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CONTENTS.

ONE of the queerest cases in the legal experience of architects is that which a correspondent cites in another column, wherein an architect was actually arrested for embezzlement of his own plans, because, having disagreed with his client, he refused to give them up. We say his own plans, for, though this architect was carrying out work begun by another, and therefore, we presume, from plans made by another, he had succeeded by special agreement to the practice and professional equipment of the other, and the whole suit turned on the question whether an architect's plans are his own or his client's, — a question which is oftener raised, and makes a great deal more trouble, than there is any occasion for. If the question were once thoroughly examined in court, and a decision recorded by conspicuous acknowledged authority, it might be set at rest; for the matter is entirely one of usage, and the usage is so universal wherever the practice of architecture is systematically carried on that there can be no difficulty in ascertaining it. Unfortunately for this end it is very much the habit of courts, as of common men, to avoid the decision of any issues which can be set aside from a trial, and of the decisions that are made a great many, being on cases which are unimportant in themselves, whatever may be the importance of the principles they involve, are not put on record; so that they are useless for precedents. Thus, in the case before us, the court before which the first trial was held only decided that, there being no evidence of an attempt to defraud, the criminal suit must be dismissed, leaving the question of ownership to be carried up in a civil suit before a higher court. We have discussed this subject before (*American Architect*, June 15, 1878), noting the unmistakable custom which prevails, with the reasons which lie at the bottom of it, and have expressed regret that a usage so important and so easy to establish should have thus far so slender a recognition from the courts to show. We may trust that in Mr. Tolman's case the question will be thoroughly examined and the usage inquired into by the court. In order to help in setting forth the matter clearly, and to take advantage of what judicial decisions may be within reach, we would suggest to our readers to communicate to Mr. Tolman, or to us — or to both — any decisions or cases bearing on the question at issue of which they may be aware. In this way they may lend a hand in clearing the practice of their profession from one very needless cause of disagreement with inexperienced clients.

EXCEPTIONAL cases will come to mind which do not fall under the general rule, but which do not invalidate it. The celebrated case of Mr. Edward Barry against the English Commissioners of Public Works was decided on grounds which do not apply to ordinary work, the usage, as we understand it, having been simply overruled on the ground of state necessity, as it were by law of eminent domain. Where architects are salaried officers of city or state, and the running expenses of their offices are borne by the city or state, the drawings which are made in these offices, like the rest of their working equipment, belong naturally to the employer, that is, the public. But even in the case of a government architetct, the claim has been advanced, and we believe allowed, that the architect's own sketches, made to help the operations of his mind, and not for use in carrying on the work, were his own, and need not be surrendered to the government. It is worth while, perhaps, to repeat here a caution which we have given before: that it is desirable for architects in making out their bills for services to avoid a form which is sometimes used, and not to render bills "for plans and specifications." This form would be equivalent to a bill of sale, and, assuming that the plans and specifications were originally the property of the architect, would transfer the title to the client who paid the bill. It is a form that we suspect is often used inconsiderately, but it would be better to use the form which more careful architects adopt, as do other professional men — "for professional services," — or, if items are demanded, to include, "for the use of plans and specifications." Several inquiries which we have lately received make it seem worth while to reprint, as we do in another column, the tariff of charges recommended by the American Institute of Architects. We will add, to avert a misunderstanding which seems to be not uncommon, that the tariff is not an enactment of the Institute, intended to prescribe a rule for the profession, in which case it would simply be a trades-union decree, addressed to the allegiance of members. It is merely a recognition by the Institute of the scale of charges usually and lawfully made by architects in this country and in Europe, to which the Institute recommends that its members, like other architects everywhere, should conform.

IN the late Sir Gilbert Scott's posthumous Recollections, edited by his son, and just published, there is a suggestive passage which indicates, or marks to those who were aware of it, a noteworthy difference between himself and his great rival in modern Gothic work, Mr. Street, in their ways of carrying on work. Sir Gilbert, as is pretty well known, being the most popular architect of his day and nation, had more work on his hands than any one man could fully follow in its details. It was understood that in the carrying out a great deal was left to his subordinates, and in these Recollections he lets it appear that his system was contrived to take full advantage of the capabilities of those who worked under him in sparing his personal care, — a system which often naturally led to a more or less unsatisfactory result. He complains that his carvers, glass painters, and metal workers were apt to work after their own fancies, and to do things for him that he did not like; that much unsatisfactory carving, for instance, was done on his work, and that sometimes it was "detestable." He compares his manner of working with Mr. Street's, and after remarking the improving effect of both on the English carving of the day, he says of Mr. Street, "He can lay claim to his more personally than I can to mine, as he gives drawings, while I do my work by influence; but the results are in both cases of a high order." The long and short of this is, we take it, that Sir Gilbert allowed his subordinates to supply their own ideas, which he influenced, to use his own word, by his criticisms, while Mr. Street prescribes everything. It is known, in fact, to be the habit of Mr. Street, a draughtsman of rare facility, whose use of his pencil is incessant, to provide his draughtsmen with sketches for everything, and even to the last detail, from his own hand, — a habit which is almost unexampled among architects of very large practice, but which gives completeness of character and individuality to an architect's work as nothing else can.

THESE two ways of carrying on work are typical. It will always be an open question how far an architect shall originate, or how far only control, the decorative details of his work, although in our day the most capable men are apt to carry their personal care farthest in the designing of detail. Carried out to a logical extreme, the difference marks a broad distinction, which separates architecture, as Mr. Ruskin has somewhere remarked, into two great divisions, the types of which are classical architecture and the styles which imitate it on the one hand, and mediæval on the other. The classical styles, indeed, are an extreme instance. Classical work was in many cases so designed as to allow every detail to be prescribed with an exactness and uniformity which one designer could easily control, and which, requiring nothing but mechanical training in the workman, left absolutely nothing at the mercy of his capacity if once his skill of hand were assured. Mediæval work, on the contrary, in its most characteristic development, gave scope for endless design of individual workmen. The ideal of modern architects has been to approximate as closely as possible to the extreme classic practice, and to prescribe every detail with minutest care; but in reality they differ greatly in their degree of approximation, and many are necessarily very dependent on the design of subordinates. This ideal way is naturally the most effective in giving to skilled design the entire harmony which comes of having every detail thoroughly in keeping with every other and with the whole; but it requires either that the work shall be designed in a style which by its formalism and repetition reduces the workman to little more than a machine, or that the architect shall confine himself to a very little work, or finally that he shall have such a working power as belongs only to a very few exceptional men. The other procedure belongs more naturally to styles which depend on fulness and variety of detail; and it generally leads to the sacrifice of something of the perfect ensemble to these. But it allows a single architect to do an amount of work which is only limited by his administrative ability or his opportunities. It can be successful only when there exists a body of workmen trained to design in their own field, as well as to work, informed with a common feeling, and trained in a uniform way and to a uniform pitch of excellence that will give to the work of all a natural unity.

This condition of things existed in the Middle Ages, but it has hardly existed since. In modern times it is seldom possible to carry out a large work with satisfactory unity where much independence is left to the individual artisans. No doubt the abstractly perfect condition is one in which every artificer may be trusted to design his own decorated fragment of a building, so that the workman may be in his own way an independent artist, while the whole does not suffer. It is this system that develops the workman to the highest point, and makes the most of a man of him; so that politically and philanthropically it is most to be desired. But it is almost hopelessly at variance with the modern tendency to eclectic design, since it can hardly succeed except when men are working together in one style with which they are all instinctively familiar, a condition of things which is the opposite pole from eclecticism, and from which we are very far at present. Where, as is too often the case, the different artificers are left nowadays to their own devices, the carving, the painted decoration, the glass and metal work are sure to be joined in a life-long quarrel. Even where an architect has supervised the whole he can seldom secure more than mutual tolerance among the different kinds of work unless he designs every detail himself. So much success as Sir Gilbert Scott achieved in his way is only possible where a large force of workmen has been painstakingly trained, as this generation has been in England under the Gothic revival. No modern nation has yet carried such a training to the point of a really satisfactory unity; whether it lies in the direction of our present progress is questionable. However much it is to be desired, at present the most really successful work is done on the other plan.

There is some natural appropriateness to an era of bursting steam boilers in the ordinance now pending before the St. Louis municipal assembly to legalize the inspection of boilers by insurance companies, ordering that the inspection of insurers shall be accepted in lieu of the official inspection required by the city, and also requiring that engineers and their assistants shall submit to examination and take out licenses. The arguments are that the city inspection is only required once a year, and is made only by the hydraulic test, which is fallacious, and may weaken boilers dangerously; that the insurance inspections are more frequent, being made every four months; more careful and thorough, being made by companies which have a risk in the boilers; and safer, because for this hydraulic test they substitute a careful examination of the boiler by mechanics, inside as well as outside. That the ordinary official testing is too superficial to be of much value is true enough, and it is very desirable to substitute something better. It is our opinion that no boiler should be used at all which is weak enough to be injured by the usual hydraulic test; but still, if a weak boiler is allowed to be used, it is certainly better that it should not be made weaker in testing. It is quite likely that an insurer, who had an interest in the safety of a boiler, would make a more searching examination than the ordinary inspector; and so far something might be gained by the proposed change, provided it were insisted on that the boiler tested should be one actually insured by the examiners, as a guaranty of good faith and thoroughness. But what is really wanted is some radical change in the methods of testing, as well as a raising of the ordinary standard of construction, which has been steadily going down for a number of years, and a greater margin of safety than is commonly provided. The usual methods of inspecting, including the hydraulic test, allow only for the steady pressure to which a boiler is to be subjected, and make no account of the sudden shocks to which it may at any time be exposed by accident or careless handling, which there is every reason to believe are the cause of most of the explosions that occur, and many of which probably could be withstood by boilers that were as strong as they ought to be. One point is that boilers should be tested in the beginning through careful examination by sample of all the iron that goes into them, with reference to its behavior at different temperatures. If this were done, and if a record were kept of their history, a great point would be gained in favor of safety. And if they were run by even tolerably competent persons, there would be another chance in their favor. At a hearing of the manufacturers of St. Louis, a considerable opposition was made, it is said, to requiring an examination or license of engineers. What real objection there can be to demanding license or examination, or any other effective qualification, for the men who are to have a special opportunity of destroying our buildings and lives, we do not know. To be sure, it might possibly raise their wages by checking the supply of incompetent persons.

We notice that Senator Burnside's joint resolution apropos of the Inter-Oceanic Canal declares, by virtue of the Monroe doctrine, that "the people of these States would not view without serious inquietude any attempt by the powers of Europe to establish under their protection and domination a ship canal," etc. We, as non-political editors, have no business with the Monroe doctrine, nor do we know whether the resolution has a chance of passing. It occurs to us, however, that the private capitalists of foreign nations, who are more likely to build the canal than any one else, need not be deterred by an expression of feeling like this, provided they have the encouragement of the states through whose territory the canal is to pass. Or if a canal project seems important enough to command the support of nations, it will be more important to our nation than to any other, and a good way to avoid this unpleasant inquietude would be either to join heartily with other nations in building the canal, and so preserve our right in it, or else take it in hand and build it for ourselves. The sound of such a resolution from a nation that stood aloof from the undertaking would be a little like the bark of the dog in the manger.

This time it is Captain Eads who comes forward with the proposition to transport steamships by rail across the Isthmus of Darien, instead of cutting the canal through it. In a letter to the New York *Tribune*, he argues that to construct a ship railway would cost only a half or a third as much as to build a canal, and would take only a fifth as long. He thinks, moreover, that the transit would be quicker, not occupying more than twenty-four hours; and that the cost of working the railway would be "considerably less in proportion to the tonnage moved over it than that of the most successful railway line in this country," a thing which would depend greatly, we should think, upon the amount of use that was found for it, and the length of the road that was compared with it. Captain Eads's plan does not differ materially from others of like kind that have been suggested, but is explained more in detail than most of them. He proposes to carry his ships across, not in tanks, but upon platforms or cradles, which would be made in sections a hundred feet long, and put together in lengths to suit the size of the vessels. The ships would be floated upon these, and raised to the level of the track in locks, or by hydraulic rams. The cradles would run on eight or ten parallel rails. Each section would be supported on some two hundred wheels, part of which would be driving-wheels, themselves driven by engines incorporated in the cradles. These wheels would carry each about twelve tons when the cradles were loaded to the full, which is about twice the weight borne and transmitted to the rails by the driving-wheels of a locomotive. A dozen freight locomotives, or their equivalents, he thinks, would be enough to carry the largest ship and cargo over grades as steep as those that are used in ordinary railroads, and at a speed equal to that of an ordinary freight train, though he would not count on a speed of more than eight miles an hour. Captain Eads does not give any estimates for the comparative cost of maintenance of a railway and a canal, but assumes rather loosely that if by his project the cost of maintenance should be half the gross receipts, the investment would still be more profitable than a canal. We will not argue against the practicability of a plan brought forward by the successful engineer of the St. Louis bridge, but it should be remembered that the data for computing the cost of such a railway as he proposes are less trustworthy even than for a canal; that a great undertaking of an entirely new kind is apt to be much more costly than it is expected to be; and that permanency of construction and ease of operation are advantages which, in such a scheme, outweigh a very great difference of first cost, so much so that, except where a great saving of time is to be gained, a costly canal is a more economical means of transportation than a cheap railway. In this last respect it is difficult to see that a ship railway across the isthmus could bear any comparison with a canal.

LORD DUFFERIN's proposal to secure the land which borders Niagara Falls on both sides for an international park, to which we referred the other day in discussing Sir William Thompson's counter proposition, and which was commended to the legislature of New York, last winter, by Governor Robinson, may yet come to be realized. It is reported that the State Board of Survey, to whom the matter was referred by the legislature, will meet the commissioners appointed by the Dominion of Canada some time in this month, and that they are likely to report jointly in favor of the park. Mr. Gardner, the director of the New York State Survey, and Mr. F. L. Olmsted, it is said, have carefully examined the lands on the American side, with an eye to the proper limits of the park land and compensation for it. The owners of the land, finding that they have been spoiling their own market and making the Falls unpopular by the series of petty exactions with which they have hedged in the approaches, appear to favor the new plan and to enjoy the prospect of selling their rights to the State, if they can do it at their own prices. A correspondent of the New York *Times* reports estimates of the cost of the land and improvements that are likely to be taken on the American side, which differ according as they come from owners or non-owners, ranging from half a million dollars to a million, and even a million and a half. The commissioners are expected to recommend taking possession of the shore from Goat Island Bridge to the Suspension Bridge, including the whole of Prospect Park. The amount of land to be taken on the Canadian side is put at forty acres, and its cost at two hundred thousand dollars.

THE HYPÆTHRAL QUESTION.[1] III.

THE Pantheon of Rome affords an isolated exception, it is true, of the light of day being introduced into an important building through an opening in its roof, which was necessarily, at the time of its construction, and which has since remained, unglazed and uncovered. But it proves the rule. The reasons which led to the exception are evident, and their consideration may throw light upon the subject, if it does not render the adoption of an hypæthron for Greek temples extremely improbable. The Pantheon consists of a hemispherical dome of brick and concrete masonry, supported upon cylindrical enclosing walls, whose height is nearly equal to the radius of their vaulted ceiling. The interior height of the building itself is thus the same as its diameter; an inscribed circle, the upper half of which is coincident with the sweep of the vault, would be tangential to the horizontal floor line. Never, probably, was there a structure with so great a proportion of its cubical contents surrounded by its covering, enclosed by the inclined lines of its ceiling and roof. This peculiar form is probably due to its original destination as a laconicum or hot room of the Baths of Agrippa. It was of circular plan that the heat and steam might be equally radiated; the opening in the apex of the vault, now the entrance for light, was then an escape governed by a bronze plate (clipeus), which was so suspended by chains as to be raised and lowered at will. As it was raised the temperature of the room fell, because of the freer passage allowed the ascending warm air; when it was nearly closed the heat was increased. These Baths of Agrippa were the first erected in Rome, and the architect was naturally obliged to experiment somewhat upon their arrangement. The great laconicum succeeded so well, was so majestical in its proportions, and so harmoniously developed, that it appears to have been before long devoted to the service of the gods as a Pantheon. The opening in the vault, the form and position of which had been decided by its original service, remained as an opaion for the admission of light to the fane. All the great vault above the interior cornice, a space of equal height with that which remains below, could not have received direct light without an orifice of some kind in the dome itself. Vertical windows in the enclosing walls would not have sufficed, as too large a part of the interior would have depended upon reflected light for illumination. With the high position of the noonday sun in the latitude of Rome, the rays falling at but a slight deviation from the vertical would, after passing through side walls of enormous thickness, have struck but a small surface of the pavement, — never the opposite wall: the dome above would have remained in darkness.

Even if the preceding explanation of the origin of the opening in the dome of the Pantheon be rejected, the great temerity of erecting for the first time a circular vault of so vast a span must be considered, and the additional difficulty which would have ensued from the adoption of side windows. The builders of the Pantheon, daring experimenters as they certainly were, could not but have feared to weaken the supports of the dome by cutting from its side walls the enormous amount of material they would have been obliged to displace to form window openings in sufficient size and number to serve even for the floor alone. The mere existence of the building, after so many centuries, and the attacks of earthquakes, conflagration, and thunderbolts, proves the exceptional care taken to render its construction secure. The lower portion of the rotunda was, moreover, partially surrounded by other walls, by its own great portico in front, and by other rooms of the Agrippa baths at its rear, an enclosure which would have interfered with a free arrangement of windows in the drum. In all, nearly one half of the periphery was thus built in. It is evident that, unless the important dome was to be left in great obscurity, some opening through it, some hypæthron, was unavoidable. The remodelling architect had no prototype for such a horizontal window, other than the original opening of the laconicum. Its retention was natural, and in many respects satisfactory. It gave a sufficient and comparatively unvarying light to the dome; by omitting a part of the vault, the incumbent weight was diminished, while the supporting and enclosing walls were left unpierced, thus retaining their ideal character of securing entire separation and isolation from the world without. The manner in which the opening was left, a simple, unprotected void in the apex of the vault, savors, it is true, of a first trial, and has not since been repeated; it was incapable of further development by later builders.

The Pantheon has often been characterized as the most un-Greek of all Roman buildings. The fundamental difference, which gave rise to all others, and in the first rank to the different method of lighting, is the curved roof of stone which took the place of the horizontal timbered ceiling and inclined roof of the Greek naos. The architectural character of any people, or of any period, is most definitely decided by the manner of roofing adopted. It is clear that no unbroken vault or dome of great extent can be well lighted solely by windows beneath the impost of its lateral supporting walls. The few existing examples where this has been attempted do but show this truth by their ill success. The usual method is to break through the main vault or dome by smaller intersecting vaults, carried up to a sufficient height above the spring of the main vault to admit of the lighting of that space by upright windows. This is so effectual, that its application has for centuries been universal where inclined and vaulted ceilings are employed. Such vertical openings may be observed in the dome of St. Sophia, where, although the ceiling is an arc smaller than a half-circle, and the space below is so much greater in proportion to that of the Pantheon that sufficient light might be supposed to enter through the vast openings in its high walls, there was yet the necessity of direct light to the dome itself. The intersecting vaults are small and numerous, giving, by their great number, an equable light, and so formed as to allow the openings to be protected by upright perforated slabs of stone. This method of rendering the light-openings into a circular dome vertical, instead of inclined or horizontal, is exceedingly ingenious, and if known before the Christian era would certainly have been seized upon by the remodelling architect of the Pantheon, for whom light was so imperative a necessity. It was reserved to be the advance of a later age. Every enclosed space should receive direct light, and the opaion was the only method then known by which the problem could be solved.

In a horizontal ceiled hall, such as the Greek naos, an opening in the covering is not sufficient; the corners, which are formed by the walls, and whatever portion of the ceiling is suffered to remain, can never be directly lighted when this latter is horizontal. Side windows alone can entirely illuminate such an enclosure. Why no window openings were left in the naos wall, where, under the outstanding ceiling of the pteroma, they would have been comparatively protected from the elements, is incomprehensible, if it be supposed that the sacred interior was destined to be reached at all by the rays of the sun. Windows under the pteroma could have received a fitting architectural development, which it would be impossible to give an opening in so disadvantageous a position as is usually assigned to the hypæthron. When it was intended that daylight should enter the Roman temples, there were windows in the side walls; that these never occur in Greek temples is a proof that daylight was not desired for the naos, — that the illumination of the interior must have been artificial.

I may propose it as an architectural principle, that, when a space is to be lighted from above through openings in its covering, roof and ceiling must then fall together as one and the same member. This is the case in the Pantheon, in St. Sophia, even in the Walhalla, which, with all its desire to be Hellenic, was obliged to forego a ceiling. Von Klenze's hypæthral Doric temple, departing as it does

[1] Papers of the Harvard Art Club. No. 1.

from the true principles of Greek architecture, while assuming its form, is interesting and instructive on that very account. The inclined lines of its roof had to be shown within, notwithstanding the employment of an iron trussed frame and the modern *pons asinorum* of glass, as a building material. For temples lighted through an opening in the roof, a ceiling would have been a worse than useless feature. If the shaft which would have resulted between it and the roof had been boxed up, this would have formed an ugly feature, intolerable because the interfering ceiling would have had no significance or function, because the method of introducing light by a chimney cut through the attic roof space is contrary to common sense. If it had been left open, and the eye had been allowed to look into the roof framing, the effect to the observer within might have been more tolerable; but rain would have been carried into the most inaccessible parts of the structure, there to cause the decay of the timbering, if not more expeditious damage, by dripping through the ornamented ceiling of the hyperoon. When inclined roof and horizontal ceiling become separate features, as they do fundamentally in Greek architecture, then the admission of light through them is not to be thought of. Galleries in rooms lighted from above are liable to the same objection that has been made to horizontal ceilings: they impede the light, which in Doric temples could never have fallen directly upon the side walls. Galleries had therefore to be omitted from the Walhalla, wisely for the hypæthral theory, as in that building, which is generally visited by daylight, their gloom would show the disadvantages of horizontal projections under vertical light, clearly as do the galleries in the Munich Odeon when seen during the dreary daylight rehearsals which precede the brilliantly lighted concerts of the evening. Hyperoon galleries existed in all those Greek temples which are now assumed to have been lighted from above. The problem of lighting such temples was in every way the opposite of that presented by the Pantheon, where every horizontal projection is avoided. There is no point of the floor, walls, or great dome of the Pantheon, from which the sky cannot be seen through the opaion; this would be true of but a very small part of the Greek temple floor if the light came from above. The roof-opening of the Pantheon is so far from the side walls that no rain could possibly fall upon them, the horizontal distance being about seventeen metres, while in the temples it could have been but one or two metres, at most, from the edge of the hypæthron to the gallery. The slightest slant of the in-falling rain would thus have carried it upon the hyperoon, from whence it would have dripped upon everything in the interior. The imaginary opening through roof and ceiling must be made ample, from its disadvantageous position; a mere chimney-like shaft would not have sufficed to admit adequate light to the interior. The Walhalla is empty; there is nothing whatever in it to absorb the light; its walls and floors are of polished and reflecting marble. It has a large window in the open opisthodomos, no ceiling, no galleries to cast shadows within, and yet it is barely light enough with eighteen per cent of the roof cut out.

Applying this proportion to the Parthenon, which was in every respect a building more difficult to light from above, it necessitates an opening which, if made symmetrical to the enclosed space, would be no less than seven by seventeen metres. When such a piece of the roof is cut from off the main apartment of the temple, from the very heart of the structure, from that which alone it seems important to protect, the question suggests itself whether the fragment which would remain might not well be entirely abolished, and the building stand altogether roofless. How devoid of reason would be the disposition of the whole temple if covered as now generally supposed. Pteroma, pronaos, and epinaos would have been carefully roofed and ceiled, while within these vestibules an unprotected space was left a mere hollow court. Surely our conception of the truth and thoughtfulness in the architecture of the Greeks is amiss, if such a structure be the highest Hellenic ideal of a sacred fane. Such being the relation of the hypæthron to the interior, let us consider its appearance on the outside. The aëtos or gable roof is in itself so complete a feature, that any such opening would seem to be actually cut out from its material, or the failing ridge to be crushed and broken in. Openings on the corner of a building are always avoided, as the constructive tie, which in such points is most necessary, is destroyed, but the ridge of the roof is no less important than the angles of its supporting walls. The exterior could not be said to gain by the adoption of an opening at this point; the sky line would be entirely disfigured, and the orifice would have the effect of an unsightly notch bitten out of the most important line of the entire composition.

When one first studies modern works on Greek architecture, it is a matter of surprise that there are so few representations of the hypæthron. In fact, it is so difficult to ascribe to the Greek designer such an affront to the fundamental laws of architecture, that but few hypæthral restorers clearly show their intention by adequate illustrations. The plans which have been published do much to refute each other, and but little to prove their own correctness. I may, of course, be excused from even mentioning those reconstructions which suppose the naos covered with translucent tiles or roofed by the perforated segmental, elliptical, or semicircular vaulted ceilings, proposed by Cockerell, Quatremère de Quincy, and Falkener.

A disinclination to break into the ridge, combined with other difficulties attending the arrangement of a mere hole through roof and ceiling, has led an eminent English writer on architecture to adopt another manner of procuring daylight for the interior, which, for the sake of a complete consideration of the subject, should be mentioned.[1] I say adopt, for though Mr. Fergusson is evidently proud of his opinion,[2] it did not originate with him, — at least he was not the first to publish it, — it having been suggested by Boetticher some years before its first appearance in England. That writer did not, however, endeavor to prove its possibility, and the opinion may still be peculiar to Mr. Fergusson. The theory supposes another story over the hyperoon of the naos, a clerestory so to speak, pierced with vertical windows, through which the desired light could fall. The advantages of this over the simple hypæthron are evident. There is a complete ceiling over the naos, as well as over the galleries; the addition above the ceiling line is not of the disagreeable pentagonal form peculiar to the other opening; and there is a roof above the interior which would prevent, at least, the direct in-fall of rain. But the system of clerestories is so foreign to Greek methods of temple building, that it is, at least, extremely improbable that such an expedient was employed. It does not even agree with the only authority for any opening whatever. Vitruvius says *sub dio* and *sine tecto* distinctly enough, and furthermore, in another part of his book, in the account of what he calls Oeci Egyptii, describes just such a clerestory as Mr. Fergusson recommends.[3] If Vitruvius had meant such a structure to be imposed upon his roofless naos, he would surely have there referred to it. Every one who reads Vitruvius with attention will observe that, in all his descriptions of temples, nothing whatever of this kind is mentioned. When he comes to speak of buildings for public and private assemblage, the clerestory appears as a new form, necessitated by their destination. Applied to the Parthenon, such a third flight gives a masked construction foreign to Greek architecture, — causes the building to seem inwardly a basilica, outwardly a horizontally ceiled temple, — thus agreeing as little with the history of the art as it does with the demands of good taste. Such an arrangement would, moreover, surely have left some traces which would have been allowed to stand by the remodelling Christians, who could well have retained it in the Parthenon if it had there existed.

In a line with this is the restoration recently proposed by M. Hittorf,[4] and advocated by M. Chipiez.[5] It is exposed to the same objection; though, as leaving the principal aisle of the naos of its natural height, and introducing the light from a lower level, it is perhaps preferable. But the hyperoon galleries are rendered useless by the light shaft above them, and M. Hittorf's suggestion must be considered as improbable as it is ingenious. Both these restorations leave long and ugly furrows in the roof, into those of the first of which, especially, a great part of the fall of water upon the temple would be led, thus necessitating complicated gutter constructions, which are entirely strange to the simple and straightforward methods of building employed by the ancients.

J. T. Clarke.

THE ILLUSTRATIONS.

COMPETITIVE DESIGN FOR THE UNION LEAGUE CLUB-HOUSE, NEW YORK. MR. R. M. HUNT, ARCHITECT.

The third story contains, as in many of the other designs, the private chambers and appurtenances for the use of members.

EPISCOPAL CHURCH AT COLDBROOK, NEAR ST. JOHN, N. B. MESSRS. R. BROWN AND J. C. ALLISON, ARCHITECTS, NEW YORK.

This church, which will be built shortly, will accommodate one hundred and thirty-two people. It will be built of wood with an open-timber roof. Two thicknesses of boarding are nailed to the purlins, then a covering of shingles. The cost of the work, including seats, pulpit, and reading-desk, will, according to estimate, received, be $1,793.

PLAN AND CALCULATIONS FOR A SYSTEM OF FORCED VENTILATION FOR SCHOOL-HOUSES.[6]

In a paper on Forced Ventilation I had the honor to read before this Society some time ago, I mentioned the great importance and advantages of such a system of ventilation, but at the same time the great difficulties which present themselves, when we intend to use it in a common dwelling or school-house.

That the ventilation in school-houses, and other buildings where a large number of persons assemble, is bad, is a fact generally admitted. In the reports of the school superintendents of the different States to the United States Commissioners of Education we find a general complaint about defective ventilation, and expressions as follow are common: "We have no good system of ventilation;" "School ventilation is thus far a failure;" "The air in our school-rooms is simply execrable;" "The smell of a primary school has become proverbial;" and similar expressions. The bad air and fearful mortality in large tenement-houses is equally well known. As an illustration of the general and most culpable neglect of ventilation in school-

1 *True Principles of Beauty in Art*, 1849.

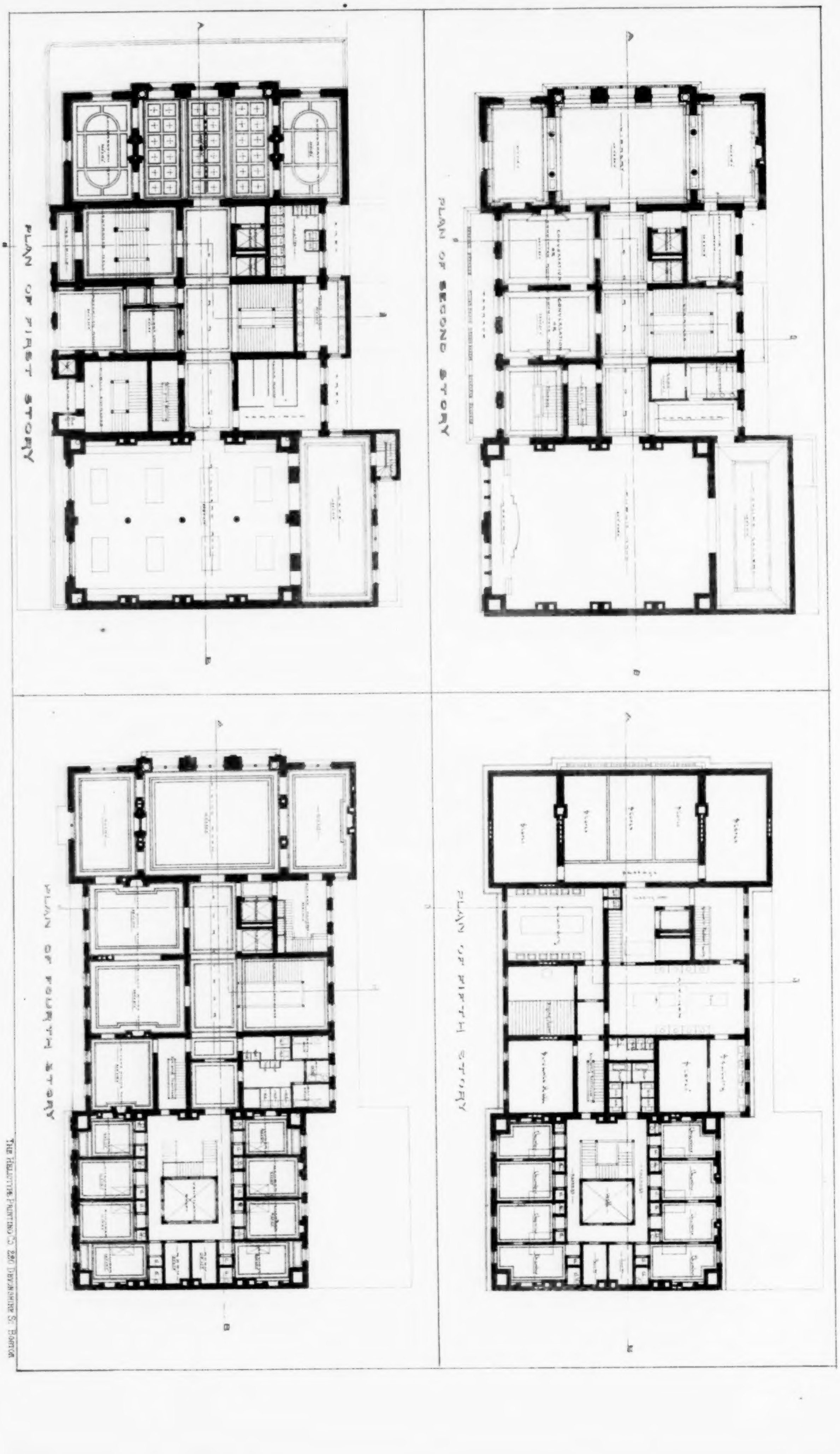
2 "In sixteen years more it may probably find its way into books on architecture, or earlier, if I die meanwhile." *History of Architecture*, 1865, vol. 1., p. 241, n.

3 Lib. v., c. vi.

4 *Architecture Antique de la Sicile*, 1870.

5 *Revue Archéologique*, 1878. A translation of the paper by M. Chipiez is to be found in the *American Architect and Building News*, January 11 and 18, 1879.

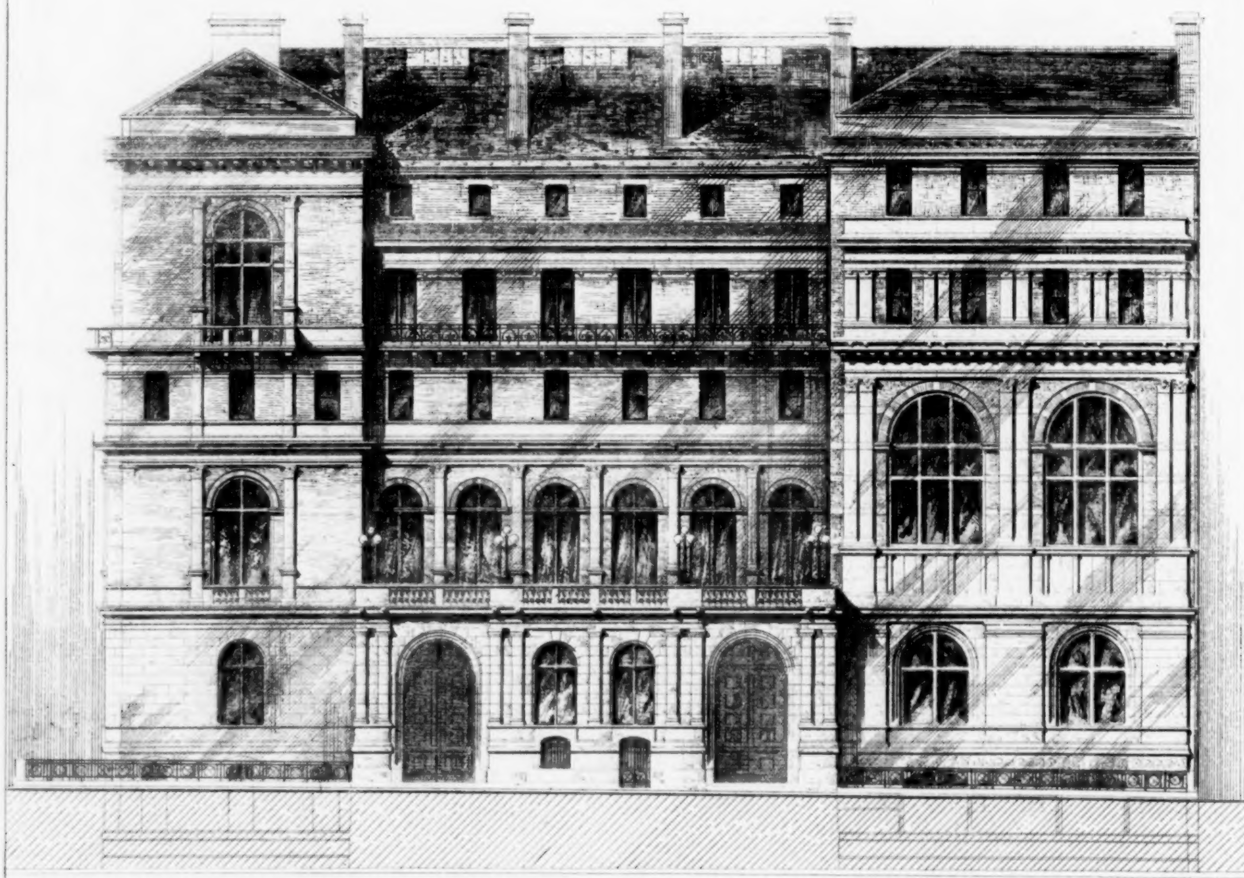
6 Read before the Alameda County Medical Association, February 11, 1879, by Henry T. Legler, M. D.



DESIGN FOR UNION LEAGUE CLUB-HOUSE.

R. M. HUNT, Architect.

THE HELIOTYPE PRINTING CO. 220 DEVONSHIRE ST. BOSTON



SIDE ELEVATION

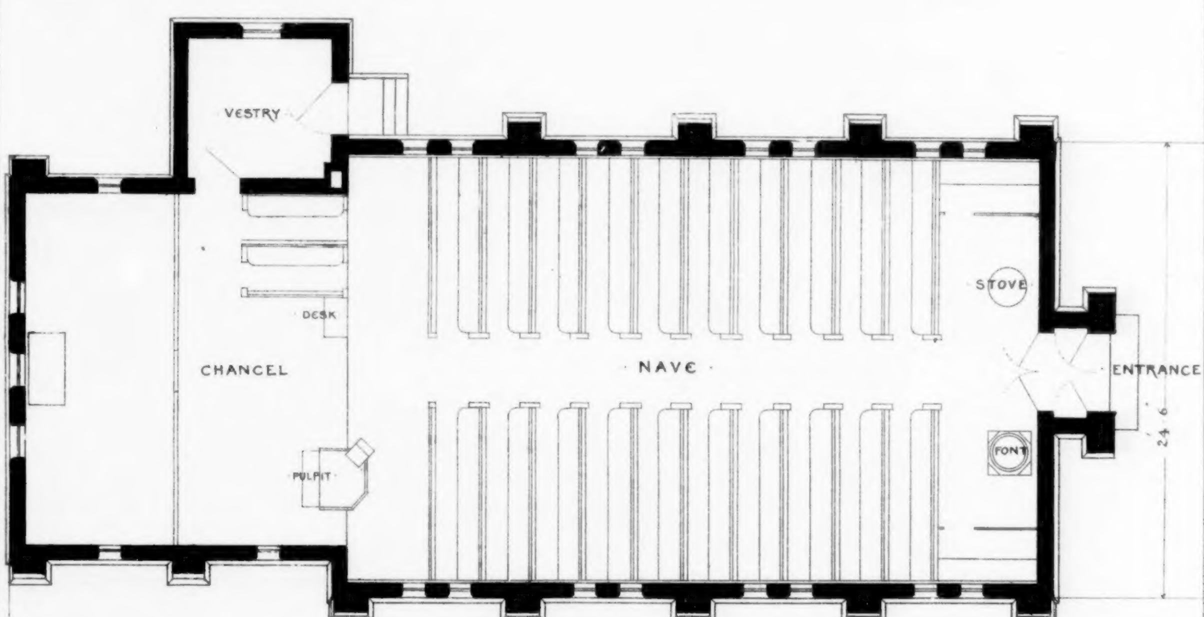
The Heliotype Printing Co. 220 Devonshire St. Boston

SECTION ON THE LINE A.B.

Design for Union League Club-House.

R. M. HUNT, Architect.


· Church ·at· Coldbrook ·
near
· SAINT JOHN · N·B ·
· R. Brown · & · J·C·Allison · Archts


VESTRY
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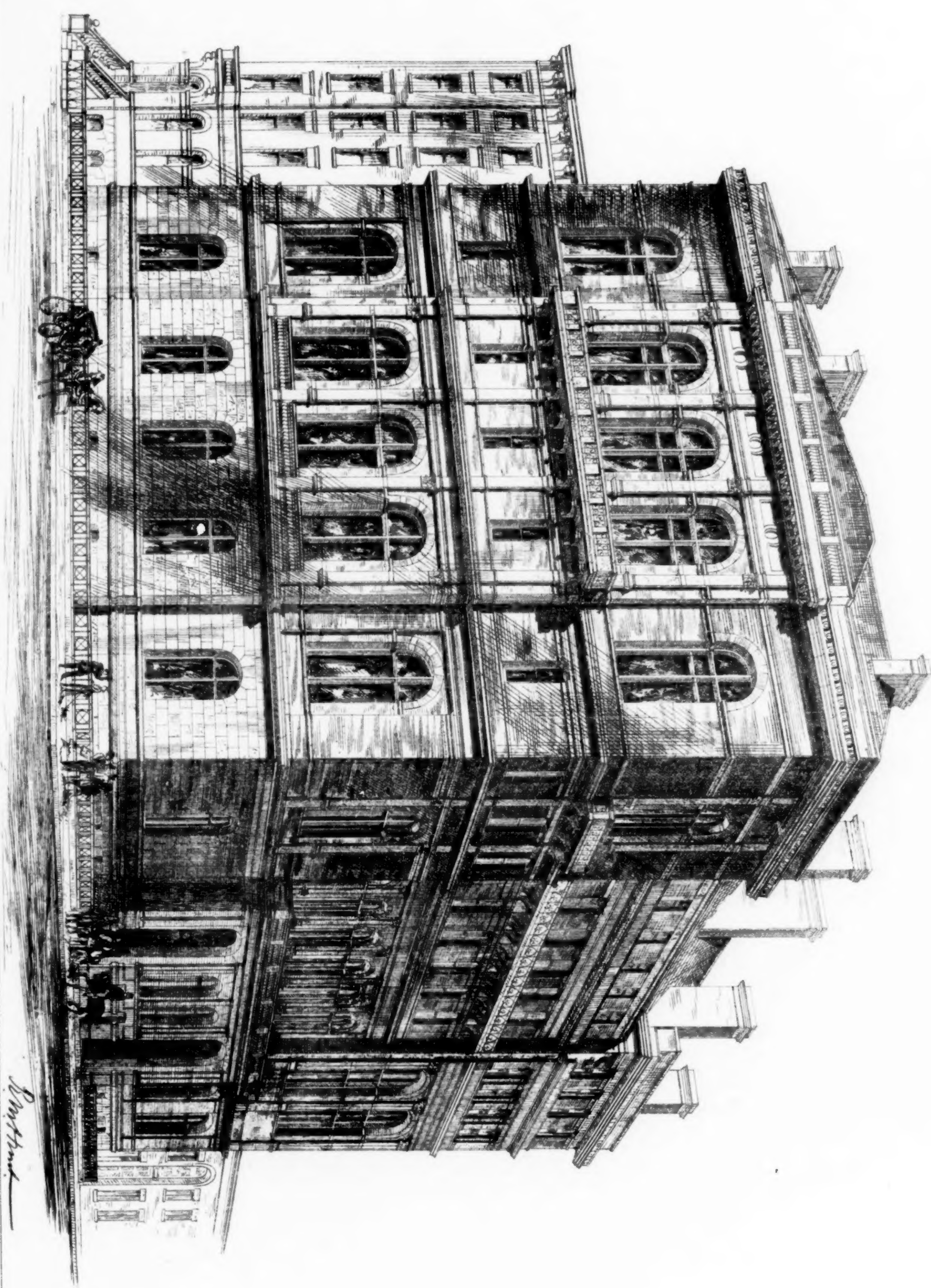
R. M. HUNT, Architect



Design for Union League Club-House.

R. M. Hunt, Architect.

Heliotype Printing Co. 220 Devonshire St Boston

houses we may make the following extract from the report of a Committee of the New York Board of Education: "Of the school-buildings under the charge of this Board there are not ten which are thoroughly healthy; in several, during the winter, the cold has been so intense at times as to render the dismissal of the classes a matter of necessity. The obstacles presented by school-buildings to ventilation, the great quantity of fresh air required, and the difficulty of obtaining it, without unpleasant draughts, have been so serious and so formidable, that in comparatively few of the school-buildings has any attempt been made to secure a good ventilation. The results of this general lack of ventilation are seen in the listlessness on the part of both teachers and scholars, and the dull following of routine, which are standing subjects of complaint, but which are only the inevitable consequences of breathing an atmosphere saturated with the obnoxious vapors exhaled from the lungs, bodies, and dress of the masses of children congregated in a single building. To breathe this foul air tends to produce irritability in teachers, and peevishness in scholars. If long continued, the rottenness of the air is communicated to the lungs and lung diseases are generated. The enormous mortality from diseases of the lungs is in great part attributable to the foul air breathed every day by the children in our schools."

So we find the evil of bad ventilation generally admitted and at the same time the failure of the common draught ventilation.

For theoretical as well as practical reasons draught ventilation must be more or less a failure in crowded rooms. On cold days it is very difficult, almost impossible, to introduce into a crowded room a large volume of fresh air without causing an unpleasant cold draught, and on warm days the motive power, that is, the difference of specific weight between the inside and outside air, is wanting to cause a change of the air (except the wind is blowing and the windows are opened). When we compare the different plans of draught ventilation we find that the simple and cheap ones are ineffective, that the volume of air which they bring into the room is too small to keep the amount of carbonic acid below ten volumes in ten thousand, which should be the maximum allowed, and that the best ones are complicated and expensive, and, therefore, in most cases impracticable.

There are some kinds of ventilating stoves and fire-grates, which bring in the air directly from the outside and warm it before discharging it into the room; for example, Breymann's or Ruttan's stoves, or Captain Galt's grate, which has been adopted in the barracks of the English army. These work well on a cold winter day, when a brisk fire is kept up in them, but they are, of course, perfectly useless in summer, and of little use in spring and fall. In these seasons even the best known plans of draught ventilation, those with large and complicated ventilating shafts and air-ducts, cannot effect a sufficient change of air in a crowded room, unless a special fire is kept burning in the ventilating shaft to cause the necessary draught, — that is, the necessary power to move a certain volume of air in a certain time, — which requires a difference of temperature between the air inside and outside the shaft of at least 40° Fahrenheit.

About this special fire, this "little fire in warm seasons," as it is mostly called in descriptions of systems of draught ventilation, erroneous ideas are prevalent. A little fire will cause, no doubt, some draught in the ventilating shaft, but when we come to calculate the units of heat necessary to move the required volume of air, we find that a pretty big fire is required, for not only a part of the air to be evacuated must be heated, but the temperature of the whole volume passing through the ventilating shaft must be raised 40° F. To raise, as in our example of a school for six hundred children, ten thousand cubic feet of air per minute 40° requires forty pounds of coal per hour. This quantity of coal burnt in a steam-engine is equivalent to five or six horse-power, while only two horse-power would be required to move the same volume of air by a fan in plenum ventilation. So, concerning the consumption of coal, it would be cheaper to ventilate a building by a fan, than by a special fire in a ventilating shaft.

So we find that, if we wish to have an effective ventilation under all circumstances and at all seasons of the year, *no other plan is left but forced or plenum ventilation.*

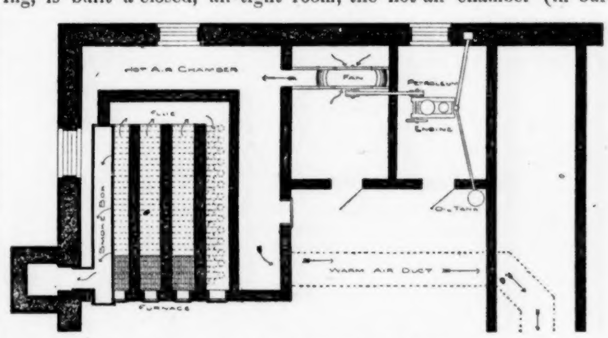
In large buildings, for example in large hospitals or asylums, where they have steam-power and the expenses are of minor importance, this plan has no difficulties; but in school-houses the case is different. Here we want not only a steady power to propel the fan, but it must be at the same time safe and cheap. The apparatus for warming the air in winter should be sufficient for a large volume of air without being very expensive. A common janitor or fireman, with a little scientific assistance from the principal teacher of the school, should be able to run the whole machine. Any plan which cannot fulfil these conditions has little prospect of becoming generally introduced in school-houses.

By the following plan these difficulties, I think, can be overcome and the above requirements fulfilled: —

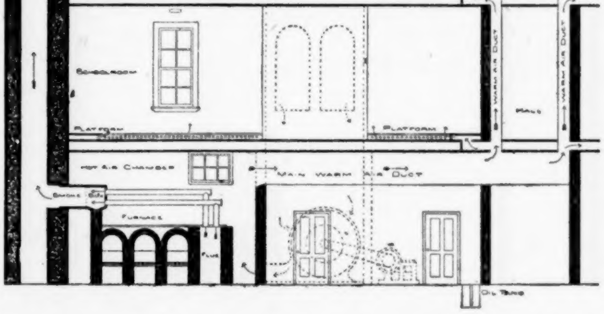
The air is forced into the rooms by a fan, placed in the cellar or an adjoining building, through a main air-duct underneath the floor, giving off branches to the different rooms. These branch air-ducts are in free communication with the space below the low platform, which commonly in school-rooms runs around the walls on three sides of the room. The front piece of this platform is pierced by many holes, or is formed by a grate, through which the air escapes into the room. The foul air leaves the room through a few openings in the walls near the ceiling. As a motive power to propel the fan a petroleum — or gas — or other kind of hot-air engine may be used, which requires little attention. Steam-power should be excluded, if possible. A steam-boiler is too dangerous a thing to have under a school-house; it requires, to be safe, constant watching and skilled labor. Water-power will seldom be available, and when taken from city water-works is very expensive.

So, in summer, such a hot-air or gas engine and a fan with the necessary air-ducts would be all that is required to secure a perfect ventilation. The size of the fan and engine has to be adapted, of course, to the volume of air required.

In winter the air has to be warmed. Here we encounter another great difficulty. The volume of air required to keep the amount of carbonic acid in crowded school-rooms below ten volumes in ten thousand is necessarily large; for example, for a school-house with six hundred children ten thousand cubic feet of air are required every minute. Several plans have been proposed and executed for this purpose, but all present peculiar difficulties when applied to our case of a common school-house. The best way of heating the air would be, no doubt, by steam or hot water, but as we have rejected steam-boilers we have no steam to heat the air by coils of steam-pipe. Heating such coils by hot water requires a very expensive apparatus. To warm on a cold winter day ten thousand cubic feet of air per minute by hot-water pipes, so that the temperature in the class rooms does not sink much below 68° F., would require four thousand eight hundred square feet of pipe surface. Such a coil alone would cost about four thousand dollars. The hot-air furnaces which we find in the shops, and frequently used in school-houses and other buildings, are insufficient to heat so large a volume of air, as they have not sufficient heating surface. The following plan of a furnace, I think, will obviate the difficulty: In the cellar, or an adjoining separate building, is built a closed, air-tight room, the hot-air chamber (in our



case of a school-house for six hundred children a room twenty by twenty-five feet and twelve feet high), which contains the furnace. Next to this is a smaller room which connects by a wide air-duct with an open window in the story above. Here the fan is located so that its outlet is in communication through an opening in the wall with the hot-air chamber. Next to the fan-room is the engine-room. As



soon as the fan is set in motion the air will be drawn through the window and air-duct into the fan, which forces it into the hot-air chamber. By passing here over the large heating surface of the furnace the air is warmed and escapes under a pressure of one third of an inch of water column — which pressure is kept up in the hot-air chamber by the force of the fan — through the main air-duct into the school-rooms. The furnace is constructed of brick and sheet-iron. It has two or three fireplaces, according to the size of the building, and the climate. The arched brick flues of these fireplaces empty into a common flue, from the top of which a number of ordinary stove-pipes, offering a large heating surface, carry the hot gases to a common smoke-box which connects with the chimney. The fire-doors are outside the hot-air chamber. In the morning and on very cold days all fireplaces are used; on less cold days or towards noon, when the outer temperature rises and the brickwork of the furnace is thoroughly heated, only one or two would be necessary. Such a furnace could be built very cheaply, and the materials could be found in the smallest town.

Below I give the plans and calculations for a ventilator of a school-house for six hundred children and a climate where the temperature may fall to 0° F. The expenses of such a ventilator would be, approximately: —

Fan	$400.00
Engine, 3 h. p.	400.00
Hot-Air Chamber and Furnace	400.00
Air-Ducts, etc.	300.00
	$1,500.00

From this sum we have to deduct the price of the stoves which are saved by this plan; so that its extra expenses could be reduced to about twelve hundred dollars; and how easily could such a sum be saved in the erection of a building which costs thirty or forty thousand dollars, by doing away with useless ornaments, or by reducing the height of the rooms two or three feet. For concerning the purity of the breathing air the height of the room is of minor importance, provided there is a sufficient ventilation, as every person in the room gets his ration of fresh air constantly from the outside and has no need to draw upon the store of fresh air in the room. With natural ventilation the air-space for each person is of the highest importance, as any insufficiency of ventilation may be somewhat compensated by an increase of air-space. With forced ventilation we have only to see that the cubic space of the room stands in such a proportion to the amount of air supplied, that the velocity of the air moving through the room remains imperceptible. The air in a room should not be changed oftener than seven times in an hour. A school-room for fifty children should not have less than seven thousand cubic feet, or not less than one hundred and forty cubic feet for each child, the hourly supply of air being forty-nine thousand cubic feet.

CALCULATIONS FOR A VENTILATOR OF A SCHOOL-HOUSE FOR SIX HUNDRED CHILDREN.

$f =$	Amount of carbonic acid in 1 vol. of fresh air	0.0004.
	Carbonic acid exhaled by 1 child per minute	16 cubic inches.
$C =$	Carbonic acid exhaled by 600 children per minute	5.55 cubic feet.
$f + \frac{C}{A} = m =$	Maximum amount of carbonic acid allowed in 1 vol. of air in the class-rooms	0.0010.
$\frac{C}{m - f} = A =$	Fresh air required per minute to prevent a greater accumulation of carbonic acid than the maximum allowed — nearly 1 cubic foot for every cubic inch of carbonic acid exhaled	9,250 cubic feet.
$B =$	Capacity of each room	10,000 cubic feet.
	Number of class-rooms	12.
$x =$	Amount of carbonic acid in 1 vol. of air of a room after an occupation of t minutes.	

$$x = f + \frac{C}{A} - \frac{\frac{C}{A}}{\frac{At}{12\,B}}$$

Fan and Air-Ducts.

(Sturtevant's or Morris's Fan, 5-inch disk.)

Revolutions per minute	200.
Capacity per minute	10,000 cubic feet.
Sectional area of main air-duct	9 square feet.
Velocity of air in same, per second	18 feet.
Sectional area of branch air-ducts for each room	1 square foot.
Velocity of air in same, per second	13 feet.
Pressure in main air-duct in inches of water column	0.3 inch.
Fresh air for each room, per minute	771 cubic feet.
Fresh air for each person, per hour	925 cubic feet.

Furnace.

$T =$	Temperature of rooms	68° F.
$T' =$	External temperature	0° F.
$T'' = 2\,T - T' =$	Temperature of hot-air chamber	136° F.
$T'' - T' =$	Number of degrees which the air is to be warmed	136° F.
	Weight of 10,000 cubic feet of air at 0° F.	868 lbs.
	Specific heat of air	0.238.
	Capacity of heat of 10,000 cubic feet of air, (Cal)	206.
	Units of heat required to raise the temperature of 10,000 cubic feet of air 136° F. = 206 × 136 = U. H.	28,016.
	Available heat in 1 lb. of coal (80 per cent), U. H.	10,800.
	Coal required to raise the temperature of 10,000 cubic feet of air 136° F.	2.6 lbs.
	Coal required per hour for the whole school-house	156 lbs.
	Heating surface of brickwork of furnace, 300 square feet.	
	Heating surface of iron plates, 28.	
	Heating surface of 34 stove-pipes, 13 feet long, 5 inches diameter, 578.	
	Heating surface of smoke-box, 100.	
	Total heating surface of furnace	1,006 square feet.
	Grate surface	12 square feet.
	Ice required to cool the air in summer for each degree F., per hour	100 lbs.

CORRESPONDENCE.

IRON FRONTS. — NEW OFFICE BUILDINGS.

NEW YORK.

WHEN iron fronts were the entire rage in this city, and legitimate architecture but now and then showed itself with more or less of success in special edifices, there was a general and persistent outcry against them. It was pointed out that canons of good taste, fixed laws of mechanics, and every rule of architectural decency and honesty were set at naught in these showy, box-like structures. But to the owner of property they offered the advantages of cheapness with great rapidity in construction, while giving ample floor space and light. All that was necessary to secure such an edifice was the filling out of a blank form, giving a few particulars of size, etc., and out of the stock in the foundry yard the building was picked in section, rivetted together, and almost to an hour the job was turned over as "a magnificent commercial palace," to the delighted investor. Every moulding and feature was designed as an imitation of stone, and when painted, the iron masks passed very well to the popular eye and at the proper distance as marble. Property owners thought they had reached a solution of the high per cent problem in real estate investments, and certain of our streets began to put on a sort of monotonous splendor. But a few out of the great multitude appreciated the hollowness of such an advance, and were assisted wonderfully in their exposition of true principles by conflagrations which gave warm support to their assertions that these iron shells were mere fire-grates, when put to the test. Still there were some who brought their best endeavors to the work of using iron in full acknowledgment of its particular merits. Sheet-iron churches and cast-iron columnar warehouses were both frowned down, and many buildings in the city to-day tell of the efforts of architects of merit and standing to apply iron architecturally. Mr. Hunt did something on Broadway; the late Mr. R. G. Hatfield erected iron-work; and one of the latest attempts was on the Austen Building at Houston Street and Broadway, where Mr. Russell Sturgis, Jr., used iron in such a way that nobody could doubt that it was an iron and not a stone structure. Showing the bolt-heads was not, however, creating an iron architecture, and this year shows more than ever the returning feeling against this work, and brick and stone are used in a majority of the buildings erected, with iron used in entire subordination and almost entirely constructively.

The present season has witnessed the completion of two important works in the line of "office buildings," or structures out of which it is intended to secure a large rental by the leasing of a large number of small apartments. Elevators have made possible the use of any number of floors which the architect may find it possible to put between foundation and roof, and this possibility the owner insists upon having stretched to its utmost. There must be cheapness, too, and rapidity in building, especially in cases where an old is replaced by a new structure, and very often the demand is made upon the architect to produce a design which shall be different from anything already in existence. It matters not in many cases whether the new be good, bad, or indifferent; provided it be unique in its use of material or combination of forms, the owner is content. With all these imperative general conditions, and in special cases as many more special ones equally rigorous, the architect sets to work.

Messrs. Silliman & Farnsworth have produced the Morse Building, and Mr. Hatch has given New York the Boreel Building. The former stands on the corner of Beekman and Nassau Streets, and on a site 80 x 75 feet, a structure nine stories high was demanded. Many who watched the uprising walls wondered whether they would ever cease growing sky-wards. The young men to whose hands the work was entrusted were tied down to a brick construction exclusively, and they have followed instructions most rigorously. There is contrast, diversity, and change, a great remove from monotony, and a solution of the difficult problem which must strike all as a most satisfactory one. There are matters of pure construction which are as yet unsettled: terra-cotta is used in various ways as constructive ornament, and it remains to be seen whether a satisfactory exhibit of the employment of that material is to be given us in this city. No one will claim that any terra-cotta work of consequence has yet been done here. The Morse Building will be interesting as an experiment, and as such much of its terra-cotta work must be classed.

The Boreel Building started with many more natural advantages. It has a plot 101 x 146 feet, with streets on all sides, one front and two of the angles being on Broadway, and for years no better opportunity has been offered for adding to the architectural wealth of that much over-admired avenue. There was height, enforced in the seven stories which rise above the curb line, but there was breadth enough to enable the designer to break undue altitude by introducing widening features. With all these openings it must be said that the merit of the building is within it, for the expanse of ground space gave opportunity for an excellent plan — a system of corridors about a central covered court, in which are placed stairways and elevators, enabling every room to get an abundance of light and air. The building is probably well constructed, but architecturally considered it does not bear much evidence of study. The Boreel Building was built from trust funds, and therefore a certain line of expenditure for special labor and rich and rare material, which a private individual, or a wealthy corporation, club, or congregation might properly indulge in, is cut off. But to assume that a satisfactory result cannot be reached except by the spending of these extra amounts is absurd, and none should be more ready to preach and practice this plain truth than an architect. The architect in this case did not hide his poverty of means by meretricious devices, to make the whole look like a palace. It catches the eye of the multitude — as the New York Post Office does — by its size alone.

If the architect is only to reflect the crudities and desires, as well as the real wants and proper demands of his client, then there is an end of advance. If architects are not to lead, let them step back into the position of contractors; let them throw aside artistic feeling, or study and cater to the unguided public opinion. There will then be cheap buildings. An honest architect of that type may then be safely trusted with the outlay of "trust-funds," and he will not be under the slightest necessity for making, as now, an apology for his work when done. He has filled his orders, met his clients' desires, carefully avoided exercising any of the powers or attainments which now permit him to claim the title of architect, and everything he puts up, provided it does not fall down, and gets the "Bravo" verdict of its untaught owner, must be considered as eminently successful architecture. W.

LIME AND BRICKS.

IN the course of the annual meeting of the Iron and Steel Institute, which was held last week at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Edward Riley, F. C. S., read a paper, entitled, "A Ready Means of Moulding Lime or Basic Bricks and Linings for Furnaces, Converters, etc."

Mr. Riley said that several plans had been suggested and used for the manufacture of basic or lime bricks, for the lining of Bessemer converters and cupolas, and various attempts had been made to line the same by ramming either with lime or limestone. One difficulty and objection in using limestone either for the manufacture of bricks or for ramming is the very large loss in weight and bulk the material must sustain from the expulsion of the carbonic acid and a little water, the percentage varying from forty to forty-five per cent in weight, and the shrinkage in bulk being at least twenty-five to thirty-five per cent. The use of quicklime is impracticable, as it is too dry and pulverulent in its character, and it is impossible to mix it with water, on account of the chemical action of the water on the lime. It occurred to the author that if some cheap liquid could be used that had no chemical action on the lime, it would be possible to mould the lime either by ramming or by pressing it into moulds. Various liquids had been tried, such as crude petroleum oil, coal oil, and resin oil. All these answered very well. Experiments were first made on a small scale by mixing ordinary lime with from five to ten per cent of crude petroleum oil, and compressing it by hammering in a small steel cylinder with a piston of about $1\frac{1}{2}$ inches in diameter. It was found that the cylinders of lime, after compression, might be at once placed in an ordinary fire, the petroleum burned quietly off, and left a solid cylinder of lime. If burned at a low to a bright red heat, no contraction takes place at all. If, however, the cylinders are burned at a high temperature, they contract to a small extent. Many hundreds of experiments have been made with different kinds of lime, and no difficulty has been experienced in making perfectly solid cylinders; the only precaution necessary is to see that the lime is well-burned, and that it has not been exposed too long to a damp atmosphere. Lime that has been exposed for ten days or a fortnight to a damp atmosphere would not give satisfactory results. Various mixtures of burnt clay and oxide of iron, and other substances, have been made with the lime. From five to seven and one half per cent of burned clay makes it much harder after burning. An admixture of three to five per cent of oxide of iron in the form of blue billy also consolidates the lime; at the same time the shrinkage is increased. The above proportions were used with a nearly pure lime. My experiments on a small scale being so satisfactory, I at once commenced to make ordinary bricks, using a Bodmer's hand hydraulic brick-press, which answered admirably. On submitting the lime to a pressure of about one ton per square inch, most perfect bricks were made, and from twelve to fourteen could be readily moulded and forced out of the mould in an hour in the hand press; the bricks could be easily handled, and would bear shaking if taken hold of at one end. These bricks were made at Notting Hill, and had to be carried on a man's back and by rail to my laboratory in Finsbury Square. Although I have made some dozens of the bricks, in no case was one broken; the only injury — and this is of no practical importance — was that the sharp, square edges on a few were sometimes slightly broken; the only means that I had to burn the bricks was by using a small square assay furnace, one foot square and two feet six inches deep. After lighting the furnace, it was filled to a depth of eight inches to ten inches with coke, broken small; the bricks were then placed on this material and burned at a moderate temperature for about twelve hours. The first three bricks were quite perfect, excepting that one was broken in two with a sharp fracture, probably due to the falling of the brick with the coke. The lime used was made from Huddlestone stone, which is a fine-grained building stone used in London, the same with which York Minster is built. It is nearly chemically pure magnesian limestone. In burning the bricks, so far as my experience has gone, it is better to use a moderately quick fire instead of a slow, gradual fire. A small experimental converter, about twenty inches wide and twenty inches deep, exclusive of top part, was rammed up with the ordinary magnesian lime used in Sheffield. The lime was ground in a mortar-mill with from ten to fifteen per cent of crude petroleum oil. The vessel was first fired with a slow fire, which had the effect of making the upper overhanging part of the converter crumbly, and ultimately caused it to fall. After repairing this damage the fire was relighted, a gentle blast was put on, and rapidly increased to a full blast. A little roll scale was thrown into the converter, and it was found that a good hard glazed surface was formed after blowing some hours with coke. From one hundred-weight to two hundred-weight of Ferry Hill pig-iron was run into this converter, first adding some iron scale and lime. After blowing a minute or two, a few pounds of a mixture of iron scale and lime were added. It was found, however, that this chilled the metal, and after blowing for rather less than ten minutes, it was thought desirable to run it out. A second charge was then run in and blown about ten minutes, but, from the small size of the converter, and the fear of the metal setting, it was found necessary to run it out again before complete blowing.

The metal from the first blow was so much mixed with cinder and sand that it was difficult to get a fair sample. In the small converter the head was movable, and the lower portion was first burnt with coke. It was found that the lining expanded and rose up above the edge of the plates. Some of the metal remained in the converter on account of its being chilled. The lining was very solid and hard, and could only be detached from the converter by driving in a chisel with a hammer.

The experiments made up to the present time have been carried out under considerable disadvantages. I have only within the past week had the advantage of a kiln, and am still without a properly constructed brick-press at Sheffield, so that the bricks may be burned where made. I have succeeded in making and burning several ordinary Bessemer tuyeres for an eight-ton converter, as nearly as possible perfect, by simply ramming the lime in the moulds. The kiln I am using requires alteration so as to obtain a higher temperature, and the only means I have at present for making the bricks is under the steam-hammer. The blow, however slight, makes the upper part of the brick scaly, and not solid as when pressed by hydraulic pressure. I have also found this to be the case in my small experimental cylinders. I have made a few experiments in moulding lime into forms adapted to metallurgical purposes, such as scarifiers, crucibles, etc., and anticipate that my plan for these purposes will be especially advantageous. As yet, however, I have only made scarifiers. I find that bricks and cylinders made from ordinary Sheffield lime may, when burned at a high temperature, be steeped in water without slaking.

The following is the composition of the bricks after burning: —

Silica	8.85
Lime	51.80
Magnesia	35.35
Alumina	2.60
Peroxide of iron	1.40
Sulphide of calcium	.55
	100.55

I regret that in consequence of the short experience I have had in the manufacture of bricks and tuyeres, and other moulded forms of lime, I am unable to present to the Institute so perfect and practical a description of my process as I could wish. It was only at the commencement of this year that I made my first bricks, and my process requires further time to perfect and develop it.

I hope by the assistance of one of Mr. Bodmer's excellent hydraulic brick-presses to turn out from six to twelve bricks a minute, mathematically true. These, I believe, can at once be used to line up a converter or other furnace. The bricks, being perfectly true and square, can be built in almost without mortar or material for the joints; and I see no reason why ordinary converters should not be lined in twenty-four hours, and burnt and glazed in another twenty-four to forty-eight hours. Either the lining of the converter with bricks or by ramming seems to me the most ready and economical means of obtaining a lime or basic lining.

An objection might be raised to the use of large quantities of crude petroleum, viz., that it would materially increase the price.

There are, however, so many sources of cheap crude oils, — as tar and resin oil, etc., — that any quantity could be produced, and if such oils are required in large quantity, it would pay to distil much of the bituminous shale that is now thrown away for the crude oil, extracting, at the same time, the solid parafine. — *The Builder.*

THE OWNERSHIP OF DRAWINGS. — A LEGAL CASE.

WASHINGTON, D. C., June 24, 1879.

TO THE EDITOR OF THE AMERICAN ARCHITECT:

As has already been noticed in some of the public prints, a case has been pending in the Police Court of this city, the final decision of which will prove of interest. That all of the profession may understand the circumstances, I quote the following from the Baltimore *Sun* of the 21st inst.: —

WASHINGTON, June 20. — A case is pending in the Police Court here, the decision of which will prove of interest to all architects and builders. A Mr. George R. Tolman succeeded the late Thomas M. Plowman as an architect, and was obliged, by right of his succession, to fill an unexpired agreement for the completion of certain houses in process of erection and owned by District Commissioner Phelps. It seems an agreement was entered into between the architect and Mr. Phelps by which the latter guaranteed to pay a sufficient sum of money on account to meet the current expenses of the office until the affairs of Mr. Plowman could be settled. A misunderstanding having arisen relative to this agreement, Mr. Phelps desired to sever connection with his architect, and proceeding to Mr. Tolman's office demanded all plans and drawings belonging to the houses. This demand was refused. A writ of replevin was sworn out, but in the mean time Mr. Tolman, in the exercise of what he thought to be his right, put the plans away for safe keeping, and was arrested soon afterwards on the charge of embezzlement, Mr. Phelps claiming that by the terms of the agreement Mr. Tolman was simply employed as a draughtsman, and not in the capacity of an architect. It having been established that Mr. Tolman was an architect, and as such was executing an existing agreement left to him by his predecessor, the question at issue now is, "To whom do the plans of an architect belong?" Supervising Architect Hill and many of the prominent architects of this city have been called as experts, and their testimony is that it is the invariable practice for an architect to retain all plans; that these plans are simply used to convey an architect's idea to his employer, and are merely instruments of service in the execution of professional work.

The counsel are now looking up decisions upon this point, and a further hearing of the case will be had next Saturday, when it is expected that a decision will be made. Architects throughout the country appear to be taking much interest in the case. Commissioner Phelps entered a civil suit previous to the criminal suit.

On Saturday last, when the case was called, the judge stated that while he would not pass upon the question of the ownership of the plans, it was clear that he could not hold Mr. Tolman any longer, as no criminal intent had been proven, and he would therefore order the defendant's discharge.

The case now goes to another court, upon the civil suit mentioned above, which is returnable July 1st, proximo. It is unfortunate that so few cases of this character have found their way into courts of record, as the counsel, though making arguments based upon the justice and common sense view of the case, find very few decisions directly sustaining them.

Mr. Tolman has secured the services of three well-known attorneys, and when the case is called in all probability abundant cause will be shown "why said plans should *not* be delivered to the owner of the houses."

As to the final decision of the case, it may be said that it is hardly probable that any court in the United States will hold that the plans of an architect belong to his client. If it were so we might expect that on the principles established by such a decision any person having occasion to avail himself of the services of a lawyer could at will demand all the briefs used in his case; or a fashionable lady could control all patterns used in making up her wardrobe. X.

NOTES AND CLIPPINGS.

Professional Charges of the A. I. A. — *For full professional services (including superintendence), 5 per cent upon the cost of the work.*

Partial service as follows: —

For preliminary studies, 1 per cent.

For preliminary studies, general drawings, and specifications, 2½ per cent.

For preliminary studies, general drawings, details, and specifications, 3½ per cent.

For stores, 3 per cent upon the cost, divided in the above ratio.

For works that cost less than $5,000, or for monumental and decorative work, and designs for furniture, a special rate in excess of the above.

For alterations and additions, an additional charge to be made for surveys and measurements.

An additional charge to be made for alterations or additions in contracts or plans, which will be valued in proportion to the additional time and services employed.

Necessary travelling expenses to be paid by the client.

Time spent by the architect in visiting for professional consultation, and in the accompanying travel, whether by day or night, will be charged for, whether or not any commission, either for office work or superintending work, is given.

The architect's payments are successively due as his work is completed, in the order of the above classifications.

Until an actual estimate is received, the charges are based upon the proposed cost of the works, and the payments are received as instalments of the entire fee, which is based upon the actual cost.

The architect bases his professional charge upon the entire cost to the owner of the building when completed, including all the fixtures necessary to render it fit for occupation, and is entitled to a fair additional compensation for furniture or other articles designed or purchased by the architect.

If any material or work used in the construction of the building be already upon the ground, or come into possession of the owner without expense to him, the value of said material or work is to be added to the sum actually expended upon the building before the architect's commission is computed.

Drawings, as instruments of service, are the property of the architect.

By order,

Richard Upjohn, *President.*

A. J. Bloor, *Secretary.*

Moore's Statue. — The people of Dublin are disgusted to find that the statue of Tom Moore, recently dedicated there, is of zinc instead of bronze, and when it was newly painted several cracks were found in the head, through which the rain had beaten, filling the statue about half full of water.

Statuette of President Woolsey. — Professor John F. Weir of the Yale School of Fine Arts is modelling in plaster a statuette of ex-President Woolsey of Yale College. The venerable instructor and jurist is seated in a curious old chair.

The Church of St. Roch. — The tower of the historic Church of St. Roch in Paris has been pulled down to make room for a new street. Architecturally it was not beautiful, nor was it very ancient; but as part of the Church of St. Roch it has associations which should have preserved it from destruction by sacrilegious street-openers. This church, which is a noticeable object in the Rue St. Honoré, near the Tuileries, was taken possession of on October 5, 1795, by the French populace under Lepelletier, as a stronghold in their insurrection against the Convention — an insurrection which was put down by young Napoleon Bonaparte, then an unemployed artillery officer, complaining of his poverty and disposed to offer his services to the Sultan of Turkey.

Polish National Museum. — The Polish National Museum at Rapperschwyl, near Zurich, is becoming with every year of greater historical interest. The museum was founded ten years ago by Count Ladislas Plater, in the antique château at Rapperschwyl, and since then has been constantly receiving gifts referring to the history of Poland. Very recently a Polish lady, living in Florence, made a magnificent addition to the museum — namely, an invaluable numismatic collection, consisting of some thousand odd numbers of Polish medallions and coins and 271 cameos, representing the chief events of Polish history and the portraits of Polish notables, all executed by talented artists. The collection is a unique one, and is valued at 40,000 francs The value of the entire collections of the museum is stated to be 1,000,000 francs. The library contains 30,000 volumes. The collection of medallions, coins, copper-plate engravings, manuscripts, and autographic and ethnographic curiosities, represents thousands of numbers. There are 17,000 documents and diplomatic letters, dating during the last three centuries, all referring to Polish history. The reading-room of the museum receives about fifty journals from various lands. The development of this interesting museum shows that the national spirit of Poland still lives.

How the Indians Made their Arrow-Heads. — A young man in the Smithsonian Institution, writes the Washington correspondent of the Cleveland *Leader*, has just made public the discovery of the method employed in making the stone and volcanic-glass arrow-heads, daggers, knives, axes, and razors of the prehistoric races. Up to this time this has been a great problem to all antiquarian students, but no theory has ever been advanced showing so practical results as Mr. Cushing's. He started to solve the difficulty by putting himself in the identical position of the Aztecs or Mound-Builders — without anything to work with except sticks, various shaped stones such as he could find on the banks of any stream, and his hands. After making some rude implements by chipping one flint with another, he discovered that no amount of chipping would produce surfaces like the best of those which he was trying to imitate. He therefore came to the conclusion that there was another way of doing it, and, by chance, tried pressure with the point of a stick, instead of chipping by blows of a stone; when, presto! he found that he could break stone, flint, and obsidian in any shape he chose. Soon he had made spear-heads and daggers that would cut like a razor, as good as any he had before him, which had been picked up from all over the world. By a little more observation, he found that the "flaking," which he calls his process, on the old arrow-head left grooves that all turned one way. He produced a like result by turning his stick the easiest way from right to left. He therefore concludes that prehistoric men were right-handed people like ourselves. This conclusion is reinforced by the fact that occasionally an arrow-head is found that has flakes running from left to right, showing a left-handed person. The importance of the discovery is that it shows that the early races were able to do this work without the use of iron or bronze, a thing long doubted.

The African Sea. — Messrs. Dufyur, Jegon, and Baronnet, the three French engineers who have for six months been taking soundings with Commandant Roudaire to test the possibility of converting the Shotts of Tunis into an arm of the sea, have just returned to Marseilles. Their report is favorable, although they themselves have suffered from the aridity of the district, where no rain has fallen for twenty-three years.

A Chinese Tile Factory. — A correspondent of the *Builder*, in a recent account of his visit to one of the mining districts of China, thus describes the Imperial tile manufactory at Lien li ku, about fifteen miles west of Pekin: In this factory all the yellow tiles and bricks required for imperial buildings are made, as also large numbers of green, blue, and other colored tiles for various ornamental purposes. The material used is a hard blue shale, nearly as hard as slate. This is allowed to lie in heaps for some time. It is then ground to powder by granite rollers, on a stone floor thirty to forty feet in diameter. The powder is then stored in heaps and taken to the works as required. For ordinary work the powder is mixed with a proper proportion of water and moulded into large bricks, which are laid out to dry for some hours, after which they are dealt with by the modellers. When bricks are to have a moulding on them, say for coping a wall, the plan of operation is as follows: Two pieces of wood, each cut to the shape of the moulding, are placed upright on a slab. The clay brick is placed between them, and two men run the mouldings roughly along with chisels. They then apply straight edges to test the accuracy of their work, and finally rub the edges with moulds somewhat in the same way as plasterers make mouldings at home. The brick is then passed to a third man, who cuts any necessary holes in it, and to a fourth, who trims it off and repairs any defect. The more ornamental tiles and bricks, representing fabulous animals, etc., are first roughly moulded, and afterwards finished off with tools exactly similar to those used for modelling in clay in Europe. Some of this work has some pretension to artistic merit. All the bricks and tiles are baked in ovens, and then, after having the glaze put on, are baked a second time. All the work done at this manufactory appears to be first-rate, and the number of people employed when they are busy is about five hundred.