special permission before required be dispensed with under the license. Among the things which have been prohibited, except by special permission, are any musical, theatrical, or other entertainment, or any military or other parade or procession, or any gathering or meeting of any kind assembled through advertisement.

In the light of these conditions and prohibitions, the Executive Committee examine the history of the Exhibition, and bring forth from its records and advertisements an indictment which shows a curious disregard of the conditions and an odd contrast with the splendid promises and schemes for universal instruction on which we have before commented (*American Architect*, June 14, 1879). Under the management of the first president, Mr. Riddle, and the first board of directors, says the Committee, the terms of the license were adhered to, and the legitimate purposes of the Exhibition aimed at; but with their resignation came a change of policy, and thereafter began a series of transformations which are certainly astonishing in a Permanent Exposition of Arts and Manufactures. Varied by an occasional entertainment, which bore some resemblance, small or great, to the original purposes, — such as a grand industrial review, a display of fruits and vegetables, a display of millinery and harnesses, an exhibition of flowers, and a display of machinery, — we read of vocal and instrumental concerts, royal marionettes, Turkish and other conjurers, stereopticon shows, bell-ringers, jubilee singers, speeches, drills, billiard-matches, picnics, Sunday concerts, balloon ascensions, hops, fireworks, carnivals, a fancy-dress carnival on roller skates, and a Thanksgiving barbecue, leading up to a display of holiday goods, sold at reduced prices. All this seems to have culminated in a demand for five acres of ground, to be planted with corn for the

animals assembled in an agricultural fair held without license, in which the Park was defiled with pig-pens, and the water of the Schuylkill contaminated in a way that brought the complaints of the Philadelphians upon the Park Commissioners; and, finally, in "a new circus-like performance called a tournament," held after notice to leave had been given the company for violation of their license. With this before us, we cannot be surprised that the Commissioners have resisted the pressure which has been brought to make them withdraw their notice to quit. One wonders a little at the indulgence which has brought forward even now a resolution allowing the company to try again, in case they can raise a fund of a hundred thousand dollars within six months, — a fund which it is probably assumed will deliver the company from the temptation to appeal to such extraordinary sources of revenue as have been mentioned, albeit a drop in the bucket of the supply which would be needed to carry out the ostensible purposes of the Exhibition.

COLONEL CASEY's report of the progress of work on the Washington Monument up to December 1, transmitted to Congress by Mr. Corcoran, Chairman of the Joint Commission, tells us that the amount of appropriated money still available for the work was at that date \$100,740, of which thirty-two thousand is appropriated for the foundation and sixty-eight thousand for the completion of the superstructure. The whole of the concrete sub-foundation inserted under the masonry was finished on the first of November. We have already given a detailed account of this remarkable piece of engineering. Minute levelling showed that in the process the monument sank some two inches. The average settlement of the four corners was 1.9 inches nearly, the western side sinking about $1\frac{1}{2}$ inches and the eastern $2\frac{1}{8}$ inches; the difference being fortunately against the leaning of the monument, which inclines a little toward the northeast. Besides this underpinning there is the buttressing of the monument, as it is called, by spreading out its lower courses in such a way as to distribute its weight over the wider foundation. A considerable part of the concrete which is to be used for this purpose is already laid. Colonel Casey computes that the money now in hand will be enough to complete the foundations, carry up the iron frame-work of the stairs 250 feet, and to add twelve feet to the shaft. To finish the whole as is now proposed to the height of five hundred feet, with stairs, elevator, and a pyramidion of glass and iron, will cost, he estimates, about six hundred and eighty thousand dollars more, and will take three years. It is a pity that so much engineering skill should be wasted on a monument in which, if it is to be carried out according to the present design, the people of the country will take no interest.

ARCHITECTS FOR GOVERNMENT BUILDINGS.

APPROPOS of the Supervising Architect, of whose report we have taken notice in our Summary, we have received a copy of an address delivered before the Association of Architects of Washington last month by Mr. John L. Smithmyer, in which discussing the defects of American architecture, he lays stress upon the difficulties and dangers of the Supervising Architect's position and the disadvantages of the system which puts the care of the government architecture into his hands. The points he makes are briefly these: that our government architecture is on the whole not creditable; that the architectural chief is likely to be, and has too often been, a mere political appointee; that he has too much power, too much work to do, and too much money to spend; and that he is not responsible for his administration. The remedies which he suggests are the regulation of the Supervising Architect's office and the distribution of the government patronage among architects by competition, for both of which he would appeal to Congress, and the abolition of government contracts. The *Boston Daily Advertiser*, commenting upon Mr. Smithmyer's address, takes similar ground, discredits the public architecture as a whole, thinks the Supervising Architect has too much power and is too much dependent on politics, and suggests that the American Institute of Architects might render a great service "by devising ways and means for placing the erection of public buildings altogether upon professional grounds."

There are arguments for these positions and arguments against them. As for the responsibility of the Supervising Architect, he is directly responsible to the Secretary of the Treasury, as the Secretary of the Treasury is to Congress. Congress might prescribe rules for the administration of his office,

but it is our impression that, so far as Congress has hitherto meddled with the administration of the Treasury Department, it has not made a success of it. The power of the Supervising Architect may be great,—at least he has the spending of a great deal of money, and his power in the spending of it is what the Secretary chooses to let him have. But if the appropriations are voted by Congress, the money is to be spent, and some one person must manage the spending of it. Even if a separate architect were appointed for every building the Government undertook, such architects must all be responsible to some one person, who must supervise their expenditures, and be substantially in that respect what the Supervising Architect now is, whatever his title might be. An attempt to make him more directly dependent on Congress would hardly mend the matter. He could not be directly responsible to Congress without being the head of a Department, a thing for which there is no provision in the present distribution of the Government. If, on the other hand, his appointment was subject to Congressional confirmation, like a collector's or a postmaster's, there would be more of politics instead of less in his vocation, and the mischiefs that are here complained of would be aggravated rather than relieved. It is very certain that the more immediately the office was dependent upon Congress the more immediately it would be exposed to political interference. As a fact, not one of the three men who have filled it since it became important has been a political appointee. Mr. Mullett, appointed by Mr. Chase, was unknown, and only became prominent as a politician in his office; Mr. Potter had nothing to do with politics, in office or out; and Mr. Hill's appointment was simply the advance of a capable subordinate. The fact that the office has, under the Secretary, the spending of Congressional appropriations makes it a mark for the influence of politicians, but its control of the spending of money cannot be subdivided, nor can it be transferred directly to the Secretary, who has neither the time nor the technical knowledge for it. In fact, the real grievances on which one can lay his finger are the facts that the Government does so much building and Congress appropriates so much money, and the tendency of politicians, especially of Congressmen, to interfere. The work must needs be all controlled by an expert, that is, by an architect or an engineer, and so long as there is so much of it, and so costly, it will bring its temptations to corruption or to political influence. The best safeguards we can think of are security of tenure in office, and seclusion as far as may be from political influence behind a cabinet officer, who is responsible for the Supervising Architect, and to whom he is responsible.

So far as we can see, then, the administration of the government building, the supervising of contracts and disbursements for them, must come more or less directly under the hand of one man, who must therefore have the power that goes with such a supervision. Probably nothing would be gained by increasing the number of intermediaries through whom his authority was exercised, nor by trying to make him directly responsible to Congress rather than to a cabinet officer. The contract question is too large for us to enter upon here. In favor of distributing the architectural work of the Government by competition there is more to be said. The amount of designing which has been required of the Supervising Architect of late years is more than one man can do justice to, and the incessant preoccupation with administrative work which his position enforces makes it almost impossible for him to put his best strength into his designs. The last two Supervising Architects, Messrs. Potter and Hill, have had the manliness to set this before the Secretary in their reports, and to propose to surrender to others of their profession what is the most attractive part of their work. There is reason to believe that if the government architecture could be divided among the best architects in the country it could be improved. But to distribute it by appointment would be to invite the maximum of political interference, and competition would seem to be the necessary alternative. The existing habits of competition among us do not incline one to look upon a great increase of it as an unmixed benefit, yet a habit of government competition might be of service in fixing a liberal and honorable standard. It may be questioned how much interest Congressmen are likely to feel in a proposal to create unlimited opportunities of patronage, and then to offer them up into the hands of the Secretary of the Treasury. In point of fact, four years ago, when a bill for establishing a Bureau of Architecture in the Treasury Department, and providing competitions for the designs of public buildings, carefully prepared by the American Institute of Architects, was

introduced into Congress, and was followed by another less ambitious measure, prepared in the department itself, which simply directed the Secretary to establish such competitions, both bills were quietly shelved in committee, and were no more heard from.

It has never been quite clear to us why authority of Congress was necessary for such competitions. In the case of the New York Post-Office, a dozen years ago, such a competition was actually invited, and brought out designs from the most capable architects in New York. It was only set aside by the Department through the opposition of the then Supervising Architect, Mr. Mullett. There is not much reason to doubt that, judiciously carried out, it might have ended in better architecture, though perhaps not a better building, than we now see in the New York Post-Office. The experiment has never been tried again. We may, perhaps, assume that later Secretaries of the Treasury have not thought it well to establish the habit, without special authorization, of spending money outside in plans, for preparing which there is provision in their own department. If authorization of Congress is necessary, the simplest machinery is probably the best, as it is apt to be in simple matters, for instance the mere passage of a resolution, attached, it may be, to any measure to which it is germane, authorizing the Secretary to procure plans for public buildings, by competition or in any way he might think advisable; or a special provision, attached to the appropriation for any building, might authorize a like procedure. This, to be sure, would not compel competitions, or itself establish a rule, but it would give an occasion for trying experiments, which, if well administered and successful, might lead to a habit, and so be an obstacle to the ambition of a less scrupulous Supervising Architect, or make it easier to fix the rule by a definite law. At the same time, it would not cut off the Supervising Architect from all share in designing public work, or compel him to enter into competition for it, both of which we think would be very undesirable. Competitions so established would doubtless bring their own special difficulties, and might not lead to their expected benefit. We doubt if they would improve the public architecture in the average; but it is likely that they might in special cases, and these, perhaps, the most important. And they might, as we have hinted, if wisely and impartially administered, set an example of honorable management, of fair treatment and reasonable compensation to architects, that would help to redeem competitions from the disreputable condition into which they have fallen; otherwise, they would bring the whole system into deeper discredit, and in that case they might, at least, help to clear the way for something better.

THE OPEN FIRE-PLACE. XIX.

MATERIAL.

It is evident that a porous material is unsuitable for the construction of furnaces, because the noxious gases generated by the burning fuel, especially by anthracite coal, pass through them under a back pressure, or even in cases of a sluggish draught. With an ordinary drum furnace like the Magee or MacGregor there is almost always an outward pressure from within at the top of the drum even when the draught is good. Under a given pressure the amount of gas passed through a given material will be in direct proportion to its porosity. Cast-iron is said to be permeable to certain gases at high temperatures and, according to L. Cailletet,¹ to hydrogen gas even when cold. Whether the gases pass through the pores, or through invisible air-holes so minute that they may be classed as pores, is immaterial so far as concerns the furnace maker. It is sufficient to know that microscopic air-holes are so liable to be present in the castings that the material has been condemned as unsafe and unsuitable for gas-holders, compressed-air tubes, and all places where a gas pressure has to be resisted.

In order to test the degree of this permeability under varying pressures, the writer had cast six cylindrical boxes from some of the softer iron used by a foundry-man in making furnace and stove castings.

The boxes, having the section shown in Fig. 135, appeared to be perfect in every particular.

The top or mouth of each piece was threaded after casting so as to receive the end of a piece of gas-pipe two meters long threaded to correspond, making with cement an air-tight joint. (Gas piping was formerly frequently made of cast-iron, but its permeability to gas under pressure was too great, and it was abandoned in favor of wrought-iron.) Clean mercury was then poured into the gas-pipe and the pressure in atmospheres on the casting was known by the

¹ L. Cailletet überzeugte sich dass das Eisen, nicht nur wie Deville und Troost nachgewiesen, im stark erhitzten Zustande, sondern auch bei gewöhnlichen Temperatur von Wasserstoffgas durchdrungen werde. (Wagner's Jahresbericht, vol. xiv., p. 54.)

height of the mercury column (Fig. 136). It was found that under pressures varying from one to three atmospheres, the first three of the six castings tested allowed the mercury to pass through the pores or



Fig. 135.

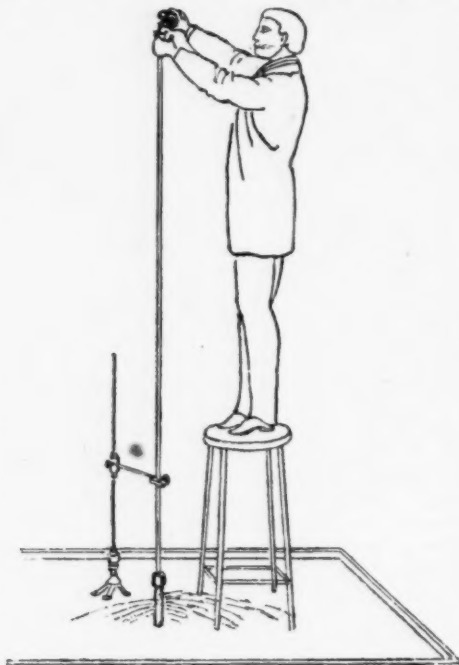


Fig. 136.

air-holes in minute jets, as shown in Fig. 136, projecting it, when the pressure was greatest, a distance of more than a meter from the vessel. Yet the feeblest pressure was sufficient to cause it to escape from the largest openings. The other three castings resisted the test. A greater pressure than three atmospheres could not be applied with the materials at command. The mercury became much dirtied, after the first three experiments, by impurities in the gas-pipe and castings, so that it is possible that the amalgam thereby formed filled the pores in the last three castings and itself prevented the passage of the pure mercury.

This experiment was suggested by the experience of Professor Wolcott Gibbs of Harvard University, from whom I have the following: He was filling a cast-iron pot with mercury, and had poured into it about fifty kilograms of the metal when it was observed suddenly to shoot out in fine streams in all directions through the pores of the vessel. Professor Gibbs described the iron which he used to be perfect so far as the eye could detect. The boxes in which mercury is put up for the market have to be made of wrought-iron.

The six castings tested as above described were fifteen centimeters long each, and nearly two centimeters in diameter. The metal was two millimeters thick at the threaded end under the shoulder, and about five millimeters thick at the other end. The object of this gradation of thickness was to discover what effect the thickness of the coating had upon its permeability. It happened that the mercury escaped in all cases at points near the middle of the cylinders, where the metal was of medium thickness. But inasmuch as it did not flow from all parts of the castings with equal freedom, but rather from particular localities in each, it would appear that it could hardly have passed through pores, as the term is commonly accepted, but rather through minute accidental pin-holes between the granules or crystals of the materials not to be avoided in casting. In this case iron of a hard, close texture would be open to these imperfections as well as soft iron, though not to so great a degree on account of the smaller size of the crystals. These openings may be partially closed by filing the surface of the casting. A file was passed over one of the castings tested while the mercury was escaping under the pressure. A number of the jets were obliterated, only the stronger ones remaining. For this reason samples to be tested should not be turned or filed, but subjected to the pressure in the rough state as they come from the foundry. It is also in this state that they appear in furnaces, for the sake of which the tests are made.

Hammering is still more effective than filing, and in wrought-iron the pores and air-holes are completely closed.

Thus every part, as large as the small samples tested, of every casting used in a furnace is liable to come out riddled, like them, with minute holes invisible to the eye, yet large enough to allow of the escape of gas under pressure. This outward pressure exists more or less frequently in every hot-air furnace now known. In the ordinary dome furnace it is constant in ordinary use, as previously said. Furnace men will differ in regard to this and will say that it is impossible, thinking that a powerful upward chimney-draught would overcome any slight upward tendency given by the height of the dome above the lower opening into the smoke-flue.

Others will be as positive the other way. But the practical fur-

nace man is unfortunately not the authority to consult on these matters. He is commonly ignorant of the scientific principles which should govern the construction or regulate the use of a furnace, and generally unwilling to see the virtue of any arrangement not found in his own.

To ascertain the truth, the writer was obliged to have a hole bored in the top of the dome of his own furnace, which is a wrought-iron MacGreggor furnace No. 4, one which is to be recommended. It is similar to the Magee shown in Fig. 132. The opening was five centimeters in diameter and threaded to take a brass tube as shown in Fig. 137.

A manometer was attached to the tube and the pressure of the gas from within or without accurately measured in millimeters of a water column. It was found that there was a constant outward pressure of from one to eight millimeters, according as the check-draught door was from one to five centimeters open. Or, roughly speaking, a pressure of about one millimeter for every centimeter of opening. No valve was used in the smoke-flue. The same pressure outwards occurred when the feed-door was open.

There was never an inward pressure except when the draught up the smoke-flue was too powerful to be left with safety.

From these experiments, therefore, the necessary inference is that cast-iron furnaces afford no adequate security against the escape of gas. Even if tested under pressure before use, a precaution which no furnace dealer or maker would venture to take, even if it were practicable,¹ they would still be unsafe for the following reason: a casting of iron when examined in section, Fig. 138, will be found to be densest at the surface and more and more open or larger in grain approaching the centre. In a section of soft Scotch pig-iron the granules at the centre appear as large as those in the centre of our figure, while the outer portions are very much finer. Outside of all a coating of silicate forms a thin skin comparatively impervious, so that a furnace, which when new would resist every test, might prove to be quite useless as soon as the thin outer coatings were destroyed by heat and rust.

With wrought-iron these objections do not hold. The gas-pipe used in the experiment illustrated in Fig. 136 was of wrought-iron. As was to be expected, no mercury passed through it under the greatest pressure then applied.

Wrought-iron is, however, more quickly burnt out than cast-iron.

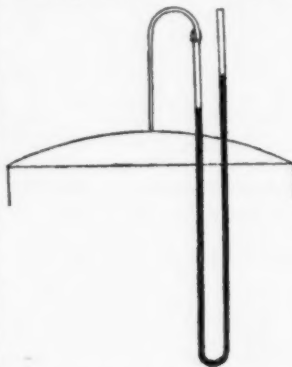


Fig. 137.

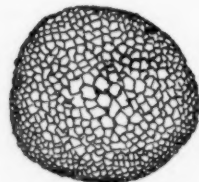


Fig. 138.

But the difference is not important, especially where fire-clay linings are used and proper care is taken in its management.

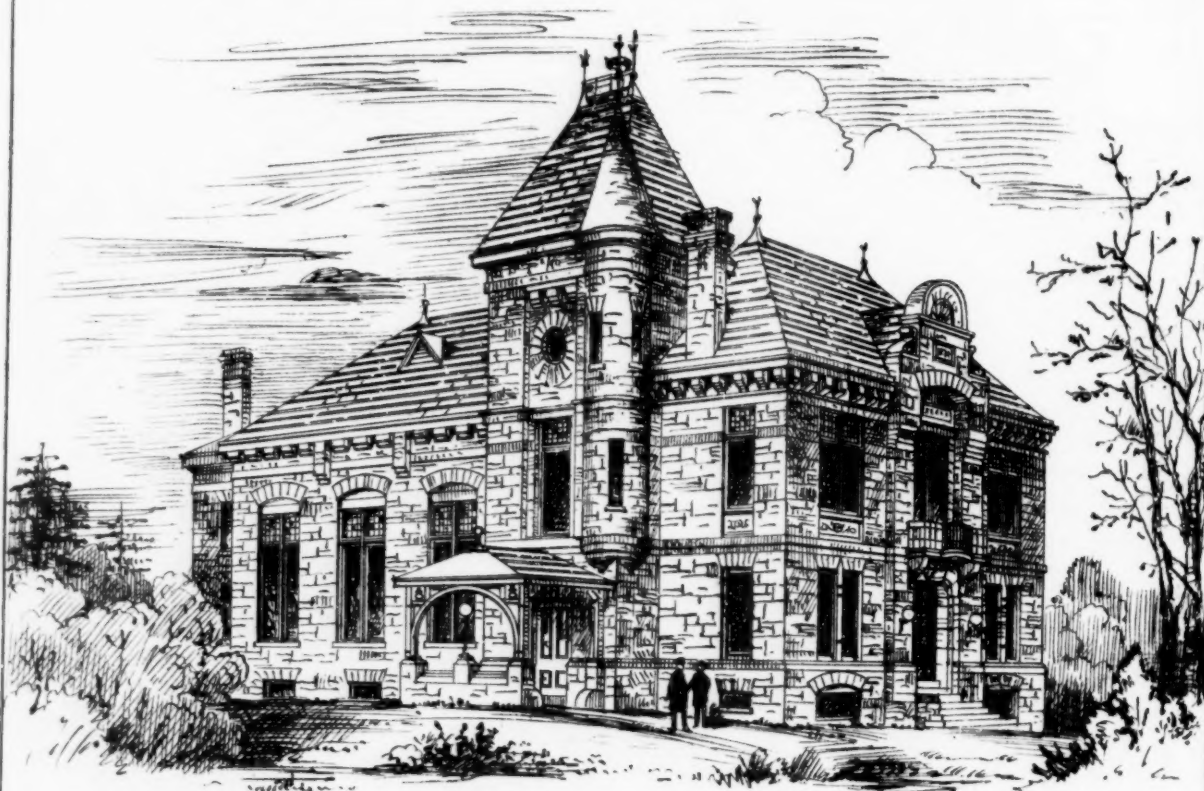
What will happen to iron in a red-hot condition seems to me to be entirely of minor importance. The matter is almost wholly dependent upon the quality of the castings used.

To obtain castings which, in the cold state, will allow no gas to pass through under greater or less pressure, either when new or after a little use, I believe to be difficult if not impossible, as furnaces are now made, and at best always a matter of chance.

Most basement furnaces are now so constructed that it is never necessary to raise them to a red heat to obtain the best results, and, in practice, this high temperature is seldom seen except under careless management.

The experiments of Deville and Troost (who were bound, as scientific and conscientious investigators, to select with care perfect castings for their test) show that a very small quantity, about one half a cubic centimeter, of carbonic oxide was found at the surface of the iron when heated to redness for every million cubic centimeters of air passed over the stove. Of this small quantity, part was generated by the fuel within and permeated the iron, and part was formed on the surface by the decomposition of the constituents of the air coming in contact with it. These experiments, and the report of General Morin to the French Academy, have given rise, for the last ten years, to endless heated discussions as to the danger of iron in this condition, — discussions as fiery when prompted by pecuniary interests as the iron itself under consideration, and having as little to do with the practical question as red-hot iron has to do with properly made

¹ The only test made by furnace men is a "careful" ocular inspection. This is evidently equivalent to no test at all, the air-holes being microscopic; a test would involve either setting up the furnace complete and applying atmospheric pressure or else a special test of each particular casting, both of which are too difficult to be applied in practice.

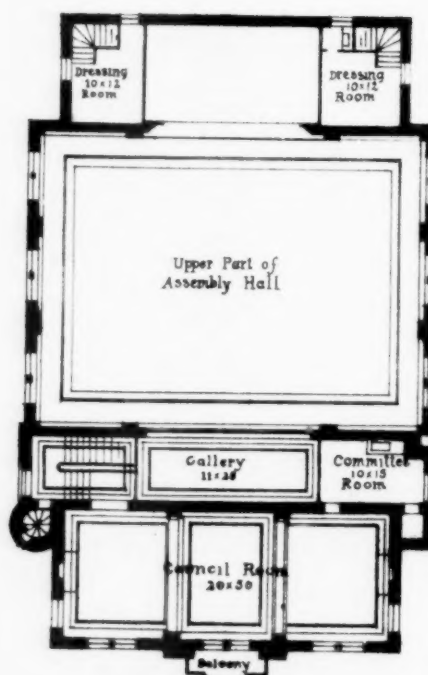


Avondale Town Hall

Des. Wm. Laughlin
Arch't. CINCINNATI O.

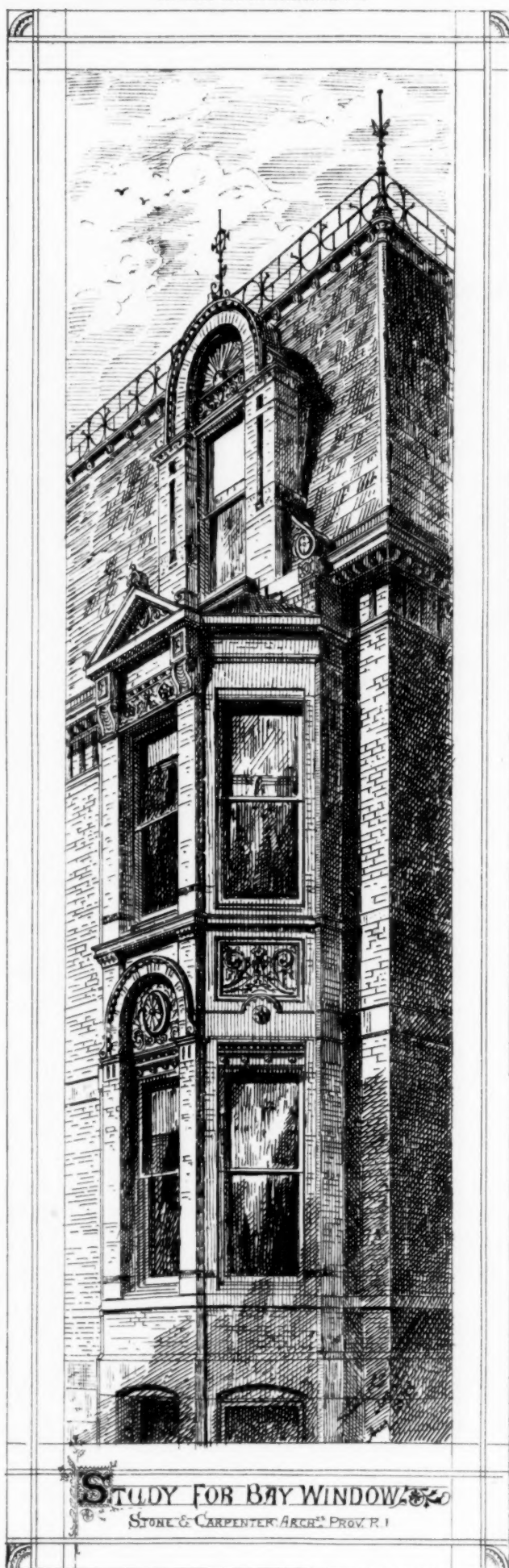


First Floor Plan

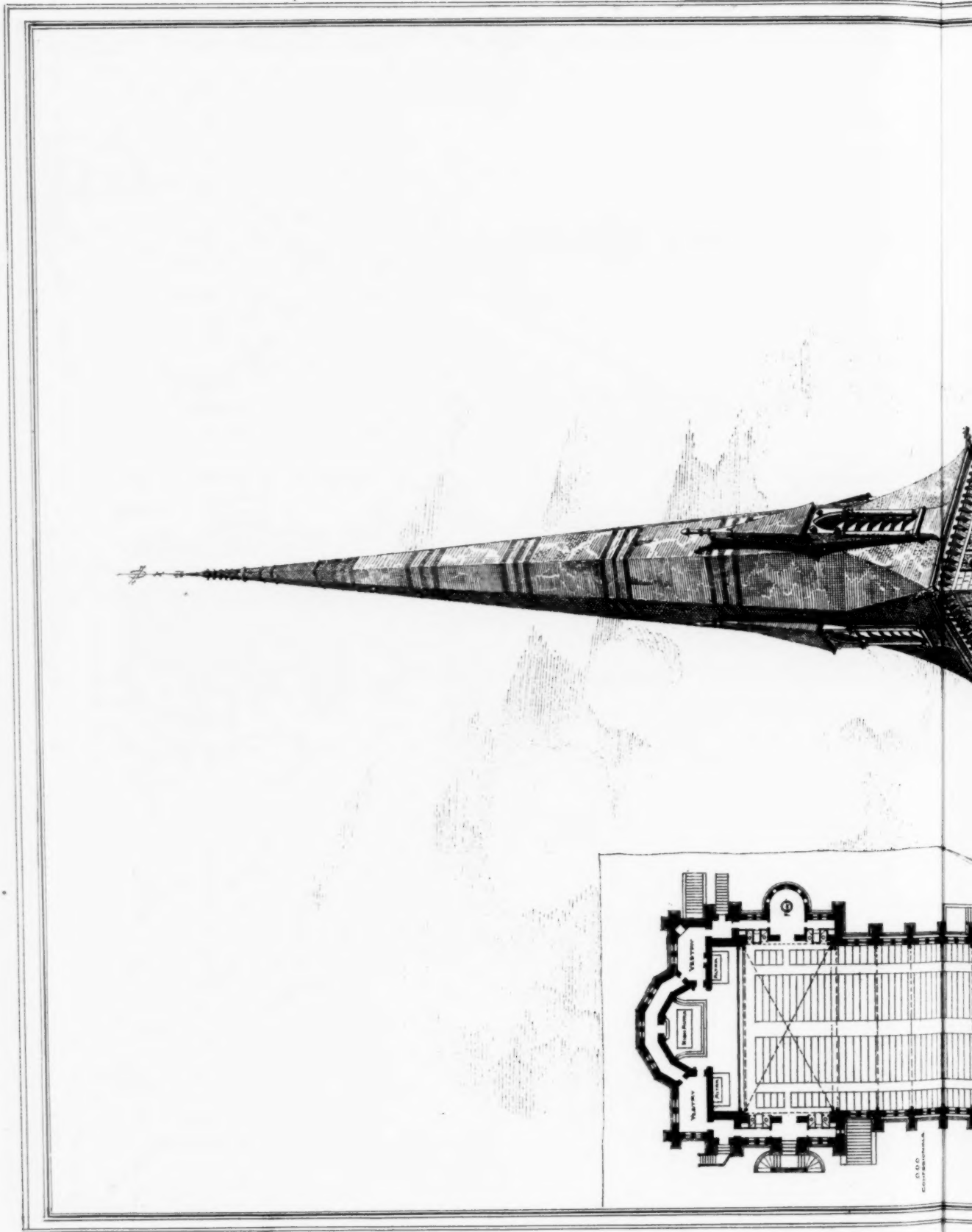


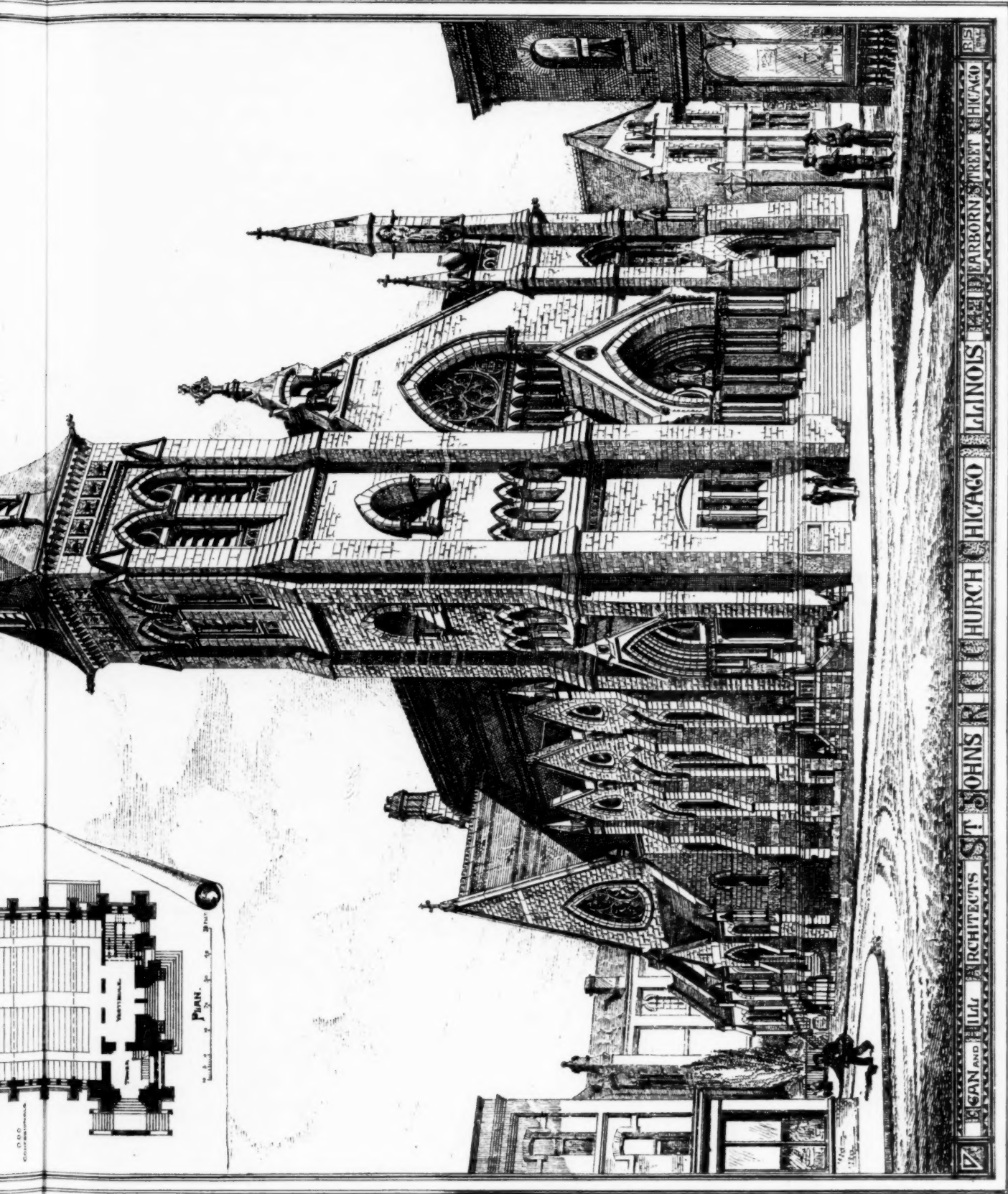
Second Floor Plan

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E. CAN AND HULL ARCHITECTS ST. JOHN'S R.C. CHURCH CHICAGO ILLINOIS 141 DEARBORN STREET CHICAGO

The Shading, Perspective, etc. by J. H. Smith

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modern hot-air furnaces in general. Since these famous experiments the iron has cooled off to a moderate temperature, but the discussions glow as fiercely as ever.

The fire-pot, now much thicker than the iron of the stove tested by Deville and Troost, is, in a proper furnace, also protected by fire-clay (practically to prevent the iron from burning out, but nominally to allay the fears of the worried and excited public). The radiating surfaces remain as thin as before, but are no longer heated to redness.

THE ILLUSTRATIONS.

ST. JOHN'S (ROMAN CATHOLIC) CHURCH, CHICAGO, ILL. EGAN & HILL, ARCHITECTS, CHICAGO.

THE accompanying illustration is a true perspective view of the new St. John's Roman Catholic Church, on the northeast corner of Clark and Eighteenth Streets, Chicago, now building. The building is now roofed in and the tower is finished up to the belfry stage level. The interior work will be commenced in the early part of the spring. The dimensions of the church are 83 feet in front, 161 feet in depth, and the height from level of sidewalk to cross on front gable 100 feet, while the finished spire will have an altitude of 225 feet. The material of which the building is constructed is Lemont limestone, it being used as rock-faced ashlar in the body of the façades, while the finish and general architectural details are bush-hammered and tooled. The columns of the doorways, etc., are of polished gray granite. The interior finish of the roof is of a somewhat peculiar construction, it being an open-timbered, hammer-beam, and brack-eted roof of 64 feet clear span. The estimated cost of the building is \$120,000.

DESIGN FOR A BAY-WINDOW. MESSRS. STONE & CARPENTER, ARCHITECTS, PROVIDENCE, R. I.

TOWN-HALL, AVONDALE, O. JAMES W. McLAUGHLIN, ARCHITECT, CINCINNATI, O.

This building is being erected in the village of Avondale, one of the suburbs of Cincinnati, for the use of the corporation and for general assembly purposes. The material of the exterior walls is the local blue limestone, laid in random courses, with finish of Buena Vista freestone. The roof is covered with dark Virginia slates. The cost will be \$16,000, F. W. Handy having the contract for the whole work.¹

CORRESPONDENCE.

QUEEN ANNE WORK.—NEW BUILDINGS.

CINCINNATI, O.

DURING the past year there have not been any buildings of magnitude either started or finished, but there have been a considerable number of moderate-sized buildings built. Everything seems to be running to pressed-brick fronts: go where you will the red pressed-bricks loom up before you in a manner somewhat startling to those who have been used to the sober freestone of which this city is mainly built. Pressed-bricks being used so freely, it naturally leads the architects into the inevitable Queen Anne. It perhaps will remain an open question as to whether this pressed-brick and Queen Anne craze is the consummation so devoutly wished for, or whether it is not more like unto a woman's bonnet, in style to-day, and to-morrow,—why, no one will look at it. This much is certain, however, that so far in this city there has not yet been built a pressed-brick front which does not show numerous cracks, which are, to be sure, merely "local," and mean no serious harm to the building, but their existence calls for some manner of prevention at the hands of the architects.

The building now under roof at the corner of George and Race Streets, designed by Mr. Hannaford, is perhaps the best example of this style that has yet been built in this city. It has every peculiarity of the Queen Anne, and is a very creditable effort. The building is to be occupied by the Phoenix Insurance Co. The Wiggins Building, corner of Fifth and Vine Streets, is a plain, six-story stone-front office-building, designed by Mr. McLaughlin, and presents nothing new, which is somewhat disappointing since it occupies the most prominent corner in the city.

The "Albany" is another office-building, nearly completed, at the corner of Vine and Baker Streets,—pressed-brick and freestone, and Queen Anne. This building started out to be the most Queen Anneish of any, but it ends up in execution a rather tame affair. Mr. Hannaford was the architect.

The Government Building,—well, this pile of granite and iron is making haste toward completion with its usual slowness. The fourth story, with its round-headed windows, seems to be completed, and now will come the main cornice, the balustrade, and the immense roof. This building grows so slowly that it hardly seems to grow at all, and it will take, no doubt, this year and next to get the roof on.

All things considered the architects have reason for self-congratulation that during the year just ended business has been reasonably brisk, with prospects of a still more busy season to come. C.

¹ This is the building in regard to which the Builders' Exchange protested against the awarding of the contract, for the reason that the State law forbids the making of contracts for an entire building, of which the cost will exceed \$10,000, to one person.

THE ARCHITECTURE OF ROME.

[We translate the following extracts from a new book by M. Henri Houssaye.]

THE monuments of ancient Rome impress one with the idea of grandeur, but not with that of beauty. The Cæsars, monsters as they were, were incapable of inspiring the serene creations of the Greeks. They could only create monsters—monsters of grandeur, indeed, of magnificence, of richness. The divine harmony, the sovereign reserve, the pure rhythm of the Greeks, were unknown to the Romans. There is even something monstrous and *tourmenté* in the Colosseum and the Forum, as in the Baths of Caracalla.

Like the monuments of pagan Rome, so the edifices of Christian Rome impress us with the idea of grandeur and magnificence, but not with the idea of beauty. The precious marbles, the overloaded ornament, the blaze of gold everywhere, the brilliant coloring of mosaics, savor more of the theatre than of the temple. But even through its excess this splendor acquires a grandiose character. With something less of luxury and costliness the interior of St. Peter's would have the air of a ball-room or a theatre. Such as it is, it seems a colossal tabernacle, which strikes one with a sudden awe.

Beauty, then, seems wanting in Rome. But, on the other hand, everything about the city is grand. Even the rococo style of the Jesuits, which prevails in most of the churches, is grandiose and imposing.

All the Roman ruins have a certain barbaric aspect which is never observed in Greece. Their sculpture is often almost effaced by time, the stone and marble of the monuments is rather hewn than dressed, and the courses of the masonry are laid in an almost cyclopean fashion.

But, independently of these imperfections, the Roman ruins can never produce the impression which one feels at Athens, because it is impossible to be alone with them. Over every pediment, every portico, every colonnade there rises some dome, or belfry, or campanile, some sordid hovel or vulgar convent hides the façade of a temple, some wretched priest or begging monk appears under a triumphal arch. In contemplating these monuments of the past we are perpetually reminded of the present. And what a present! On the Acropolis one may imagine himself living in the age of Pericles. It is very hard in the Forum to imagine one's self living in the age of Augustus.

When France sets herself to any enterprise her hand is soon recognized. Ten years ago nearly the whole of the ruins of the Palace of the Cæsars, on Mount Palatine, were buried under ground, and covered with a wild vegetation, amid which the owls found an undisturbed retreat. To-day the excavations begun by the Emperor Napoleon III.—*cuique suum*—have brought to light a new Pompeii. Foundations appear, many still carrying their ground-floor apartments; statues, busts, pedestals, fragments of sculpture, shafts of black marble columns issue from the ground; frescoes, bright and warm in color, and superior in execution to the paintings in the museum at Naples, glow in the sunlight. Guide-posts, inscribed with texts from the Latin authors, indicate the sites of the streets, the palaces, the gardens of the imperial mount. With his Tacitus and Suetonius in hand one may wander through the innumerable labyrinths of this theatre of the splendors and crimes of the Cæsars. All this work is carried on with a method and a cleanliness which are very foreign to Rome.

The ruins of the Baths of Caracalla seem to have been born of storm and tempest. Everything here is on such a scale that one almost refuses to believe it the work of mere mortals, and would rather believe these immense blocks of travertine to have been dropped here by some cataclysm, or thrown from the slings of Titans fighting against the gods. And if one imagines these colossal buildings entirely clothed with the rarest marbles, serpentine, lapis lazuli, rouge and verd antique, supported on columns of porphyry, rose-granite, and basalt, decorated with frescoes and mosaics, filled with more than two thousand statues of marble and bronze,—of which the Torso of the Belvidere, the Callipygian Venus, the Flora, the Venus of the Musée Chiaramonti, the Farnese Hercules and Bull, are only a few of the masterpieces,—an immense library, hot and cold baths, theatres, circuses, arenas, where three thousand hired bathers found employment, and an army of gymnasts, actors, and athletes; and finally that every Roman citizen might enter here freely, without price, the whole being offered to the people and paid for by the Emperor,—such a picture staggers the reason and overwhelms the imagination.

For one curious in the history of art there are few more interesting subjects of study than the paintings of the sixth century in the crypts of the Church of San Clementi. One can here put his finger on the transition-point from pagan to Christian art. These figures are not yet stiffened by the immovable drapery imposed by the Byzantines; art has not yet bound itself in the monkish strait-jacket which it is only to burst ten centuries later. In the frescoes of San Clementi one sees the traces of the fine movement and the easy charm of the Greco-Roman paintings. The expression of the heads is Christian, but the bodies are pagan.

The crypts of the Capucins are divided into several halls, entirely decorated with tibias and femurs, with skulls, vertebrae, clavicles, and every sort of bone. The earth of these chambers has the prop-

erty of preserving bodies from decay. The Capucins are buried here, and after lying three years in the ground are exhumed. If the bodies are in good condition they are clothed with the robe of the order, put into an attitude of prayer, and stuck up thus, upright and with clasped hands, in niches formed of the bones of their brethren. If the bodies are, on the other hand, partly decayed, they are dissected, and their bones are used in the construction of vaults and walls and niches, of lamps, crosses, and funeral emblems with which to adorn the walls.

It is the rococo boudoir of the king of terrors. Nothing can be more indecent than this immodesty of death, this violation of the grave, this exhibition from beyond the tomb. Surely the Capucins well deserved the sarcasm of Voltaire, who said to one who had signed himself an *unworthy Capucin*, "Of what can you be worthy, if you are unworthy of being a Capucin?"

Certain churches of the Middle Ages are symbolic. The dismal crypts represent the Church suffering, the Church in purgatory, the Church persecuted and hiding herself, the Church of the catacombs, the desert, and the martyrs. The nave, where the light passes through the narrow pointed arches, stands for the Church militant, the Church of Earth, where the faithful are struggling against temptation and anguish, the Church of Constantine, of Charlemagne, of the Crusades. The towers, lifted into the light of heaven, symbolize the Church triumphant, the Celestial Church of the Blessed, the Church of the prophets.

One may trace a like symbolism in the various styles of religious architecture which have followed each other across the ages.

The Romanesque churches, with their full-centred vaults, their elliptic arches, their low doors, like the posterns of a fortress, crouching under heavy lintels, their massive and coarse sculptures, their barbaric simplicity, — here, again, is the Church in tribulation. The Gothic cathedrals, with their airy vaults, their stone lace-work, their sharp spires and pinnacles, which seem as if destined to arm the heavenly legions, their parapets like loopholes, their sharp ridges, their long reaches of sinister shadow, their expression of courage and *elan*, represent the Church militant. The Roman basilicas of the sixteenth century, of which St. Peter's is the prototype, with their immense domes filled with golden light, their vast windows letting in the sun in all his splendor, their vaults blazing with decoration, their casings of precious marbles, their columns of porphyry, jasper, agate, lapis lazuli, and rouge-antique, their altars of silver and gold, incrustated with sapphires, rubies, and topazes, their pavements of marble and mosaic, — these stand for the Church triumphant.

ARCHITECTS AND UNDERWRITERS.

[We copy from the Boston *Journal* some parts of its report of an address delivered last week by Mr. Edward Atkinson, in Boston, before the Society of Arts, on "The Relation of the Architect to the Underwriter."]

"I HAVE given to the secretary as the subject of the evening, 'The Relation of the Architect to the Underwriter.' I might close that chapter like that on the snakes in Ireland — there are no snakes in Ireland; there is apparently very little relation between the architect and the underwriter. It is rather the relation which ought to exist between them to which I shall devote my attention. It will be found among the undoubted facts that the fire-tax imposed upon the people of the United States is the heaviest tax to which they are now subjected. It is distributed with greater equality than almost any other. It is more than equal to the cost of the largest standing army of any European nation. It is as causeless and as useless and as unfit as would be the existence of a standing army of an equal cost in the United States. The record of the fires of four years prior to this which has just ended, carefully calculated after the facts have been ascertained, and not from mere newspaper report, amounts to \$327,000,000. The last year exceeds the average. The indirect charges are the cost of sustaining insurance companies, not less than \$30,000,000, and the cost of fire departments, not less than \$25,000,000. The price we pay for carelessness, ignorance, stupidity, and, I think, less than we commonly think, fraud, is \$130,000,000 a year. The actual sum paid out by insurance companies in the four years preceding this year was \$170,000,000.

"Now, by what title have I any right to speak on this subject, representing an insurance company, representing a method of insurance which is assumed, as a rule, by most persons to be of an entirely different character from the ordinary method of insurance, a mutual insurance company, with no capital whatever, insuring textile factories, paper-mills, and machine-shops — the extra hazardous risks as a whole? Forty-five years ago the Hon. Zachariah Allen, of Rhode Island, having a cotton factory with some of the appliances that are now known to be effective, went to an underwriter of that day and asked that, in consideration of those appliances, the rate of insurance upon his factory should be reduced. The answer which he received was, 'Oh, we can't send our men around to look at these little improvements that may amount to something and may not. The rate on cotton factories is two per cent. You may take it or leave it.' This induced Mr. Allen to found the system of the mutual insurance of factories, with a system of inspectors who did go around to look into these little appliances and see whether

they made any difference in the risk or not. The result of that is a combination of companies now insuring \$200,000,000 a year, each insuring the other. The company of which I am president insured last year \$43,000,000. It was a disastrous year in other lines, a year of excessive losses; we have lost less than \$14,000. The mutual alliance of companies which Mr. Allen founded forty years ago returned to their members this year, on the first of January, on the risks then expiring, an average of ninety per cent of their premiums, and their average premium on the mills which they insured instead of being two per cent is nine tenths of one per cent. The sending around of a few young men to see whether these appliances were good for anything or not has reduced the cost of the insurance of those extra hazardous properties to nine one hundredths of one per cent the past year.

"Now let us look at the architect. I know and count among my personal friends many men as thoroughly competent to build safe warehouses, safe churches, and safe school-houses, as any architects in the land, and what I shall say will not apply to them. I shall speak only of those who, having had a few lessons in the art of design, and being capable of copying from photographs, and of combining a few elements of outside architectural effect, in many cases entirely unfitted to the climate and conditions of this land, but incapable of considering this or the necessities of the business to which the buildings are to be devoted, assume to be architects, and impose upon public opinion. Pretty pictures put into brick, stone, and iron are many of the buildings in the new part of Boston, unfit to be insured, incapable of being lighted, as to many rooms, unprofitable to the owners, and, as soon as their interior faults are known to those who examine them, no longer carrying any pleasure, even to the eye, in their outside decoration, however beautiful it may have appeared until its utter unfitness had been measured. The men who build those structures I don't call architects. I have given the values of fires for four years; now let us go to classes. In the years 1875, 1876, 1877, 1878, — 1879 increasing the average, but not yet compiled, — there were burned, wholly or in part, in the United States, 1,354 hotels, 265 churches, 182 school-houses, 40 court-houses, and 45 almshouses, hospitals, asylums, and poorhouses, — a total of 1,883. That represents a class of structures that some skill, some architectural requirements, some capacity is usually supposed to be applied to. Let us go to another class to which the art and skill of trained men is not supposed to be applied: saw-mills, 652; livery stables, 523; furniture factories, 372; liquor stores, 733, — in all, 2,280 uninstructed, or about 400 more than the instructed. Now, gentlemen, I said that my predecessors, my coaljutors, have made cotton factories, woolen factories, and paper-mills better risks than stone churches, brick school-houses, and iron warehouses; and, perhaps, better than hospitals.

"Now, why?" Mr. Atkinson gave a description of the structure of the Immanuel Congregational Church, burned about a year ago, saying that it was in reality a wooden building inside a stone shell, and drawing the conclusion that the fire was caused by a defective arrangement of heating apparatus. He referred to the danger to property arising from rats building their nests of oily rags, stating that a fire arising from that cause had damaged the Rialto Building some \$2,000 or \$3,000. He spoke of the new Latin School-House as a building in which the danger of fire has been very thoroughly considered, but still one in which there is great danger of fire, from the facts that its dados are of wood and separated from the walls, and that public opinion has compelled the erection of a roof that is by no means what it should be. He next referred to the Sturgis building, in which an incipient fire was checked by a plastered flooring, and asked how many structures there are in Boston that are protected in a similar manner. Since he had been an underwriter he said that he had seldom found such protection; on the contrary, he had examined many buildings in which the motive of the architect seemed to have been to protect fire from water, and that was the rule throughout the city, in the new part and in the old. Now, he said, we come to iron warehouses. "We had a fire the other night, and it brought down iron warehouses with iron roofs; there was a loss then of about \$550,000. I had visited the building in which the fire took many times, and years ago, before the passage-way was cut through from it into the Cathedral Building, it made me shudder when I went to the upper stories of that building and saw the number of men and women at work in them; for it had wooden stairways for their exit, lined upon each side with wooden boards. I would have insured that building, with its kind of occupants, at a lower rate to burn within twenty-five years than I would have insured it not to burn." Mr. Atkinson criticised the employment of iron shutters to keep out fire, saying they warped as soon as the flames struck them, and that wooden ones covered with tin are much more serviceable.

Mr. Atkinson then answered his question as follows: "There are some lights that can be drawn from factories, and there are some things that cannot be. The modern factory has no place in it, if we know it, where a rat can build a nest and not be found, or where fire cannot be reached by water. The factory properly consists of a brick wall, with the floor timbers eight feet apart. These are about 6 by 12 inches, and on them is laid three-inch plank, and sometimes two thicknesses of tarred felt, and then the top floor. The whole construction is open; the spaces between the beams are wide, not narrow; water can be sent in great streams crosswise or lengthwise. The roof is built in the same way, nearly flat, so that

whatever happens there is a standing-place upon it for the firemen. There is not a great mass of gables and cornices and concealed spots, which modern architecture so many times requires, and which public opinion imposes upon architects who know better. In the factory we don't allow any furrings or plaster on the walls. There is another thing which we never permit in the factory, but which, like iron shutters, is, I believe, required by the building law of this city, — that the timbers should be connected with the walls, so that when the beam burns off or is torn off it brings the wall down. We have the beams laid on an iron plate, with their top corners arched off, and the bricks immediately above them laid dry, so that if anything happens to those beams they roll out of their places and do not tear the wall down. But the great secret is cleanliness and order and the means of putting out small fires. When the secret is discovered how to make the interest of the assured and the interest of the underwriter identical, and to give the assured an interest in the success of the insurance company, as it is in the mutual company, then discipline may be enforced."

OSCILLATION AND VIBRATION OF MILL BUILDINGS.

BEFORE citing any examples of the jarring of mills, I desire to call attention to the character of such motions, and the difference between oscillation and vibration, and then, with this distinction and its causes understood, we will consider a few cases of the vibration of factories and the nature of the remedy.

The motion of a pulsating body is either oscillation or vibration; the first being caused by external forces; and the second the consequence of forces, one of which is the cohesive force within the body, binding its molecules together, and dependent for its character upon the elasticity of the body. To illustrate: If a suspended wire is struck, the forces of the blow and of gravitation cause it to oscillate; if the same wire is strained between two points, the forces of the blow and of elasticity cause it to vibrate.

The rapidity of this vibration is governed by the dimensions, elasticity, and tension of the body; and every mass will vibrate at a constant velocity, whenever that vibration is produced by adequate causes and conditions. Not only every piano-forte wire and organ pipe, but every bridge and factory has its key-note. As the vibrations of the communicating air will force the piano or organ to answer in harmonious response to the tone of the voice, so the structure will reply to the proper vibratory force.

The shaking of a mill is chiefly limited to the vibration of the elastic floor and beams; while the swaying of the whole building is generally caused by oscillation. Both of these motions appear in the same building, but oscillation is due to poor construction, while vibration is produced by impulses synchronous with the key-note of the building, and bears no relation to the solidity of construction. In a certain district of New England many factories were built during the war when high prices, haste for completion, and perhaps limited capital, resulted in poorly constructed buildings. Shabbiness prevails everywhere, the walls are too light, the beams too small, and the floor planks too thin, when compared with structures built by our leading engineers as standards.

In many instances, the weight of the machinery has deflected the floors several inches, and in others, additional columns have been necessary to keep the floors level. The oscillation of these mills is excessive, but I do not recall an instance of extreme vibration.

In the practical construction of machinery, the revolving portions are not *absolutely* balanced; and when one considers the immense weight of revolving parts of mill machinery and its velocity, it seems as if the aggregation of unbalanced centrifugal forces would overturn, instead of merely jar, a mill; and such a destructive result would undoubtedly ensue if these irregularities acted in unison, instead of opposing each other.

Let us consider the characteristics of a vibrating mill floor by comparison with those of a metal plate when vibrating under conditions which are simple and easily controlled.

If a metal plate is supported at the centre, and a violin bow be drawn across the edge, the plate will not vibrate as a whole, but in divisions, which are readily distinguished if sand has been dusted on the plate, as the vibrating portions will jar the sand to the nodes or dividing lines which are at rest. If the plate is a square one, and the bow drawn at the corner, while the free vibration is damped by resting the finger at one side, midway between the two corners, the sand will gather in two lines, dividing the plate into four equal squares; if the bow is drawn at the middle of one side and the finger placed at one of the corners, the ridges of sand will divide the plate along the two diagonals extending from corner to corner; and by varying the positions of the damping points and the bow, the nodal divisions resolve into complex and curious curves and lines. A vibrating mill-floor is under similar conditions, except that the contact of pillars and surrounding walls, as far as they restrain free vibration, complicates the details of these vibrating divisions beyond the power of analysis, except to show that the vibration of the floor is separated into numerous and irregular divisions.

The effect of these forces has been observed in many factories, and for examples I would refer you to the ring-spinning rooms, where the frames are of the same manufacture, and supposed to be operating under identical conditions; some of them will shake violently, while others beside them run as steadily as could be desired.

Some of the gas-pipes extending from the ceiling in the upper

story of a flat-roofed mill were observed to be in motion, while others were stationary, showing some of the divisions in the vibrations of the roof. On account of their rigidity gas-pipes do not indicate the divisions of vibration as sensitively as hanging lamps. In a mill at Haydenville, Mass., the vertical motion of certain hanging lamps showed that there was a vibration of the floor amounting to an inch in some places. Other lamps moved less and some were still.

One of the most delicate indications was in the unoccupied attic of a mill at Exeter, N. H., where the agent had judiciously placed upon the floor numerous fire pails filled with water. The surfaces moved in unison with the vibration of the floor, generally swaying, some traversed by successive lines of waves, whose direction varied in different pails, others evidently over nodal lines were at rest, while a few which were situated upon centres of vibration were covered with ripples such as are produced when a hanging pail of water is struck underneath. Of two pails situated within a foot of each other, one indicated by its ripples that its position was over a centre of greatest vibration, while the other showed by its wave-like motion that its location was near such a point of greatest vibration, but not over it. The vibrations of the floor are in waves moving up and down without any progression, and the character of the motions of the water in these pails was concurrent with such action.

It is well known that some notes on a church organ will cause only certain portions of that church to vibrate. I have been informed that in some portions of the picker building of a Woonsocket mill, the vibration jarred the dust to the nodal lines, showing the divisions clearly.

Although these areas of vibration are modified by the columns and walls, yet they are not coincident with any divisions of the floor, because excessive vibration has been observed near such places, while the portions away from such support were at rest, but the reverse is generally the case, and most perfect repose is near the points of greatest stability, where one would naturally expect to find it.

The superintendent of a New Hampshire mill, when in the factory on Sunday, was greatly surprised at the shaking of the building. He observed that the water was flowing in broken sheets over the dam, and presumed that the pulsations of air were synchronous with the key-note of the mill; continuing his observations, he learned that with a greater or a smaller flow of water over the dam, the mill was at rest; and also with the scuttle in the roof open, so that the puffs of outside air were in free communication with the interior of the mill, the vibration was much greater than when the scuttle was closed.

At Centerdale, R. I., the water flowing over the dam caused at times a great vibration in the mill. This has been stopped by fastening vertical pieces of plank, at intervals of ten feet, against the front of the dam, and projecting upwards so as to break the long sheet of water into numerous short falls, whose key-note was different from that of the whole sheet of water which they displaced.

At the Essex Woolen Co., mill number 8 is sometimes thrown into vibration by the water flowing over the dam, and when this happens, the watchman on duty alters the note of the dam by opening the waste gate, and the mill soon comes to rest. Mill number 5, of the same company, but at a privilege lower down the stream, is often thrown into vibration by the falling water at that point, and the story is told that a watchman once fled from that mill, thinking that it was about to fall.

Of the eleven mills owned by this corporation, I have been told that none of the others vibrate from the above cause. When in operation, mill number 6 was often thrown into vibration by the motion of the machinery.

When vibrations are due to machinery, they are stopped by changing the speed.

At the Merrimac Mills, Lowell, and many other places, this method has been successful. It is unnecessary to cite further examples, but in all cases vibrations are noticed when some adequate cause is sounding the key-note; if the velocity of these pulsations is altered, the vibrations due to that identical cause will cease.

The consequences of mill vibration in the power absorbed by its exertion in the continual straining of machinery and mill must inevitably tend to damaging results to plant and product.

Were not a lot of columns placed almost at random out of the question in a mill, we could make the statement that vibration could be diminished and nearly stopped by placing columns under the principal centres of vibrations, and so dividing the floor into still smaller areas of vibration.

The only sure method of prevention applicable to the future seems to be in the construction of one-story mills, with the shafting resting upon piers in the basement. The result in the additional speed without any disturbance of stability, and of the diminution of the repairs under the same excessive conditions, in mills constructed upon the one-story plan will hasten their introduction. In such a mill, if vibration should take place, it could be stopped by additional columns in the low basement without interfering with the machinery.

The swaying of a mill owing to oscillation is due to a lack of stability, and weak construction, and the only correction possible for such cases is to increase the strength by reconstruction of the weak portions of the building. — C. J. H. Woodbury in the *Manufacturers' Review and Industrial Record*.

THE HYPÆTHRAL QUESTION.

TO THE EDITOR OF THE AMERICAN ARCHITECT:

Dear Sir,—I have translated from the *Repertorium für Kunstwissenschaft*, Vol. 3, No. 1, the following favorable notice of Mr. Clarke's essay, "The Hypæthral Question," by Dr. Franz Reber, the historian of classical art. "Since Bötticher's refutation of Dr. Ross," he says, "the statements of Vitruvius on this subject have been generally accepted as authoritative, and there has been an inclination to treat any further protest against them as mere stubbornness. The practical difficulties, however, in the construction of the 'Hypæthrum' have baffled the ingenuity of the most skilful students and restorers of ancient architecture. Mr. Clarke's pamphlet is, in our opinion, successful, at least to this extent: that the existence of the hypæthral temple can no longer be considered an established fact."

He gives quite a full analysis of Mr. Clarke's arguments, accepting them without any criticism or doubt. He condemns only the attempt of the "really worthless" essay of Schultz to prove that Vitruvius was a mediæval monk. His closing words are: "Although many doubts yet remain unsolved, we have no hesitation in saying that the weight of probability is against the existence of the hypæthral structure." X.

PUBLICATIONS RECEIVED.

OUR ARCHITECTURE AND ITS DEFECTS. A Critical Essay prepared for the Association of Architects of Washington, D. C., and delivered there December 22, 1879. By John L. Smithmyer, A. A. I.

COMMON SENSE IN CHURCH BUILDING. Illustrated by seven original plates. By E. C. Gardner, author of *Homes and How to Make Them*, *Illustrated Homes*, and *Home Interiors*. New York: Bicknell & Comstock. 1880.

FIFTH BIENNIAL REPORT of the Board of Capitol Commissioners to the Governor of Iowa. October 31, 1879. Printed by order of the General Assembly.

NOTES AND CLIPPINGS.

GOOD BOOKS FOR STUDENTS. — The Royal Institute of British Architects recommends to students who intend to present themselves before its examiners the following list of books: —

- Architectural Publication Society's Dictionary of Architecture. (Incomplete.) I, III, IV, V.
 * Baker, Land and Engineering Surveying. 12°. 1871. II.
 * Baker, Mensuration, 6th edition. 12°. 1867. II.
 Barlow, Treatise on Strength of Materials. 8°. 1867. II, IV.
 * Burnell, Limes, Cements, and Mortars. 12°. 1872. V.
 Brandon, Analysis of Gothic Architecture. 2 vols. 4°. 1849. I, V.
 Burchett, Linear Perspective. 8°. 1871. I.
 Chambers, Civil Architecture. (Various editions.) I.
 * Dobson, Art of Building. 3d edition. 12°. 1871. IV.
 * Dobson, Foundation and Concrete Works. 12°. 1872. IV.
 * Dobson, Masonry and Stone-Cutting. 12°. 1871. IV.
 Dobson, Students' Guide to Measuring and Valuing, edited by Tarn. 1871. III.
 Donaldson, Handbook of Specifications, with Glenn's Law of Contracts. 8°. 1859. III, IV.
 Fairbairn, Application of Cast and Wrought Iron. 4th edition. 8°. 1870. IV.
 Ferguson, History of Architecture in all Countries. 3 vols. 8°. 1865. V.
 * Fownes, Manual of Elementary Chemistry. 12°. II.
 * Gibbons, Law of Dilapidations and Nuisances. 8°. 1849. III.
 Gregory, Mathematics for Practical Men. 4th edition. 8°. 1862. II.
 Gwilt, Encyclopædia of Architecture, edited by Papworth. 8°. 1871. I, II, III, IV, V.
 Laxton, Examples of Building Construction. 2 vols. large folio. 1855-58. I, IV.
 Newland, Carpenter's and Joiner's Assistant. 4°. 1860. I, IV.
 Noble, Professional Practice of Architects and of Measuring Surveyors. 1836. III, IV.
 Normand, Parallel of the Orders of Architecture. Folio. 1829. I.
 * Portlock, Treatise on Geology. 12°. 1859. II, IV.
 Reid, Young Surveyor's Preceptor. 2d edition. 4°. 1871. IV.
 Rickman, Attempt to Discriminate the Styles of English Architecture. 6th edition. 8°. 1862. I, V.
 * Smith (T. Roger), Acoustics of Public Buildings. 12°. 1861. II.
 Tarn, Practical Geometry. 8°. 1871. II.
 Todhunter, Mechanics for Beginners. 8°. 1867. II.
 * Tomlinson, Warming and Ventilation. 12°. 1868. II.
 Tredgold, Elementary Principles of Carpentry (Barlow). 8°. 1870. IV.
 Viollet-le-Duc, Dictionnaire d'Architecture. I, IV, V.

Explanation. The books mentioned are divided into five classes and belong to one or another class according to the indications of the Roman numerals attached. These classes embrace: I. Drawing and Design; II. Mathematics and Physics; III. Professional Practice; IV. Materials and Construction; V. History and Literature. The books marked with an asterisk belong to Weale's Rudimentary Series.

THE BROOKLYN BRIDGE. — The Executive Committee of the Trustees of the Brooklyn Bridge have just reported that of the entire estimated cost of the bridge, \$13,708,026.60, \$11,706,457.62 have been expended, leaving the estimated amount to complete the work \$2,001,594.98. To this is to be added the estimates for advance in cost of materials, making the requisite amount \$2,250,000. A bill will be recommended to the Legislature providing that New York be authorized to pay \$750,000 and Brooklyn \$1,250,000, for the completion of the work, the money to be raised by the issue of bonds.

THE NEW CAPITOL AT ALBANY. — The commissioners in charge of the erection of the new capitol report that the total amount expended to date is \$9,600,681.65. The amount standing charged to this account on the books of the comptroller is \$10,261,870.84. The difference between these two statements is assumed to be in the cost of land and other expenses incurred prior to the beginning of the construction account. Of the sum first mentioned \$132,583.45 were paid for furnishing the completed portion of the building. The last appropriation of \$500,000 for the continuation of the work was not made available, by the terms of the act, until the commissioners had filed a written certificate with the Secretary of State, to the effect that, after examining the estimates, plans, and specifications, they were satisfied the building could be completed at a further cost of \$3,500,000 over and above that appropriation. This provision was complied with, and the commissioners claim that the record of work performed during the year demonstrates the correctness of their estimates and proves that if there shall be no considerable advance in the price of labor and materials the building can be completed for the sum stated. The commissioners are also of opinion that the prosecution of the work to the best advantage will require appropriations of \$1,500,000 for the ensuing year, and \$1,000,000 for each of the two years thereafter, and that the entire building can be made ready for occupancy within three years from this time.

DILATORY CONTRACTORS. — The contractors for supplying the iron for the roof of the new building for the Bureau of Engraving and Printing have got themselves into trouble and been brought up with a short turn by Secretary Sherman. The contract for the iron called for the delivery several weeks ago, and provided for a penalty of twenty-five dollars for every day it was delayed after a specified time. The iron was not delivered in accordance with the terms of the contract, and the work on the building has been set back several weeks in consequence. The contractors allege as the reason for the delay that iron has advanced in value very much since they took the contract, and that they have more orders on hand than they can fill, and that consequently the Government must wait. Secretary Sherman does not consider these reasons satisfactory, and has given instructions to enforce the penalty against the contractors for not complying with the terms of the contract. He is determined to see whether this will not hurry up the iron, so that the building can be put under cover, and the plastering proceeded with.

A BELGIAN PERMANENT EXHIBITION. — On the first of next May a permanent international exhibition will be opened at Brussels, the capital city of Belgium. This year is the fiftieth anniversary of Belgian independence, and the occasion will be largely celebrated by various festivals, and a large attendance at Brussels is expected for next summer. The Belgian government is anxious that other nations should exhibit specimens of manufactured goods and art work.

ARCHITECTURAL PATCHWORK. — Bits of former great mansions in England are curiously scattered here and there. The columns of what is known as the National Gallery, in Trafalgar Square, once adorned the front of Carlton House, the famous abode of the Prince Regent, of which not a trace to-day remains; and the stone screen from the same palace now stands in front of the Duke of Westminster's London home. The staircase of the Duke of Chandos's residence, Canons, was bought by the lettered Lord Chesterfield for Chesterfield House, where it remains.

ROBBING THE MUSEUM AT ALEXANDRIA. — The Boulak Museum is the best history that exists of the Pharaohs, with their twenty-five dynasties, and the Persians and Greeks who followed them. Statues, pictures, ornaments, and writings are all there to tell the story. But the locale is small and damp, and changes were projected last summer which required the closing of the museum for a time, and the packing away of all the valuables in cases until the alterations were completed. They were all deposited in a neighboring warehouse under what seemed proper guardianship. But robbers the other day broke in through the roof; and they must have been robbers of a certain rank of intellect, for some eighty or one hundred *scarabæi*, of great value pecuniarily and impossible to replace, as they related to the early dynasties, were abstracted, although they were things of no apparent worth to an ignorant person.

NEW TEMPLE AT MOSCOW. — The Kham Spasctelya, or Temple of our Saviour, at Moscow, is now rapidly approaching completion. The building was begun so far back as 1833, and was designed in commemoration of the French expulsion from Moscow. Nearly 4,000 laborers, for a month, were employed in digging out the ground for the foundations, and considerable energy was displayed in building the base; but, after a while, operations languished, and the work has gone on by fits and starts, until it has now reached a stage when the architect can promise its completion next August, in readiness for the twenty-fifth anniversary of the Emperor's coronation. The height of the structure is 288 feet, and the style of architecture is the Russo-Byzantine, the building being in the form of a Greek cross, surmounted by five cupolas, one at each corner, and a large one, or dome, in the centre. The roof and the framework of the cupolas weigh 1,800 tons, and the gilding on the latter has already consumed more than half a ton of gold-leaf. Above the centre cupola is a massive bronze cross, which can be seen from every part of Moscow. The bronze frames of the windows, each nine yards high, weigh nearly three tons, and the hinges of the bronze doors have to support five and one quarter tons of metal. Inside, the walls are gorgeously decorated in the usual style of Russian churches, and contain a number of jasper pillars, each of which cost upward of £2,000. The total cost of this wonderful building is estimated to exceed 20,000,000 roubles, or £2,500,000. But this is not all. Recently the architect reported that a block of houses in proximity to the temple was detrimental to one of the aspects, and as a mere matter of course, the Synod voted £200,000 to demolish the buildings, and to construct in their place a terrace. It must not be forgotten that this is the second great cathedral which Russia has raised during the last sixty years, the famous one of St. Isaac's in St. Petersburg having been begun in 1819 and consecrated in 1858, after an expenditure of 36,000,000 roubles, or £4,500,000. A third cathedral, not quite so large, is also rising at Nijni Novgorod, and will involve an outlay of £2,000,000 before completion. — *The Parisian*.