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VOL. XL.

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ENGINEERING

DECORATION

TICKNOR & COMPANY

CONSTRUCTION

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APRIL 29, 1893.



SUMMARY:—

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THE Board of Supervisors of Monroe County, N. Y., through a committee, has issued an "invitation" to architects to submit competitive plans for a court-house in the city of Rochester. As the building is intended, according to the circular of invitation, to cost something like six hundred thousand dollars, in addition to the cost of the land, it certainly seems as if the people who will have to pay for it were entitled to have their money expended under competent professional direction, and it is only fair to warn them at the outset that the terms offered by the Supervisors' committee will not secure such direction. The sole promise made by the committee to the profession which it invites to spend many thousand dollars in making competitive plans is that five plans will perhaps be selected, for which three hundred dollars each will be paid, the committee to have the use of all the five plans until the construction of the building is begun. No other promise, direct or indirect, is made to any one who may see fit to send competitive drawings. It is true that one sentence in the invitation says that "The compensation for all architectural service and the superintendence of the erection of said building shall not exceed three per cent of the cost thereof," but there is nothing whatever in the circular that indicates any promise or intention on the part of the committee, or of any one else, to employ any of the competitors to render this "architectural service," or that would prevent the committee from having their own man, after the five selected drawings were secured, make such a copy or combination of them as he and they might see fit, and carry it into execution.

AS the committee do not make any promise incompatible with this suggestion, we do not feel that we cast upon them any imputation of bad faith in saying that the circular seems to contain internal evidence that some such plan may be intended. The profession is informed that "a competent expert will be employed, if necessary, to assist the committee in the selection of the five plans above named," but nothing is said about employing expert assistance in the much more difficult task of deciding which, among the five, is absolutely the best; and there are portions of the programme which have an air as if a person who knew something about India-ink, and "geometric line-elevations," and a little—a very little, in this case—about court-house plans, had been consulted in their preparation. Of course, we may be all wrong in our surmises, and it is quite possible that the committee really wishes and expects to get the best professional service from an architect selected from the most competent members

of the profession for a sum which, at the usual ratio of expenditure to income in large offices, would not pay the wages of the draughtsmen and other assistants engaged on the work; but, whatever may be the private intentions of the committee, we can only say that, even if the circular mentioned the usual five per cent where it specifies three, it would be folly for any architect in accordance with it to send competitive plans, with any hope of getting more for his trouble than a possible three hundred dollars.

THE Municipal Council of Paris has fallen into trouble with certain architects in a peculiar way. It will be remembered that the late M. Galignani left a large sum of money to the city of Paris, to be expended in the construction and maintenance of a charitable institution. He had selected his architects, and the plans of the proposed buildings were in tolerable shape, before his death, so that, in a manner, his legacy included both the plans, and the architects who knew best what his intentions were. The Municipal Council, however, found it most business-like, instead of inquiring closely into the wishes of their benefactor, to fix a limit of cost for the buildings, leaving M. Galignani's benevolent plans to be squeezed into this limit as best they could. Not unnaturally, M. Galignani's architects, fresh from their conferences with their principal, seem to have thought that the city wished to carry out his intentions in regard to the buildings, whether they absorbed a little more or less of the bequest than the portion provisionally allotted to them. If they had been at work for private owners they would have been quite justified in this assumption, but architects can hardly be too frequently warned that such liberties cannot safely be attempted with public bodies. Before the buildings were completed, one of those inquisitive gentlemen who look after the doings of public bodies rose, at a meeting of the Council, and desired to be informed why the architects of the Maison Galignani had been allowed to exceed the appropriation for the buildings. All the members of the Council who were not in office, and wanted to make things unpleasant for those who were, joined with enthusiasm in the inquiry, and a committee of investigation was appointed, not merely to ascertain whether the architects had really exceeded the appropriation, but to determine what steps should be taken to recover back from the architects the amount which had been spent or contracted for in excess of the appropriation. The committee duly made its investigation, and reported that there was no evidence that the architects had incurred any expense uselessly, or had made any mistakes in their plans or specifications or estimates, so that there was no ground for a legal claim against them. Moreover, the committee reported, the architects were chosen by M. Galignani, and considered themselves, and were generally so considered, as having been employed by the city as the interpreters of his ideas; and the interpretation which had been taken by the architects had been the subject of repeated discussions between them and the Department of Public Assistance of the Municipal Administration, and had been finally acceded to by the Administration. The committee hinted that the Administration, finding an attack imminent upon that ever-vulnerable point,—its handling of the public money,—had shielded itself by putting forward the architects as the responsible persons; and it added that, as the employment of the architects had been terminated, there seemed to be no occasion for further steps.

WHEN we hear about the experiences of architects who have the misfortune to serve the average State or Municipal Government, we are reminded of the country preacher who, on having his hat returned to him empty after a collection, gave pious thanks to Providence that the hat had come back safe. Few, indeed, are the honest architects who can say that public employment has brought them either profit or reputation, and among the experienced and responsible members of the profession the idea of making an effort to secure such employment, except under very unusual circumstances, is looked upon with scorn. It is common in the profession to attribute this misunderstanding between architects and legislators to the ignorance of the latter concerning an architect's professional duties, joined with a disposition to crowd and overreach persons whose confidential relation exposes them to such treatment, and, to a certain extent, this view is, or has

been, correct; but as the advance of civilization defines more clearly the position of architects in the community, and diminishes the influence in legislation of the horse-jockey and pedler class, the misunderstanding ought to disappear, and it seems to us that the process might be hastened if architects would examine their own position, to see whether they, as well as their official employers, have not something to correct. In the first place, it is our belief that far too little heed is paid by architects, in public work, to the limit-of-cost fixed by law, or by formal appropriation. With private clients the intended limit may be exceeded, if the client is willing, without causing any person annoyance or trouble; but the case is very different with public work, where, in every important case, at least, the exact amount which shall be devoted to the building is fixed by enactment, often after a long series of disputes and compromises between the different parties in the legislating body. If the architect can keep the cost within the amount fixed, he seldom finds reason to complain that the contract which he may have made with the official authority for his services has not been faithfully carried out; but he must not be surprised if a discrepancy between the cost and the appropriation, which must be provided for by a new appropriation bill, and is sure to furnish an occasion for attacks, recriminations and political manoeuvres against the party in power, involves himself in the extreme aversion which it excites in legislators and officials. Only those who know something of the way in which legislation and official budgets are made up can realize how anxious is the care with which the estimates are studied, and the sudden dumping, by a careless architect, of an extra bill of fifteen or twenty thousand dollars into the midst of this delicately adjusted piece of calculation is not likely to inspire those who have constructed it with confidence and esteem toward the profession of architecture in general, or the offender in particular. Of course, it will be objected that appropriations for buildings are generally made too small, with, apparently, the vague notion that they can be got for less than they are worth by not appropriating money enough to pay for them; but the evident answer to this is that the architect is the proper person to call the attention of the officials to this fact, and that the proper time to do so is before the building is erected, rather than afterward. By such care and effort as it is the duty of every man to use who is intrusted with the spending of the public money, it would generally be easy for an architect to ascertain the real value of the proposed building, either before the appropriation is made, or so soon afterward as to permit the plans to be modified, if necessary, and the skill, care and frankness requisite for this purpose would be nowhere more highly appreciated than by an official committee. Perhaps no achievement casts more credit on such a committee than to carry out an important building without exceeding the appropriation, and the man who can tell them what appropriation will be needed, and can carry the work into execution within his figures, will rarely have occasion to complain that the profession of architecture is not appreciated among public men.

M. RAOUL PICTET, the renowned Swiss chemist, whose devices for the production of ice by mechanical means have rendered his name as familiar in the industrial world as his experiments in the liquefaction of gases have in the region of pure science, appears as the loser in a lawsuit of considerable general interest. Some years ago, M. Pictet sold to a corporation—the Compagnie Industrielle des Procédés Raoul Pictet—the exclusive right to the use of all his inventions, already made or to be made, relating to the production of cold. Recently, differences arose between M. Pictet and this Company, and the great chemist felt himself justified in considering the arrangement at an end so far as his subsequent inventions should be concerned. Having devised a new frigorific liquid, as well as some improvements in freezing-machines, he organized a company in Berlin, under the name of Rudloff, Grübs & Co., to which he assigned the use of these inventions. The Berlin company established branches in Austria and Belgium, and afterwards consolidated with another corporation, the Société Linde of Wiesbaden. The original company promptly took up legal arms in defence of its rights, and brought suit against the German company and its agents simultaneously in Paris, Berlin, Vienna and Brussels. The suits were decided nearly at the same time, and with substantially the same result. The German company did not dispute that the contract between Pictet and the French company was, on its face, binding upon him, but it contended that it had

bought its rights in ignorance of the terms of his French contract, that the patents had been assigned to it in full accordance with the German and Austrian patent laws, and that, as an innocent holder, its rights, acquired thus legally and formally, could not be interfered with for the benefit of the shadowy title conveyed by the French contract.

ALL the Courts rejected this claim at once. They ruled unanimously that the sole right to the use of the inventions in question belonged to the French company under its contract with Pictet for inventions made or to be made; and they held that the Berlin company had, either actually or constructively, notice of the terms of this contract, so that it could not be regarded as an innocent purchaser of its rights. The Belgian and Austrian courts, consequently, ordered the Berlin company to transfer its patents to the French company, and directed that, in case of refusal, the transfer should be made by the Patent Office itself. The Berlin court discovered an objection to this proceeding in the fact that the inventions in question, not having come into existence when the French contract was made, were then the subject of a promise only, and not of actual transfer, so that definite proprietorship, which, we suppose, is intended to mean something like what real-estate lawyers call "seisin," had not passed to the French company, and it could not claim to have the patents formally transferred back to it; but it held that the French company had the exclusive right to the use of the inventions to which the patents related, and commanded that the Berlin company should immediately cease to use them. M. Féolde, in *Le Génie Civil*, in a very clear and interesting account of the case, justly observes that these decisions establish the fact that contracts relating to patents granted in one European country will be sustained in all the others, and that the rights of manufacturers depending upon patents will be defended, in all the principal countries in Europe, against attempts to infringe them on technical grounds.

WE described, some time ago, the artificial skating-pond which was formed in Paris in 1890, on the site of the old "Plaza de Toros." It seems, from an account given in *La Semaine des Constructeurs*, that this enterprise failed, and was abandoned, on account of the irregularity of the surface of the ice. Although the designers of the pond had the benefit of the experience gained at the New York and London artificial skating-ponds, it appears that they did not take sufficient care to make the ground under the ice impervious, and the water escaped irregularly, leaving the ice uneven, and useless for skating. Notwithstanding the disastrous collapse of the earlier undertaking, people have been found venturesome enough to repeat the experiment in another place, and a few weeks ago was witnessed the public opening of a skating-basin, to be known as the "North Pole," in the Rue de Clichy, on the site of the former "Casino de Paris." In this basin, the escape of water has been prevented by the effective, though costly, expedient of covering the entire surface with sheet-lead, laid on a pavement of ground cork and tar, which, again, rests on a bed of concrete. The area thus treated is about a hundred and thirty feet long, and sixty feet wide. Upon the lead rests a network of iron pipes, through which circulates a solution of chloride of calcium, cooled by two huge ice-machines, each driven by an engine of fifty-horse power. The depth of water over the pipes is not mentioned. The account in *La Semaine* says in two places that the basin contains eight thousand cubic metres of water. This would require the water to be forty feet deep, so we presume that an inadvertent cipher must have been added to the number, and that the real depth is about four feet. This is a much greater depth than has been previously used for such purposes. In the New York rink, the water was not more than two inches deep over the pipes, but the skate-blades occasionally cut through, so that a greater depth would have been preferable. Naturally, the length of time required to freeze the water increases with the volume, and forty-eight hours is needed to provide the "Pôle Nord" with a sufficient coating. Once frozen, however, the ice is easily maintained in good condition, and every night the snow which forms on the surface from the cutting of the skate-blades is swept off, and a thin sheet of water allowed to flow over the basin, to freeze, and form a fresh surface for the next day. So far, the "Pôle Nord" has been well patronized, and is proving profitable. The temperature of the air in the building is kept, in cold weather, at about sixty, so that it is quite comfortable for spectators as well as performers.

ARCHITECT, OWNER & BUILDER BEFORE THE LAW.¹—XXXI.

ORDERS.



Old Doorway in Philadelphia, sketched by Frank R. Neff.

ALTHOUGH not strictly belonging to the interpretation of contracts, it will be well here to refer to the decisions of the Courts in regard to the orders, which, whether recognized by the contract or not, are frequently given by the builder to his creditors, to enable them to obtain from the owner money which would otherwise be payable to the builder, and this may be followed by some illustrations of the position of sub-contractors.

Orders drawn on the owner by the contractor are usually accepted by the owner if he is willing to pay them on the contractor's account, but this acceptance does not relieve the contractor from any of the conditions upon which he would himself be entitled to the money. The law, as stated in Massachusetts,² is that "Orders drawn by the contractor on the owner, payable when the contract has been completed to a certain point, and accepted by the owner, cannot be collected when the contractor has abandoned his contract before completing it to the specified point, and it has been completed by the owner at a cost greater than the sum which would be due the contractor if he had completed it, unless the owner has practised force, fraud or collusion against or with the contractor."

This principle seems to be very strictly maintained in Massachusetts.³ The contractor for a church once gave orders on the owners, which were accepted by them, with the proviso that they should be "payable when the work is accepted by the Church." Before the completion of the building, the tower was found to be defective, and was taken down, and its completion abandoned by mutual consent. The owners, although they agreed with the contractor that he should not be compelled to rebuild the tower, claimed that the defect which made it necessary to do so was the result of the contractor's fault, and they accordingly retained some of the money which, according to the terms of the contract, would have been payable to him on the completion of the work. The building was, however, finished without its tower, and occupied for religious services. The persons to whom the contractor had given orders claimed payment from the church authorities, on the ground that the work had been "accepted by the Church," this having been the condition of payment stipulated by the church authorities in their acceptance of the orders. The Supreme Court held that if the defect which led to the demolition of the tower was due to the contractor's fault, and not, as the contractor claimed, to the defective character of the plans, the action could not be maintained, notwithstanding the occupancy of the building by the church society.

In a Michigan case,⁴ a man accepted a contractor's order, with the qualification, "It is understood that the dwelling shall be completed before this draft is paid." The contractor who had given the order failed to complete the building within the contract time, or any time, and the owner finished it himself.

The cost of completing the building used up all the unpaid balance of the contract price, so that there was nothing payable to the contractor, and therefore nothing applicable to the payment of the order. The holder of the order, nevertheless, sued the owner, claiming that as the dwelling was now "completed," the acceptance was valid; but the Court held that the "completion" referred to in the acceptance could only mean the completion contemplated by the contract, and decided that the terms of the acceptance had not been complied with.

In another case,⁵ an order was accepted "to be paid when the house is finished." Neither the contractor nor the owner finished the house, but it was sold in its unfinished state, and completed by the purchaser. The holder of the order claimed payment from the former owner, under the acceptance, but it was refused. There was no evidence that the former owner had suffered any damage from the house being unfinished, and it was held that the payee of the order was entitled to recover.

SUB-CONTRACTORS.

The position of sub-contractors is defined to a great extent by the contract between the owner and the principal contractor, but there are cases in which certain points, which are not covered by the principal contract, have to be decided by the courts.

In practice, perhaps the most important of the principles so determined is that subcontractors are bound in all respects by the terms of the principal contract,⁶ unless some express exception is made in their favor with the consent of the owner. Thus, where the agreement with the principal contractor provides that orders for extras shall only be valid when given in writing, it has been held that sub-contractors can recover nothing for extra work done on verbal orders given to them. Circumstances might, however, affect the decision in such cases. Thus, where, after the agreement with the principal contractor had been signed, the plan was changed, without the knowledge of the sub-contractor, and the principal contractor absconded, leaving the sub-contractor unpaid, it was held that the sub-contractor was entitled to recover from the owner compensation for work done without written orders, although the principal contract⁷ required that orders for extra work should be in writing, and the architect had refused to give such orders.

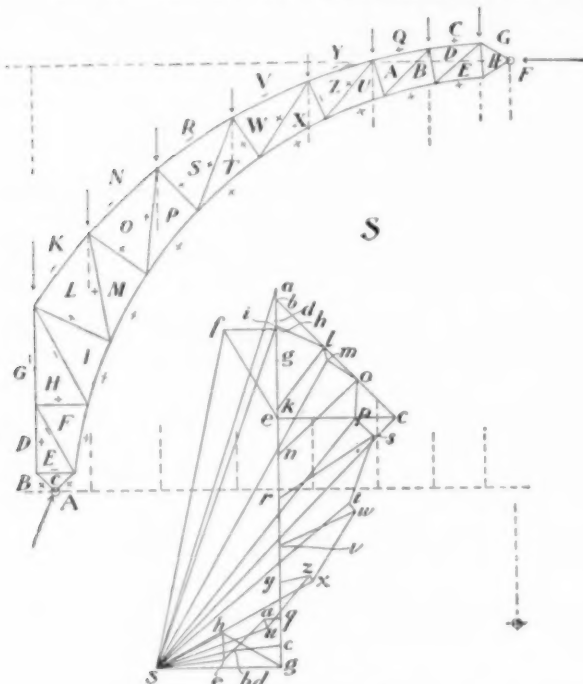
As the owner is bound to the sub-contractor only under the terms of the principal contract, so the principal contractor can cite the contract to protect himself against transactions between the owner and the sub-contractors which he has not authorized. In a case⁸ where the owner had advanced money to a sub-contractor, and had charged the amount to the account of the principal contractor, it was held that the principal contractor could only be charged with what had been advanced by his authority.

As to the extent to which the principal contractor is responsible for the acts of his sub-contractors, there is some uncertainty in the law. To the owner, the principal contractor is undoubtedly responsible for the acts of the sub-contractors, but the case may be different with regard to the public. It has been held in New York⁹ that the principal contractor for tearing down a building is not liable for injuries caused to a person passing by falling material, at a time when neither he nor his men were at work on the building, the only persons at work there being sub-contractors or their men; and it was also held that the principal contractor, under these circumstances, was under no legal obligation to adopt precautionary measures for the protection of passers-by, that duty devolving on the sub-contractors who were actually at work; but the general tendency of the decisions seems to be to hold the principal contractor responsible for damage caused by the negligence of the sub-contractors.

[To be continued.]

RUINS OF A GREEK TEMPLE NEAR MYCENÆ.—The researches of the American School of Archaeology at the Temple of Hera, near Mycenæ, have just been rewarded by an important discovery. The excavations of two hundred workmen under the direction of Dr. Charles Waldstein have revealed the foundations of the ancient temple. Many priceless antique works of art have been unearthed.—*The New York Evening Post*.

¹ Continued from No. 903, page 38.² Linnahan vs. 149 Mass. 29. Newhall vs. Clark, 3 Cush. 376. Somers vs. Thayer, 115 Mass. 163.³ Gray vs. James, 128 Mass. 110. Farquhar vs. Brown, 132 Mass. 340. Proctor vs. Hartigan, 143 Mass. 462. Duffield vs. Johnston, 96 N. Y. 369.⁴ Ferguson vs. Davis, 65 Mich. 678.⁵ Robbins vs. Blodgett, 129 Mass. 279.⁶ Green vs. Jackson, 61 Georgia, 250. Fireproof Building Co. vs. First N. Bk., 54 N. Y. Sup. Ct. 511. Shaw vs. First Bap. Ch., 44 Minn. 22.⁷ Fitzgerald vs. Beers, 31 M. A. 356.⁸ Mineral Point R. R. Co. vs. Keep, 22 Ill. 9.⁹ Eccles vs. Darragh, 48 N. Y. Sup. Ct. 506. See, Wilson vs. White, 71 Geo. 506; Homan vs. Stanley, 66 Penn. St. 464; Gray vs. Pullen, 5 B. & S. 970; Best vs. Leonard, 15 Minn. 304; Sherman vs. Bates, 15 Neb. 19.

OFFICE-HELP FOR ARCHITECTS.¹—X.

·STATIC·LOAD·
Fig. 40. Framed Arch.

§ 194. Framed Arches:— (Fig. 40) These arches are used for very wide spans, such as armory roofs, railroad-stations and the like. The arch is hinged at the crown and springing so as to avoid excessive strain due to change of temperature and to simplify the computations; reaction then at crown must be horizontal, and at springing may be either vertical or inclined.

To determine horizontal reaction at crown, let fall perpendiculars from the point of application of each load to a horizontal line drawn through the springing, take moments about this point by multiplying each load by its lever arm, remembering that the loads at the left of A (the point of support) would have a minus effect, then divide by the vertical distance from the line through A to the line through centre of joint at crown. Then for load-line we have $ab, bd, dg, gk, kn, nr, rv, ry, yq, qc, cg$, making one-half of total load; then, gs the horizontal reaction at g , found as above outlined, noting that the loads bd, dg, gk have negative moments; then sa is the reaction of the abutment, which can be resolved into a horizontal thrust $= gs$ and a vertical reaction $= ga$, if desired, and the thrust taken up by means of a tie-rod.

Joint A :— ab, bc, cs, sa .

Joint *B D*: — *bd, de, ec, cb.*
 Joint *C F*: — *ce, ef, fs, sc.*
 Joint *D G*: — *dg, gh, hf, fe, ed.*
 Joint *F I*: — *fh, hi, is, si.*
 Joint *G K*: — *gk, kl, li, ih, hg.*
 Joint *I M*: — *il, lm, ms, si.*
 Joint *K N*: — *kn, no, om, ml, lk.*
 Joint *M P*: — *mo, op, ps, sm.*
 Joint *N R*: — *nr, rs, sp, po, on.*
 Joint *P T*: — *ps, st, ts, sp.*
 Joint *R V*: — *rv, vw, wt, ts, sr.*
 Joint *T X*: — *tw, wx, xs, st.*
 Joint *V Y*: — *vy, yz, zx, xw, wr.*
 Joint *X U*: — *xz, zu, us, sx.*
 Joint *Y Q*: — *yg, qa, au, zu, zy.*
 Joint *U B*: — *ua, ab, bs, zu.*
 Joint *Q C*: — *qc, cd, db, ba, aq.*
 Joint *B E*: — *bd, de, es, sb.*
 Joint *C G*: — *cg, gh, he, ed, dc.*
 Joint *G S*: — *hg, gs, sh.*

Wind-Left Diagram: — (Fig. 40 *a*) Wind acts horizontally, $\therefore$ it will act on all parts up to GK without diminution and its effect may be obtained by multiplying the area of surface supported by one truss by 50 pounds per square foot. Effect on KL and the other sections of rafters will be normal thereto and will be found most readily thus: (1) Draw horizontal lines through the joints giving the vertical projection of one side of the parallelogram forming the surface against which the wind acts, the other side being the distance between the trusses. (2) Multiply this surface by 25 pounds (one-half unit wind-pressure). (3) Draw a normal line at centre of rafter and a horizontal line out from the same point. (4) Lay off on horizontal line the load found by the second step, beginning at the intersection of the horizontal line with the normal line, and measuring along the normal line to the left. (5) From the end of this line draw a line perpendicular to the normal line; it will cut from the normal line one-half the load on the rafter.

Now, plot ab , bd , dq , gs representing the part of gk due to $G H$, and the part due to $K L$; sk being found in manner similar to that above described. The wind-pressure at each joint is due to the combined action of the wind on the one-half of each rafter meeting at the joint: thus gk is the resultant of $\frac{1}{2}$ of $G H$ and $\frac{1}{2}$ of $K L$. sk being drawn $\parallel$ to the normal line and $= \frac{1}{2}$ of the total pressure on $K L$ — sk is prolonged to 9. $k9 = sk$ and $s9$ being the total wind-pressure on $K L$; $9n = n10$ and 910 is the total wind-pressure on NO , and kn the pressure at the joint KN . In this manner the load-line is drawn to q .

Now to get gs at the end the horizontal reaction at the point F at the apex of the truss: The centre from which the rafter was struck falls just below n on the load-line, $\therefore$ all of the normals representing the wind-pressure must pass through it and a line through it, $\parallel$ to the resultant of the curved part of the load-line, to g will give the resultant wind-pressure on the curved rafter; that line is so marked. A line through the centre of the vertical portion will represent the resultant of the horizontal wind-pressure and will intersect the other line at 4. (Note: Effect of bc is considered as though $B\ U$ were vertical, as it would be in practice.) Then from 4 draw a line $\parallel$ to ag intersecting rafter; this is the point of application of the resultant; its horizontal effect will be found by intersecting a horizontal line through g with a vertical line from a . Multiply this horizontal component by the vertical distance from the point of intersection on the rafter to a horizontal line through A , and divide by the distance from F to same line, or, in other words, take moments about A ; this will give gs . (In the figure multiply 1 g , by 25, and divide by 26.)

Then go around frame in same order as before. Wind on the opposite side will give same results. If a monitor roof is put on the resultant and horizontal thrust at F will be found in similar manner, first taking pressure on rafter, then on vertical part of the monitor and finding their resultant, prolonging to an intersection with the resultant of the curved part and working back to the resultant of all pressures, and then taking moments about A .

§ 195. **Masonry Arches:**—(Fig. 41) Assume that there are joints at centre and springing points, then curve of pressures or equilibrium polygon must pass through these joints at the centre. To find H , the horizontal thrust at the key-stone, divide the one-half chord into any convenient number of equal parts, continuing the points of division up to as far as the superimposed

¹ By George Hill, Consulting Engineer. Continued from No. 904, page 56.

ABBREVIATIONS AND SYMBOLS.

$\square$	= equal to.	$\therefore$	therefore.
$\parallel$	parallel to.	sq	square feet.
$\div$	divided by.	sq	square inches.
$\times$	multiplying.	s	road s pounds per lineal foot.
$+$	added to.	C	channel bar.
$a \times b$	a multiplied by itself.	I	I-beam.
$a > b$	a greater than b .	T	T-iron.
$a < b$	a less than b .	L	angle iron.
$\frac{a}{b}$	a divided by b .	D	deck beam.
		$\bullet$	round section.

I ton = 2,000 pounds as this is the conventional ton, the legal ton is 2,240 pounds, but is rarely used.

l = the length between supports of any beam or girder or height of any column, always in feet.

b = breadth of any beam or girder, always in inches.

d = depth of any beam or girder, or the least transverse dimension of any column, always in inches.

L = total load uniformly distributed coming on any piece in pounds.

W = concentrated load on any piece in pounds.

S = span of any arch or truss between centres of end pins in feet.

A = area of any section in square inches.

M = maximum bending-moment in inch pounds.

a = distance of centre of gravity of section from either top or bottom edge in inches.

I = moment of inertia, neutral axis through centre of gravity.

R = moment of resistance of section.

r = radius of gyration, in inches.

Sc = safe compressive strain in pounds per square inch.

St = tensile " " " " " "

Ss = shearing " " " " " "

S = strain per square inch in extreme fibre.

P_u = upward reaction of support at left-hand end of beam.

P_f = " " " " right " " "

e = distance of centre of gravity of load from left hand of beam.

f = " " " " right " " "

load goes. From the centre of the key-stone drop a vertical line and on it lay off aa, ab, bc, cd, de, ef , representing the loads on the arch due to the sections ab, bc, cd , etc. Assume any point as O , and from it draw lines to a, b, c, d, e , etc.; start at a , draw ai to an intersection with a vertical line

the only difference being in the assumptions as to loading, and these will be more fully explained in subsequent chapters.

[To be continued.]

SIDE LIGHTS ON VIOLET-LE-DUC.¹—I.

IT has happened more than once in the last twenty years that I have felt called upon to express my admiration for the Viollet-le-Duc of the Siege of Paris, and so, since the publication of "*Souvenirs de la Cour des Tuileries*," by Madame Carette, people have never tired of throwing in my face the opinion of Viollet-le-Duc which this lady of honor to the empress entertained. I do not hesitate to introduce here a quotation from the elegant pages written by this lady-in-waiting, for the criticisms contained in her book in no degree diminish the real merits of Viollet-le-Duc:—

"One of the ordinary objective points for excursions was the Château de Pierrefonds. From the very beginning of his reign, the emperor, impressed by the beauty of our historical monuments, applied himself to restore them to their ancient splendor. The Louvre, Notre Dame, the Palais de Justice, the Tour St. Jacques, all those chefs-d'œuvre buried, lost in the labyrinth of foul lanes, once gnawed by the leprosy of decaying buildings, now admirably restored, had recovered their magnificence and become the gems of the new city. Millions were consecrated to these immense works. An army of workmen was employed on them. All our artists were summoned to lend the aid of their talents. Among them Viollet-le-Duc made for himself a superb rôle. His real merit alone had not marked him as worthy of the benevolence of the emperor: while travelling in Spain in his youth, for the sake of studying the marvellous specimens of Moorish art, he had the fortune to be presented to the Comtesse de Montijo, and in that way came to know the Duchess of Alba and the empress, who were at that time young girls. After the emperor's marriage Viollet-le-Duc knew how to make his former relations of value to him, and because of his untrammelled wit, enthusiastic and seductive, he was allowed by the friendliness of the empress to have free access to the emperor, and became one of those to whom imperial

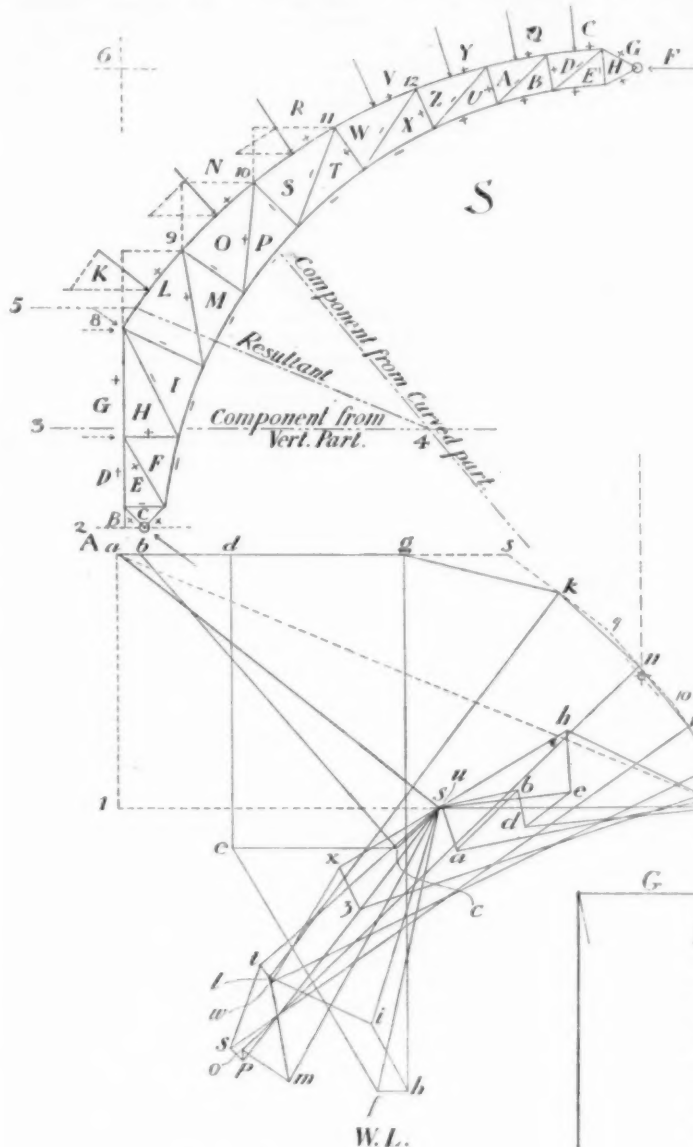


Fig. 40a. Framed Arch.

drawn through the centre of gravity of the section A , then draw $ij \parallel$ to bo , to 2, vertically under the centre of gravity of B ; then $n \parallel$ to co ; $kl \parallel$ to do ; $lm \parallel$ to eo , and so on to jk . From n draw $np \parallel$ to fo , until it intersects ao , in p .

Then draw px vertically until it meets a horizontal line through a . From x draw xy 7 through the centre third of the joint at the springing line.

Then draw $fh \parallel$ to xy ; hf is the abutment thrust and ha the thrust at the key-stone. Now from h draw line to a, b, c, d, e, f ; these lines represent the thrust on the several joints. Starting at a draw al to centre of A ; $12 \parallel$ to ha , to centre of B ; $23 \parallel$ to hc ; $34 \parallel$ to hd , etc., giving the line $a, 1, 2, 3, 4, 5, 6, y$, which is the equilibrium polygon.

So long as the equilibrium polygon keeps within the middle third of the voussoirs the arch is safe, but if it passes outside of this, a different arch curve should be taken so as to bring the polygon within the middle third. This for masonry. For ribs of wood or metal, if the polygon fall outside of the rib it will create in it a bending-moment which will equal $ha \times$ the greatest vertical distance from the equilibrium polygon to the centre line of the rib.

The above analysis applies to flat arches and domes as well,

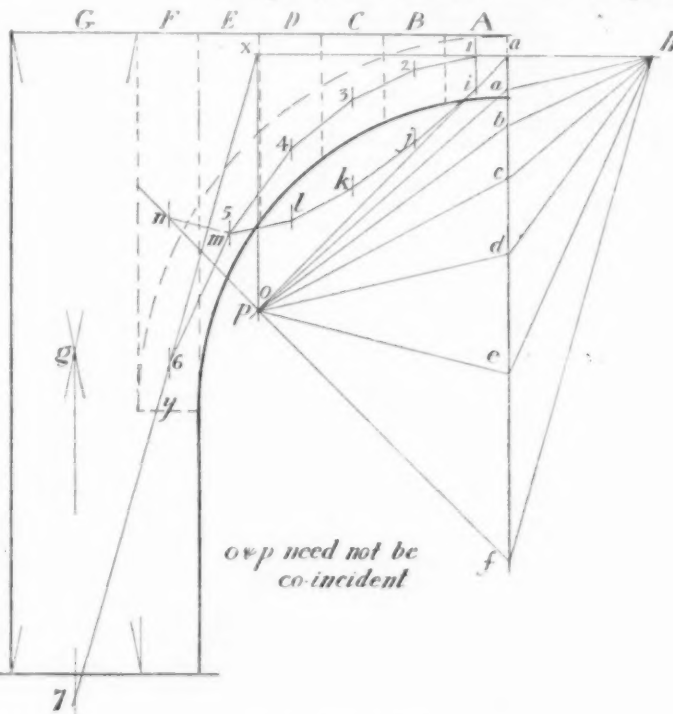


Fig. 41. Masonry Arch.

favors seemed to rightfully belong. The emperor intrusted to him the restoration of Notre Dame, and soon he became grand arbiter of all historical monuments. He then began to dream of reconstituting one of those feudal marvels, of which the impressive remains are so

¹ Extracted from "*Viollet-le-Duc et Alphand au Siège de Paris*" by Massillon Rouvet, Paris. Librairie Imprimeries Reunies, 1892.

well adapted to tempt the science of the archaeologist, which was the most notable element of his own talent. He had not much difficulty in persuading the emperor to entertain such a proposition. The question of money created a certain amount of difficulty, for it was easy to foresee the necessity of great credits; but the emperor's initiative rarely failed in an enterprise where science and art were equally interested. The emperor, therefore, prepared himself to open his privy purse with great generosity. Pierrefonds, whose ruins, noble, grand, at one of the extremities of the forest of Compiègne, seemed, because of its proximity to one of the royal dwellings, designated for this very interesting experiment in restoration. Still, the ambition of Viollet-le-Duc was tempted by a work even more vast. In the Department de l'Aisne, not far from the forest of St. Gobain, the ruins of the Château de Coucy offer an example at once the rarest, the most impressive and also the most elegant of all feudal architecture. Constructed in the 14th century by one of the members of the Enguerrand dynasty, whose power and wealth held in check the power of our kings, tradition pretends that this magnificent dwelling was erected in a few years only by the same architect who, in England, built Windsor Castle. In fact, in the general structure of the plan and in the proportions of the immense donjon are found many analogies with the royal dwelling of the English sovereigns.

"In 1858, after the war with Italy, the Court then sojourning at Compiègne, their majesties made excursion to Coucy, going post. Under the enthusiastic guidance of Viollet-le-Duc, their majesties visited the ruins in every part. Attracted by the beauty of the site, by the idea of restoring to France this gigantic marvel, the emperor seriously entertained the idea of undertaking this restoration. Viollet-le-Duc, all afire with enthusiasm, set himself to work and studied the matter. He restored in their integrity all the ancient plans, and delivered himself up to the labor of research in a spirit worthy of a Benedictine monk. The real value of such a task can be appreciated when we compare the present state of the ruins with his restoration, which he presented to the emperor, accompanied with an estimate of cost, which amounted to twenty millions. This was so exorbitant that the plan had to be renounced, and they came back to the idea of reconstructing the Château de Pierrefonds, for which the estimate prepared by the architect did not exceed five millions, although actually, thanks to the generosity of the emperor, this sum was far exceeded. The neighborhood of the court at Compiègne added attraction to the enterprise, for the empress pointed out that, later, the *jeune cour* could be established there, and the place would become an appanage for the Prince Imperial possessing many attractive qualities. So, not without regret, the project of restoring the Château de Coucy was abandoned, and only a certain amount of work in preventing further dissolution was undertaken there, while work at Pierrefonds was begun in earnest.

"The condition of the ruin was so ancient, the devastation so complete, that it seemed foolish to think of utilizing such remains, crumbling away on all sides, and which appeared on the very point of further dissolution; but the primitive construction had those indestructible qualities of which the mediæval architects knew the secret; and so, by making use of the ancient foundations of all the parts still standing, it was possible to rebuild the ancient château as it must have been built, at the end of the 14th century, by Philippe d'Orléans, of gallant memory, the brother of Charles VI, the rival of the Duke of Burgundy, who caused him to be assassinated at Paris in 1407. The Château de Pierrefonds was justly considered one of the marvels of the Middle Ages, and it was hardly finished at the time of the assassination of the Duke of Orléans. 'It was,' says an old chronicle, "*Un château moult bel, puissamment édifié et moult défensible.*"

"The seven towers, each thirty-five metres high, defended the *enceinte*, which presents four faces, without, however, making a regular square. In order to give the structure a solidity capable of sustaining sieges and defying the storms, the stones were banded together by iron cramps run with lead. This explains their capacity for resistance. In area, the fortress occupies 3,400 square metres.

"The Château de Pierrefonds underwent many sieges. Its history is interwoven with the history of the different factions which desolated France up to the reign of Louis XIII. Henri IV desired to drive out of it a certain Rieux, chief of a band which pillaged the country and exacted a thousand penalties. The Duke of Eperon laid siege, but was obliged to withdraw, after having received a wound which put his life in peril. After him, Marshal Biron vainly endeavored to seize Pierrefonds with the aid of a heavy siege train of artillery. All he succeeded in doing was, in the picturesque language of the times, to 'whiten the walls.' Finally Cardinal Richelieu, that grand leveller, being unwilling that a fortress should exist with the reputation that it was impregnable, a refuge always open to brigands and rebels, ordered the destruction of Pierrefonds. Condemned thus by the implacable minister of Louis XIII, whose genius did not shrink from any sacrifice, first, they tore off the roofs, but destruction being but slowly accomplished in this way, they exploded several mines, in order to make breaches in the towers and in the walls of *enceinte*. Time has done the rest, and during a century and a half these ruins, delivered over to the elements, invaded by a luxuriant vegetation, reflected from the top of the cliff in the little lake which lies at its foot, have been the admiration of every tourist who has visited the forest of Compiègne. To-day, entirely rebuilt, the Château de Pierrefonds has recovered its ancient splendor. One recognizes in its walls traces of the former ruin, and the white tone of the reconstruc-

tion is marked here and there by large areas of the old gray stonework of the primitive structure. Certain lovers of the picturesque cried out at the profanation when the gigantic scaffoldings were reared about the ruined monument. During six years, encircled by a veritable forest of masts and beams, the château resembled from a distance a gigantic vessel almost ready to be launched into the ocean. The work being vigorously pushed and generously supported by the imperial privy purse, to which Viollet-le-Duc made frequent appeal when means of prosecuting the work became scant, the exterior work at length approached completion. During a sojourn at Compiègne, on an excursion adroitly proposed for the purpose of examining other works, their majesties perceived all at once, at a turn in the road, in place of the mournful and sombre ruins, a fairy-like palace, a white marvel, lifting into the air its powerful towers crowned with steep roofs, fantastic weather-cocks and brazen oriflammes. Viollet-le-Duc had acquitted himself with great brilliancy in his immense undertaking, and everything which architectural science, all that art and taste could create in its most complete form, he had brought together to give gratification to his sovereigns. The emperor was prodigal with his felicitation and recompenses. He never was chary of his admiration or the more substantial marks of his satisfaction. The empress, much interested in the scheme of restoration, had all along given great attention to the plans and the works. She joyfully allied herself with the successful issue of a work accomplished by a man whom she considered an old friend.

"When the mere rebuilding of the château was finished, it was necessary to take thought for its decoration, and soon the cold whiteness of the stonework in these elegantly proportioned halls was covered with paintings and decorations, which, with the most scrupulous fidelity repeated the primitive decoration. With the utmost care every vestige of the original treatment had been garnered, and ancient chronicles had been ransacked with untiring persistence, till at length has been given to the modern Pierrefonds the general character of the Pierrefonds known to Duc Philippe d'Orléans. We know that the fecund imagination of our ancestors knew how, with incomparable taste, to impress upon mere stones the gracefulness of their budding poetry. The 'Romance of the Rose' blossoms in the chief halls of the Château de Pierrefonds. In the *salle des chevaliers*, among the interlacing vines, standing out over a vast fireplace beneath King Arthur, in his azure surcoat emblazoned with three crowns, appear, clothed in their proper bearings, the Knights of the Round Table: Lancelot of the Lake, with silver surcoat, blazoned with three gold bands, him who was reared by the fair Vivien, the Lady of the Lake, the most courteous of knights; in love with the fair Guinevere, the wife of King Arthur, he draws upon himself the ill-will of the fairy Morgana whom he has disdained. Then, besides, Valentine the Gaul, Tristram of Lyonesse, Conradin of Otranto, all exhibit beneath their helmets the mysterious poesy of their amorous and warlike exploits. In the immense gallery of armor we see the nine noble dames, Semiramis, Deifemme, Lampedo, Thamyris, Tanaquil, Deiphile, Hippolyte, Penthesilea, Menelippe, in their dresses of cloth-of-gold, their foreheads bearing heraldic crowns, leaning upon their armor-bearing escutcheons, and bearing in their hands, in the attitudes of saints, a flower symbolic of their chaste amours, or a weapon emblematic of their courage. More poetic still than these fictions of our forefathers, the melancholy shade of Valentine of Milan flickers through this fair dwelling, where she secluded herself after the assassination of her husband, the brilliant Duc d'Orléans. Young and beautiful, with the prestige of noble birth and great wealth, she buried herself here an inconsolable widow. Just as the last slab seals her tomb, she, so cruelly disenchanted, sealed her broken life with this device: '*Rien ne m'est plus, plus ne m'est rien.*'

"During the visit of the empress to Pierrefonds that she might decide on the decoration of this hall, as yet only filled with the fine powder raised by the stonecutters' chisels, Viollet-le-Duc begged Her Majesty to authorize that to the statues of these nine dames, who were to occupy the empty niches over the monumental chimney-piece, should be given the features of herself and of the ladies who accompanied her. The empress consented, and so each one of these ladies has a statue there. There were with Her Majesty the Princess Anna Murat, the Duchess of Bassano, the Duchess of Cadore, Madame de la Poëze, Madame de Pierres and myself. The following year, on returning to Pierrefonds, we saw our images installed in their niches. No great pains had been taken with the matter of resemblance. Nevertheless, Tanaquil, the middle statue, that which represented the empress, has certainly Her Majesty's features; and, alas, there could be read at the feet of this image the device of the desolate Valentine of Milan.

"Some years afterwards, having gone with friends to visit Pierrefonds, this little episode of the statues, amongst other curious stories connected with the restoration, was told to us by the wife of the guardian, who showed us over the place. She didn't recognize me, and I asked her if these statues were indeed portraits of the ladies whose names she had repeated with the accents of a lesson thoroughly well learned. 'Assuredly,' she answered; 'and it is easy to see that you don't belong to the court.' I begged her to point out to me the statue of Mlle. Bouvet. 'She is Menelippe, the little one in the corner,' she answered, 'and everybody easily recognizes it. She does not wear a crown, like the others, because she wasn't married.' Well satisfied with this explanation, I thanked the good woman, saying that I could hardly believe that the ladies whose names she had given were actually as pretty as the statues. 'Ah, Madame,' said

she, 'you should have seen them. All were as pretty as the wax figures at the hairdresser's in the Grand Place at Compiègne.' After so flattering a comparison, I feared to draw down upon myself mortification by insisting, so we withdrew, complimenting the cicerone on her erudition, and begging her to instruct the public in the same interesting manner.

"For the organization of various amusements at Compiègne — the promenades, the comedies, the tableaux-vivant — Viollet-le-Duc was an inexhaustible resource. If any accessory were wanting, with a few strokes of the brush he quickly indicated a decoration. Ingenious, able in everything, he, in a marvellous degree, understood how to remedy a mishap, to turn a couplet, to direct the setting of a scene, to restore to his self-possession some frightened actor, and he filled with indefatigable patience the trying and thankless rôle of prompter to the, generally inexperienced, troops of amateurs. During performances one saw the fine head of Viollet-le-Duc, crowned with light-gray hair, his face always beaming, peeping now and then from the prompter's-box. With extreme courtesy he corrected the pretty actresses, for the greater part unversed in the scenic art. He had the mimic's gift to perfection, and from the silvery voice of the ingénue to the tragic accents of the traitor, he imitated to perfection all their gestures, all the tones of the voice, now gracefully sketching out the courtesy of a duchess, or delivering the fatal thrust of the bravo. Full of enthusiasm, of good-humor, putting everybody at ease, he succeeded in preserving harmony under conditions where petty susceptibilities are so easily excited.

"The empress counted on him for all negotiations where delicacy was required. In a word, he had very skilfully developed, under the veil of old friendship, the suppleness, the address, the adaptability of the perfect courtier. No one better than he knew how to conceal audacious flattery under the apparant brusqueness of sincere attachment. Extolling more than anybody the beauty, the wit, the ideal grace, the great good qualities of the Empress Eugénie, he always added, 'I am one of those who have the right to speak thus. My testimony is above suspicion, for I am a friend of old.' Very often I have heard this speech come from his lips. He showed a very particular devotion to the Comtesse de Montijo, and whenever the empress's mother visited France, it was generally Viollet-le-Duc that Her Majesty charged with the task of going to Lun to receive her at the frontier. Having no official character, being very attentive and very careful, Viollet-le-Duc always acquitted himself easily of this commission.

"Viollet-le-Duc was always invited as a permanent guest during all the sojourns at Compiègne. He was one of the very small number whom the empress addressed without giving them the usual handle to their names. When Her Majesty spoke to him, she did not say, as she would to another, 'Monsieur,' but 'Viollet-le-Duc,' and often 'My good Viollet.' Hence the nonchalant manner in which he threw off all bonds of gratitude caused me great surprise.

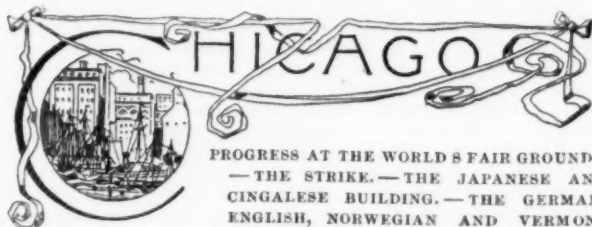
"Some months after the war I was at Rheims, on an excursion to visit the Cathedral, when Viollet-le-Duc entered the room where we were breakfasting. He joined our party, and after having given a little dissertation on the beauties of the Cathedral compared with the beauties of those of the Cathedral at Laon, which I had found more interesting, more romantic, I asked him if he had no commission for England, whither I was going to see the empress. He answered in the negative. 'Perhaps,' said I, 'you are counting on going there yourself soon.' 'Why should I go to England?' said he. 'Why, for the same reason which summons me to see their majesties.' 'Oh, it is different,' said he. 'For my part, I have always been very independent, and I have not the same reasons for attachment that you have.' 'What!' said I. 'Is it you who talk in this way after Pierrefonds and Compiègne, after all those sweet and affectionate relations, the generosity of the emperor and the confidence of the empress?' 'I worked for Art, not for them,' he answered.

"I was thunderstruck."

Let Madame Carette be thunderstruck. It is quite for her advantage, for the benefits of the high position she had at court were forever lost to her, and we can understand her regrets. It was not allowed to her to take the same position as Viollet-le-Duc. Is it the same for the eminent artist? Could not one ask, as in the case of Raphael and Michael Angelo, "Who was it, the Pope, or these artists who lent glory to his time?" Was it Napoleon III, or was it Viollet-le-Duc? Ought friendship to prevail over talent? If Madame Carette had read some of the pages of the "*Entretiens sur l'Architecture*" by Viollet-le-Duc on the matter of the relations between clients and architects, perhaps she might have modified her melancholy verdict. But I have no mission to defend Viollet-le-Duc. I do not believe that he needs a defence.

[To be continued.]

THE LARGEST HANGING BELL.—A Buddhist monastery near Canton, in China, contains the largest hanging bell in the world. It is of solid bronze, eighteen feet high and forty-five in circumference. It is one of eight great bells cast by command of the Emperor Yunglo about A. D. 1400, and is said to have cost the lives of eight men, who were killed during the process of casting. Inside and out the whole bell is covered with an inscription consisting of 84,000 embossed Chinese characters about half an inch long, which relate a Chinese classical story. — *Invention.*



PROGRESS AT THE WORLD'S FAIR GROUNDS.
—THE STRIKE.—THE JAPANESE AND
CINGALESE BUILDING.—THE GERMAN,
ENGLISH, NORWEGIAN AND VERMONT
BUILDINGS.—THE ETHNOLOGICAL EXHIBITS.—THE MONASTERY
OF SANTA MARIA DE RABIDA AND ITS VALUABLE CONTENTS.
—THE PERISTYLE.—NO INDICTMENT IN THE CASE OF THE
YORK BUILDING ACCIDENT.

AS the time for the actual opening of the great Fair approaches most strenuous efforts are being made that everything may be in readiness for the great event. Two weeks ago, as if there were not enough to do to overcome the delays caused by the winter storms, a strike of mammoth proportions was pending. As usual, it was the question of non-union men being employed side by side with union men, with some other trivial question added to give the whole proceeding a little less arbitrary look. For one day, or a part of it, four thousand men were off duty, which performance alone cost the Fair twenty-five thousand dollars, it is reported. Had the strike continued no other considerable loss would have been the result, for the Directory had been preparing for this emergency for several weeks, so though much delay would have of necessity resulted from a change of hands, still it would have made less trouble than might have been expected. Whether it was the determined attitude of the Directors, or the lack of sympathy with the movement in the actual workers, the strike has been declared off, and the present agreement necessitates good behavior till the completion of the work, if the compact is lived up to. Of course, after the opening-up of the Fair season, the number of workmen here in Chicago is going to be much in excess of those required for the actual amount of work and it would have been absolute folly on the part of the men to have necessitated the bringing-in of five or six thousand new laborers.

As one approaches the grounds, in fact as one rides all the way from the down-town Illinois Central Station, one is impressed with the tremendous amount of work that has already been accomplished, and, also, with that still to be done. Especially in the vicinity of the grounds is the crude, rough state of the surroundings to be noticed. What with the elevating of the tracks of the Illinois Central Railroad, with the necessary changes in platforms and stations, the final construction of the elevated-road down to the grounds and the tremendous amount of rapid and hurried building, the entire section has, to put it mildly, a far from reposeful aspect. Fortunately an exceptional spring has given for the last three weeks almost uninterrupted time for work, and in every direction has the chance been improved. As is often the case after a severe winter, the spring has opened early and the work of cultivating the actual grounds of the Fair has been pushed rapidly. Levelling, planting, sodding are being done in every quarter, while portions which were graded and sodded last fall fill the eye with a true English greenness. The space at the south of the great Liberal Arts Building is a delight in the spring sunshine, gay, as it is, with crocuses and its beautiful velvety turf. It looks like an impossibility that in the landscape-gardening department alone any very finished appearance can be attained before the first of June. One special part of the landscape-gardening which promises to be well along is that which is being carried out around the Japanese tea-houses. Picturesquely situated by the side of the graded road which leads to a bridge, and by the side of the lagoon, is situated the little spot which this curious and interesting people are transforming into a bit of a park from Tokio. Miniature mountains and tiny hillsides already make the average Occidental feel life must be a sort of plaything with these pleasant, gentle-mannered folks. In the midst of these tiny gardens, which are surrounded by a picturesque greenish bamboo fence, stand the two little tea-houses. One shows the often-described paper walls and partitions of the Japanese houses, while the other is built with walls of curious bamboo matting on three sides, while the fourth side is open to the south-west breezes blowing over the miniature mountains and across the artificial lake.

The Hoodew or Phoenix Temple, before described in these letters, stands, quite completed, on the "Wooded Island," and has, in fact, been dedicated, the keys to it having been handed over by the architect to the Commissioner. With the characteristic exactness of the Japanese, the amount of work and the amount of time have been duly calculated upon, and nearly everything is in readiness for the Exhibition.

Aside from the large and most widely-known buildings at the Fair, there are a certain number of smaller ones, which, from their great beauty or unique character, will attract attention among architects. Down in the space allotted to the buildings for the different States and foreign countries stands a little structure that, because of its unassuming appearance, one could easily pass by when strolling along the drive. This is the edifice, overlooking the Lake and picturesquely situated in a grove of trees, which is to be the headquarters of the Cingalese at the Fair. The general outline of the structure is low and spreading, an outline familiar to us in many of

the tombs and kiosks of India. What especially makes the little edifice noticeable is the exquisite carvings. Those that are noticeable from the exterior are the jambs of the windows, framework of the doors, and curious, grotesque panels in high relief beneath the windows. A certain irregularity in the mouldings points to the careful hand-labor that in even the simpler parts of the structure has been bestowed upon it. The building, like some of the other smaller ones from distant countries, has evidently been first erected in its native clime, then taken apart and reshipped here to be reconstructed at the Fair. The carvings enclosing the window and door openings are deep-cut and finished, while those under the windows are less elaborate in design, though standing out in very high relief. They are evidently scenes from the legends and history of Ceylon; one curious carving looks like a little Jonah before the mouth of a very large whale. History and legend do repeat themselves, as we know, in time or places, though this may only be a gentle hint of the idea of transmigration, so pleasant to the Buddhist mind. The chief carving in the interior is bestowed upon beautiful columns forming a circle in the central building and aisles down the wings. Not many of these pillars have yet been unboxed, but the few that have been display great richness and beauty. They are of the native woods of Ceylon, the shafts as well as the capitals being most beautifully carved out of the solid. They are more in that style introduced by the Mogul emperors in the sixteenth century than in the heavier grotesque designs of earlier times.

By the side of the larger structure stands a small one, presumably a hut for the workmen, as it shows marks of wear. It is made of dry palm-leaves, sewed together with some vegetable fibre, forming a thatch for both sides and roof.

The building by which Germany represents herself is the neighbor of this structure from "India's coral strand," and one is at first inclined to smile at the decorations of this comprehensive example of all of the German styles of the Middle Ages. The longer one looks at it, however, the more pleased one becomes, though at first its colors may seem more in keeping with a Bohemian beer-mug than with a building of somewhat large and imposing proportions. It at least has a most festal appearance, fitting for the time and place, and is most picturesquely and appropriately situated in a grove of willows, only high enough to somewhat hide the lower stories while they but lightly screen a portion of the upper part. A portion can well be screened and still enough that is vivid remain to make quite an impression on the beholder. German mottoes, pink storks, green tiles, black timber-work and white plaster make a combination which, to say the least, does not lack variety.

Across the road, England's old country-house of brick, terra-cotta and open-timber construction is not so appropriately situated as regards a certain fitness of surroundings, though the lake gives it a fine background, and no pleasanter quarters for a club-house could be found during the hot weather. When entirely completed, all of these buildings will be, without doubt, worthy of further notice.

Another very interesting structure is that constituting the Norwegian headquarters. It has hardly reached a sufficient state of completion to be described in detail, but the general feeling of the old Northern church is well preserved, and the building promises to have a good deal of quaint charm about it.

An unusual design for a State building is found in a little structure where the Green Mountain State will make her sons at home. It is of staff construction, and is a veritable little Greek dwelling-house, with court in front, in which a fountain is destined to play. Around the court under the covered sides, benches are built on which to repose during the heat of the day. Caryatides support the architrave above which rises the pediment. The caryatides directly in front of the entrance are large for the place, and one does not feel as if they and the Vermont people would seem appropriate companions for such close quarters. The fountain in the diminutive court usurps a good deal of room to itself. The classic proportions are all well carried out, however, and the whole scheme, though curious, is rather fascinating, in spite of certain imperfections.

Another curious little building is that which belongs to Turkey: low and with wide-spreading eaves, its walls as well as the soffit of the eaves are entirely covered with panels of beautiful Turkish wood-carving, relieved by a slight inlaying of mother-of-pearl. The inside of the building is entirely without ornamentation at present. The design of the panel is, aside from the border of tracery, composed chiefly of the letters so often seen in Turkish design, presumably sentences.

Though not in themselves buildings, but of a character similar to two of the structures already mentioned, are the Indian and Cingalese booths in the Liberal Arts Building. The carving on the Indian booth is by far the most beautiful feature of its kind in the grounds as yet. Again, none of the heaviness or grotesque character appears in this work, but all is light, elegant and beautiful in design. The effect is light: in reality, the ceiling and especially the brackets contain carvings very heavy and deep. The wood itself both in this and the Cingalese booth, aside from the carving, is a worthy exhibit. This latter department of Ceylon is very near the Indian pavilion, and here the same wonderful pillars as in the Cingalese headquarters are seen. Ebony or teakwood, shading down in color to some woods as light as our maple, constitutes part of the exhibit, and these pillars are each said to be worth four hundred dollars.

The Liberal Arts Building is a busy scene indeed and much rush-

ing work has yet to be accomplished to get things in readiness very near the opening time. Spain and France are both especially late in their preparations. The French marines guarding the property of the latter government and the Spanish flag hanging over that of the former seem to be the most noticeable things in these two departments.

At the south of the Liberal Arts Building passing through the large amphitheatre, where will be displayed the different race-horses, in connection with the agricultural exhibit, and passing out beyond into the southern extremity of the grounds, quite a number of curious structures are to be found. One of the old, while at the same time, one of the best-preserved, Dutch windmills from Holland here swings its ancient arm, while a little farther north stands a fac-simile of the famous old White Horse Inn, where the immortal Pickwick and Sam Weller flourished. The original old white horse sign is to hang over the door.

At the almost southern extremity of the grounds are to be the headquarters of the ethnological exhibit. Ruined gateways from Central America have been carefully reproduced here, and as they have been taken from the casts of the original remains will doubtless be of much interest to those who have made any sort of study of them. Directly across the way from them stands the structure which is eventually to be known as the home of the "cliff dwellers." At present this structure resembles nothing so much as a huge pile of packing-boxes, thrown together hap-hazard for a large bonfire. It is worthy of admiration, however, that anything designed and premeditated should come from anything apparently so chaotic. It seems as if the plans for it would make a most unusual and interesting feature in any collection of drawings, and that great ingenuity must have been displayed in this curious collection of orderly and disorderly matter. The structure will, of course, be eventually covered with staff, but at present the rugged rock consists only of laths, nailed to apparently crossing and interlacing beams. Considering the well-known reputation of the man who is at the head of the exhibit, it is not too much to expect that this curious structure, as part of it, will be a success.

Farther north standing on what is meant to be a somewhat bold promontory of the lake shore is the reproduction of the old monastery of Santa Maria de Rabida. A plain enough looking old building it is, but fitting that it should stand in the midst of this great Columbian Fair, for within its walls, it might almost be said, occurred the immaculate conception of our great nation. The building is of brick of fireproof construction, with whitewashed walls and red tile roof, and is naturally as careful a reproduction of the old original as could be produced. The fireproof construction was a necessity, of course, as it is to be used as a museum for historical relics connected with the life, voyages and discoveries of Columbus. These relics are nearly all furnished by Spain and are to be displayed in the chapel of the building in showcases made of heavy plate-glass and steel. Among other things in the cases is the autograph of Columbus, the royal letters patent from Ferdinand and Isabella to the great discoverer when he sailed on his first voyage, making him admiral of the fleet. There is also an autograph letter from Queen Isabella returning a book which Columbus had loaned her and urging him not to delay his voyage, besides many letters written by Columbus to his son Diego in 1504. In another case are old coins made from the first gold found in America. On the steps of the altar are six roughly-hewn stones, all that remains of the first Christian Church in America. There are also two anchors used by Columbus, and four cannons which were on the "Santa Maria." They are queer little things, only about four feet long, roughly made of iron and very rough and crude in finish.

The setting to the building is especially good and fitting, indeed quite like the pictures of the old place. It is perched on a barren hillside and quite a hill it looks in this part of the world where a rise of even an inch is noticeable. A granite sea-wall is on the water-side. One of the most picturesque views of the old place is looking across a stretch of water from the Casino, whence it is indeed charming.

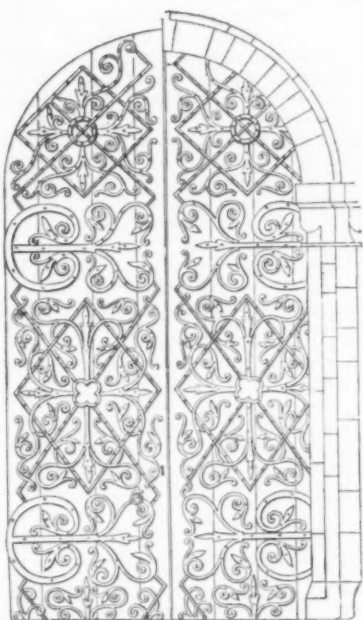
The Peristyle, which is now nearly completed, is all it promised to be and is a really delightful creation from an artistic point-of-view. This Peristyle with its beautiful columned space connects the Casino with the Music-Hall. Its three rows of beautiful Corinthian columns are only broken by a central structure which rises to about the same height as the colonnade and upon which is to rest the beautiful composition before spoken of in these letters,—a victorious chariot drawn by prancing horses, the steeds held by most lovely girls. From within the Peristyle the view is bewitching. On the east is blue Lake Michigan, doubly beautiful when framed in between these stately white pillars; north and south you can look through the long vista formed by the columns, with the sunlight making rich lights and shades on the red brick floor. To the west stretches out before you the Court of Honor, the basin surrounded by the fine buildings, its terraces, its flowers and fountains, while directly in front of the Peristyle stands Mr. French's grand "Columbia." As yet only her liberty-cap is visible to the public, as the sheathing of wood still encases her. This part of the grounds will be especially beautiful in the evening, as electric-lights and electric fountains are to flash everywhere. Fifty feet or so above your head the little electric-wires can be seen way up among and above the capitals of the pillars of the Peristyle waiting their globes and finishings.

The case of the indictment of the architect, contractor, inspector

and owner of the wrecked York Building, referred to in the last letter, has been settled by the grand jury failing to find a true bill against them. In spite of the strong feeling at the time of the coroner's inquest the general excitement seems to have died out, and nothing is to be the result of all the show of righteous indignation. Probably from the architect's standpoint he did not seem the man, and it hardly appears just in a case like this to hold him responsible for an accident, when so many experts testified that in their opinion the wall was safe.

TOPOGRAPHICAL AND ARCHITECTURAL HISTORY OF THE CITY OF MEXICO.—I.

THE SITE AND ITS SETTLEMENT.



Hinge-work at Durham Cathedral.

IN the twenty-second year of the sixteenth century certain Spanish adventurers together with a horde of Tlaxcalan allies, all under the command of Hernando Cortés, succeeded in capturing an Indian pueblo in the lake region of Mexico, then bearing the name of Tenochtitlan, and ever since celebrated in poetry and romance, and in historical writings deeply tinged with romance, as the seat of the powerful "Montezumas," and as the capital of "Anahuac," a great Aztec Empire. As the simplest, and, under the circumstances, probably the best, manner of disposing of their capture, the conquerors completed the partial destruction which had

attended the siege of the pueblo and left not a vestige of what have been frequently termed its former "glories." Upon its site they built the City of Mexico, the veritable capital of New Spain, the Spanish Dominion in North America, — a city intended to vie in splendor with the cities of the Old World.

The city then erected has naturally submitted to mutations to which all the habitations of man are subject, and no part thereof survived the seventeenth century. Nor does more than a small portion, if any, remain of the city which gradually took its place, as it slowly decayed and required renovation. But covering the same site, bearing the same name as the city built by the Spanish conquerors, and historically identifying itself therewith, and, through it, with the previously existent pueblo, stands to-day the capital of the Mexican Republic, justifying its claim to greater historic interest than any other city of the North American Continent. This historic interest rests no less upon the topographical and architectural development of the city than upon the military, civic and ecclesiastical exploits which have made it famous throughout the world.

Dazzling indeed are the pictures given us of Tenochtitlan, the earliest historic occupant of the spot, and of the civilization to which its inhabitants had attained. But the accounts given of the size of this Indian pueblo, of its population and architectural grandeur, are now known to have been grossly exaggerated and unworthy of credence. He who has recently described "the old pueblo, resting on the dull waters of the lagune like an adobe patch surmounted by the clumsy mounds of worship," and as comparing unfavorably with the present "City of Mexico with its domes and spires glistening in the noonday sun,"¹ has given us a picture, which, though wholly at variance with the reports of the *conquistadores* and the early Spanish historians, is the only one that can be reconciled with phenomena now observable in and about the modern Mexican capital.

As is now generally known, the foundations of the Aztec pueblo were laid in the year 1325, upon small islands in the marshy western borders of Lake Texcoco. To visitors in the City of Mexico, a fountain in the Plaza de Santo Domingo bearing in bronze the device adopted as the seal of the Mexican Republic is pointed out as marking the spot where the pioneer Aztecs saw an eagle upon a nopal strangling a serpent, and hailed that strange sight as a sign that the gods intended this to be the scene of their future greatness. It is more probable, however, that the great *teocalli*, or temple-mound, whose site has been elsewhere identified, was erected with the intention of marking the spot where, according to their tradition, the will of the gods was made known to them.

The selection of such an unprepossessing site, to the civilized mind so miasmatic and insalubrious, for the habitation of men, demands a more satisfactory explanation than the legendary one usually offered; a more plausible one would be that offered for the selection of the islands at the mouth of the Brenta as the location of the city of Venice. The Aztecs who arrived at the marshy shores of Lake Texcoco in 1325 were an oppressed and hunted people. By tribes already settled in the Lake region, they had been driven out of Tepeyacac and then from Chapultepec; and they failed to find a permanent resting-place either in the islands of Lake Acocolco, in Huitzilopochco, in Mexicalcingo or in Ixtacalco. It was almost in despair that they finally settled upon lands uncovered by any of their predecessors in the valley. The spot was a canebrake, probably, surrounded by a swamp. It offered seclusion, a natural protection from their enemies and a scanty means of subsistence, — fish, game and facilities for producing the few agricultural staples which the sedentary Indians require. The position was, furthermore, readily defensible and, as events proved, capable of being made the strongest military position known to the Indians up to the advent of the Europeans in the sixteenth century.

The Aztecs who sought an asylum at this place proceeded at once to increase their horticultural facilities by enlarging their islands. They enhanced their military strength by building dikes, by which they provided not only ready means of reaching the main-land but completed their isolation by converting their marshy surroundings into a portion of Lake Texcoco. By the dike, which became in course of time the causeway of Acachinanco, connecting the two pueblos of Tenochtitlan and Ixtapatapan, a basin was formed southwest of the island pueblo. As this causeway was subsequently extended to Tepeyacac, on the opposite side of the pueblo, and as the two causeways — that connecting Tenochtitlan with Tlacopan (Tacuba) on the west, and that running to Coyoacan from the point called Xoloc, on the Acachinanco dike — were constructed, a series of dams resulted which held back the waters of streams emptying into the lake on its southwestern side and extended the borders of the lake several furlongs beyond the pueblo in that direction.

The pueblo of Tenochtitlan was unique in its situation and construction, but it accomplished, by the means thus employed, precisely what was sought to be gained by the fortification of a land pueblo according to Indian ideas, — that is, the elevating it above the surrounding country. The Aztecs who occupied Tenochtitlan were not only enabled to protect themselves from their enemies quite as well as if in an elevated position, but they were also in a position to assume the aggressive and to plan attacks upon the neighboring tribes for the purpose of securing the subsistence which their island home in time failed to supply to their increasing population.

Fully in accord with the invariable rules of social organization among the Indians by gens, phratry and tribe, the settlers in the island of Tenochtitlan naturally fell into four divisions representing that number of gens. With the growth of the pueblo these four divisions were sedulously preserved and in time acquired the names of Teopan (place of the god), Aztacalco (house of the heron), Moyotlan (place of the mosquito), and Tlaquechiuhtlan (the place where sleeping-mats are made) or Cuicopopan (the place of the dike), and we shall see the same divisions preserved under Spanish ecclesiastical or parochial names.

In each of these divisions, barrios, wards or quarters, as they may be called, accommodations were supplied for a gens or kin, — huts of reeds and earth at first, to be replaced, as the tribe developed and as need required, by more substantial communal residences. A humble temple to the war-god, Huitzilopochtli, in the centre of the pueblo upon ground belonging in common to the four kins, was among the first structures erected.

In 1338, thirteen years after the settlement of the pueblo, a fifth barrio, or ward, was created by the defection of a portion of the settlers, who, taking possession of a marshy island close at hand in the direction of Tepeyacac, established the pueblo of Tlatelolco.

To obtain a mental picture of the pueblo in its earliest stages it is necessary to understand that the Aztecs owned no land save that which was actually occupied by them, and in that their ownership was communal. Certain lands were allotted to each kin for agricultural purposes, the products of which went into a common store, whence it was distributed, a certain portion being set off for the support of the government (which was a pure democracy, merging, in time, into a military confederacy of the Aztec with neighboring tribes), another portion being devoted to the support of religion, and the remainder was for the consumption of the kin. Such a thing as a feudal tenure of lands was unknown to them, even as monarchy and despotism were unknown, despite the efforts of historians to invest them with all the paraphernalia of a monarchical, and, later, an imperial, government. We have seen that beyond the subsistence derived from the soil, from fishing in the lake and from the hunt, which became insufficient in time for the support of a population which rapidly increased, tribute was levied upon neighboring tribes. This was the chief object of their aggressive wars. We have now to observe, what is more intimately connected with our subject, that when the soil of which the settlers were the owners in common became insufficient, by reason of increased population, for the horticultural demands of the tribe, the construction of what were named "chinampas," and are now known as "floating gardens," began. They were unquestionably artificial garden-beds, whether or not we accept the descriptions of Prescott and the Spanish writers whom he quotes,

¹ Bandelier. "An Archaeological Reconnaissance into Mexico."

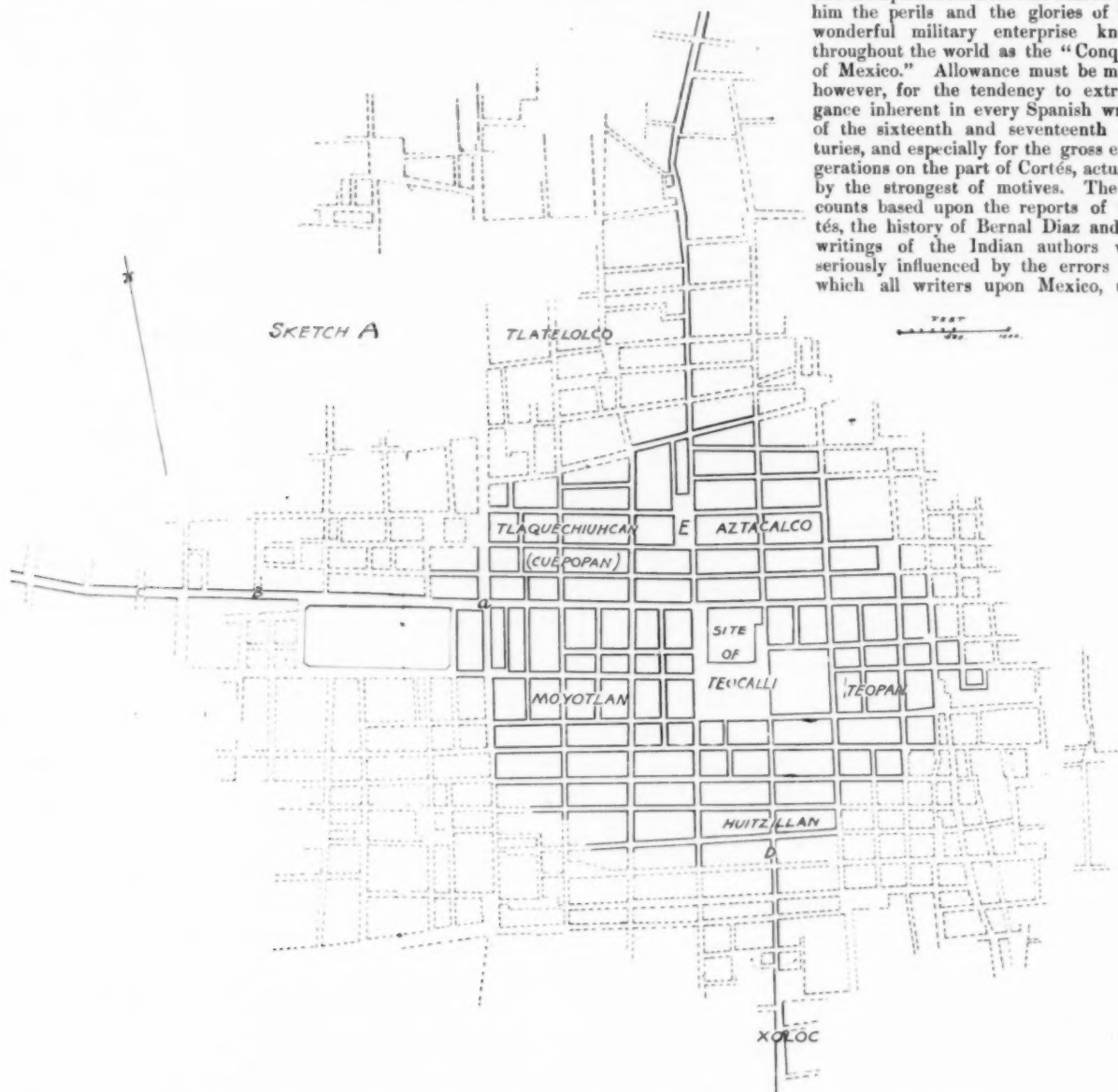
and whether or not we believe the oft-repeated assertion that what are now pointed out as the chinampas at Santa Anita and Ixtacalco once floated upon the waters of the lake, whose borders have receded, until they are now several miles distant.

We have no means of tracing, step by step, the process by which the huts of reeds and earth gave way to more substantial and commodious structures for the accommodation of the occupants of Tenochtitlan and Tlatelolco, their government and their religion. It is said to have been in the time of Acamapichtli (1375-1403), the first of the line of war-chiefs popularly known as the Aztec Kings or Emperors, that the erection of stone buildings began, and the irregular watercourses which intersected the pueblo were straightened into canals. It was about 1486, in the time of the war-chief Ahuitzotl, that the great teocalli in the centre of the pueblo — that which the Europeans found there in 1519 — was completed and dedicated.

whom the Aztecs were tributary until the reign of Izcohuatl (1422-33 A. D.), when they secured their independence."

This inscription exhibits, more than anything else, the deficiency in historical accuracy prevailing in Mexico in the eighteenth century when the modern aqueduct was erected and the inscription set up, for not only were the royal titles and monarchical rule, therein represented, never existent among the Aztecs and their neighbors, but the terminus of the present aqueduct — the fountain of Salto del Agua — is considerably beyond the boundaries of the ancient pueblo. Not improbably, however, the modern aqueduct follows the course of the ancient one so far as it goes, that is a distance of about two miles, but the older watercourse must have been the longer of the two.

The fullest descriptions we have of the appearance of the pueblo are derived, directly or indirectly, from the accounts given by Cortés and the Spanish soldiers who shared with him the perils and the glories of that wonderful military enterprise known throughout the world as the "Conquest of Mexico." Allowance must be made, however, for the tendency to extravagance inherent in every Spanish writer of the sixteenth and seventeenth centuries, and especially for the gross exaggerations on the part of Cortés, actuated by the strongest of motives. The accounts based upon the reports of Cortés, the history of Bernal Diaz and the writings of the Indian authors were seriously influenced by the errors into which all writers upon Mexico, until



A, Mariacala Bridge; B, S. Hipolito Bridge; C, Alvarado's Leap; D, Puente de Jesus; E, Fountain, Plaza Sta. Domingo.

It was at this time also that an aqueduct of stone was constructed from the natural reservoirs in Chapultepec to the pueblo. It is asserted that the chief object of this aqueduct was to refill the lake, whose waters were so low at the time as to endanger the defences of Tenochtitlan, and that the immediate result was an inundation of the pueblo and the opening of a long chapter on the subject of hydrostatics in the history of the Mexican Valley. It is more probable, however, that this aqueduct replaced an earlier structure whereby the terms of a treaty between the Aztecs and the Tecpanecas for securing to the former the water-privileges of Chapultepec were made effective. The aqueduct, now bringing water from Chapultepec to the fountain known as "Salto del Agua," in the southwestern part of the City of Mexico, bears an inscription to the following effect:

"The course of this aqueduct is that of the aqueduct made by the Aztecs in the reign of Chimalpopoca, who was granted the right to the waters of Chapultepec by the king of Atcapotzalco, to

within the last few years, have fallen, regarding the social organization and government of the Aztecs. Their accounts have to be carefully compared with each other and with the known landmarks of the Mexican Valley, and then reconciled with what is now known of the Aztecs and their civilization, before an intelligent idea of the appearance of this island pueblo can be formed.

It becomes necessary, first of all, to locate the site of the pueblo with reference to the city which so many visit in these days, and find, perhaps to their surprise, several miles from the shores of the lake whose waters, in the words of romantic historians, formerly "washed the walls of Tenochtitlan," and upon whose "dull waters," in the words of a more accurate writer, the pueblo rested "like an adobe patch." It has been frequently explained that the waters of Texcoco have receded, largely by the help of earthquakes in the seventeenth century. It is not so generally known, that the recession of the waters has been principally upon the western and southwestern

sides of the lake. In our efforts to determine the extent of the ancient pueblo we are aided by a variety of circumstances, but chiefly by the present street nomenclature of the City of Mexico. In nearly every case the name of a Mexican street is changed with every block, and the names thus given are historically suggestive. The word "puente"—bridge—included in the long musical name of a street, would indicate that the street at one time led to or crossed a bridge. Some of these puentes are known to have been located on the borders of the pueblo and of the early city, its immediate successor. For example, the Calle del Puente de Mariscal (the Street of the Mariscal Bridge) is well identified as the place where the portable bridge of Cortés was—on the eventful night called "Noche Triste"—placed to provide the soldiers the means of crossing from the pueblo to the causeway leading to Tlacopan. The Calle Puente de Jesus has been likewise identified as occupying a similar position with regard to the Acachinanco causeway. Between these two points an irregular line may be drawn on the map of the present City of Mexico, crossing three streets bearing the name "puente," the names of the other streets upon the line being readily traceable to more recent circumstances. From the Puente de Jesus a line may be carried, forming an irregular circle around the main plaza, crossing no less than nine "calles del Puente," and meeting the formerly projected line at its beginning, in the Puente de Mariscal. On the north, the line thus projected roughly coincides with a ditch, still visible in parts, once separating Tenochtitlan from Tlatelolco, which makes it all the more reasonable to suppose that we have correctly defined the extent of the ancient pueblo and its topographical relations to the present city.¹ The extent of Tlatelolco, for a while independent of Tenochtitlan, we have no means of determining.

The accompanying sketch (A) exhibits the thickly settled and compactly built portions of the City of Mexico, with the space occupied by the ancient pueblo distinctly defined thereon, also the relative positions of the barrios and wards. Not unlikely the reader will wonder at the limited area of a pueblo which has been variously reported to have contained from sixty thousand people to sixty thousand families. And this wonder is destined to increase when, upon a further archaeological survey of the pueblo, it is discovered that much of this limited space was occupied by the great teocalli, and the smaller temples distributed through it, as well as by various public buildings, and, according to the descriptions of the Spanish writers, broad streets, canals, gardens and market-places.

The site of the great teocalli has been approximately identified, only, as near the centre of the main plaza of the present city, probably directly south of the great cathedral. All authorities agree that it was a truncated pyramid of three stories or elevations. But no accurate dimensions are furnished, nor can it be told whether, at its base, it was square or oblong. Descriptions of it awaken the suspicion that they are exaggerated, like the accounts of the court-life, imperial splendor and advanced civilization of the Aztecs. Nor are anything like accurate dimensions furnished of the coatapantli, or serpent-wall, enclosing the teocalli and its appurtenant buildings. The fact that it is within the space now occupied by the main plaza and the Cathedral, that all the archaeological remains now preserved in the National Museum in the City of Mexico as sculptures of the Aztec period and as portions of the teocalli or coatapantli were discovered and exhumed,² naturally leads to the presumption that the coatapantli enclosed no more than that space. There are allegations, however, that it enclosed a larger area. Some of these allegations may be here adduced to illustrate the difficulties in the way of an accurate identification of so notable a structure in the ancient pueblo as the teocalli:

1. Fray Diego Duran states that one of the lodges of the idols stood where, in his time, the archiepiscopal palace was erected. This would include within the coatapantli the block directly east of the Cathedral, bounded by Calles Seminario, Arzobispado, Cerrada Sta. Teresa and Sta. Teresa, or, more likely, on the east by Calle Indio Triste.

2. Ramirez ("Notas y Esclarecimientos," p. 103), basing his observations upon manuscripts he had consulted and investigations he had made, was inclined to believe that the "temple" (he must surely have referred to the serpent-wall which surrounded the teocalli) extended from the corner of Calles Plateros and Empedradillo to Calle Cordobanes, and from thence east to Calle Seminario, which would include the Cathedral block and the block north of it.

3. Prescott, in a note to his latest edition, describes a street, called, in "the period immediately following the Conquest, the Calle de Ixtapalapan," as identical in the ancient pueblo with a broad straight avenue from the causeway of Acachinanco to that leading to Tepeyacac, but intercepted in its course by the great temple. The street still exists, and bears various names in its several blocks,—Seminario and Reloj immediately north of the plaza, Jesus, Flamencos and others south of the plaza. It has to deflect towards the west about eleven blocks north of the Cathedral in order to enter the

present road to Guadalupe, which is declared to be the ancient causeway to Tepeyacac. This would place the teocalli east of the Cathedral and favor the extension of the coatapantli to Calle del Indio Triste.

4. It is again and again reiterated by the early Spanish writers that the streets leading to the causeways were straight and broad and ran out from each of the four sides of the temple and coatapantli; in other words, that the teocalli and serpent-wall were concentric, and that their common centre would have been the meeting-point of Calles Escalerillas, Reloj, Sta. Teresa and Seminario. This could be reconciled with the northerly boundary given by Ramirez (II), but not with his southerly or easterly boundaries, the latter of which would have to be removed a long block farther east.

5. The site of the National Palace is that of the building known as "Montezuma's new house" or palace,—that in which the war-chief, Montezuma II, was taken prisoner by Cortés. The Volador market occupies ground within the domains of the "new house" once devoted to the Aztec game of pelote. It was a marshy and waste ground long after the Conquest. If this "new house" were, as may reasonably be supposed, not a palace (for, there being no royal personage in Tenochtitlan, there were, of consequence, no palaces) but a "tecpan," or house for the transaction of tribal business, including storehouse, etc., and hence upon ground held by all the kins in common, we might expect to find it within the coatapantli. This would add no less than three large modern blocks east and southeast of the main plaza to the coatapantli enclosure; and, to render it symmetrical, a corresponding area on the south.

6. The so-called "palace" of Axayacatl, where the Spanish troops were lodged, upon their entering the pueblo in 1519, as the guests of the Aztecs, is declared to have occupied the site now known as the corner of Calles Sta. Teresa and Indio Triste, and to have faced the eastern (Prescott erroneously calls it the western) gate of the coatapantli. But it is impossible to reconcile this with any of the other statements without subdividing existing blocks which, it is claimed, have maintained their integrity from the time of the ancient pueblo.

7. The church and monastery of San Francisco were built upon lands said to have been the garden and wild-beast-house of the "Kings" of Tenochtitlan. From all that we can learn of the social life and conditions of the Aztecs of Tenochtitlan, such a house could have been but a place for the storage of animals secured by way of tribute from surrounding tribes, and would properly have belonged within the limits of the communal tribal property. Such a disposition of it would have extended the borders of the teocalli square (assuming that the teocalli square comprised all the communal lands of the tribe) so far towards the limits of the pueblo as to leave only a small portion of the barrio of Moyotlan for residence purposes.

The subjoined sketch (B) will render some aid in exhibiting the difficulties surrounding the identification of the most prominent site in Tenochtitlan notwithstanding the frequency with which it is referred to by the early and later Spanish writers and the apparent explicitness with which they describe it.



A, Archiepiscopal Palace; B, Cathedral; C, Main Plaza; D, National Palace; E, Volador Market; F, S. Francisco Church and Monastery; G, Mariscal Bridge; H, Acachinanco Causeway; I, Calle Seminario; J, Calle Cerrada Sta. Teresa; K, Calle Sta. Teresa; L, Calle Indio Triste; M, Calle Arzobispado; N, Calle Plateros; O, Calle Empedradillo; P, Calle Cordobanes; Q, Calle Reloj; R, Calle Flamencos; S, Calle Jesus; T, Calle Escalerillas.

Difficulties arise, likewise, in the identification of the ancient causeways. It is generally said that the present street of Tacuba with its continuation under various names (it bears the general name of Avenida de los Hombres Ilustres, though each block has a separate name) follows the course of the causeway to Tlacopan (Tacuba); and the place where Cortés located his portable bridge on the famous Noche Triste, the night of his retreat (Puente de Mariscal),—the place where, in default of another portable bridge, he was surrounded and a terrible slaughter ensued (San Hipolito), and the place of Alvarado's

Leap (el Salto de Alvarado), are all identified and, without doubt, accurately. But why should the Aztecs have deviated from a straight course in the construction of this causeway?—as they must have done if the present street follows the same course; or as they must have done in any case to reach the pueblo of Tlacopan, if its site be preserved in the modern Tacuba. A similar query is suggested by an examination of the alleged course of the causeway to Tepeyacac. If it be, as heretofore mentioned, at present

¹ Mr. Adolf F. Bandelier, in "An Archaeological Reconnaissance into Mexico," pp. 49 and 50, arrives at about the same conclusion regarding the extent of the pueblo of Tenochtitlan, but without reference to the street nomenclature. He calls the space occupied by the pueblo, "at the time of the Conquest, scarcely more than one-fourth of the area now covered by the city," and concludes that the present cathedral occupies the geographical centre of this space. He cites, furthermore, a large oil-painting, alleged to have been made by Juan Asensio in 1523, two years after the Conquest, which confirms these dimensions.

² These sculptures consist of enormous serpents' heads, and the so-called "Calendar Stone," "Sacrificial Stone" and statue of "Teoyamiqui," or "god of death and war."

followed by the continuation of the Calle del Seminario (seven blocks of which bear the name of Reloj), it deflected first to the west and then to the east. If it be the continuation of the Empedradillo, there are likewise deflections from the right course. What we have already seen of the development of the pueblo and what little we know of its architecture are opposed to the probability of there having been any streets within Tenochtitlan laid out with precision and crossing each other at right angles, as has been frequently alleged. But no reason appears for the construction of a causeway in any other than a direct line across a body of water.

The causeway of Acachinanco is most frequently and most explicitly described. It undoubtedly entered the pueblo at or near the spot called Huitzillan, now marked by a tablet in the walls of the Hospital de Jesus, at the corner of the Calles de Jesus and Paja, and proceeded directly to the coatapantli in the course now followed by the Calles del Puente de Jesus, Hospital de Jesus, 1^a de Jesus, Porta Coeli and los Flamencos. About six cuadrados (squares of unequal dimensions) south of the Puente de Jesus are the puente and chapel of San Antonio Abad, marking the ancient site of Xoloc, where the causeway forked, one branch going to Ixtapalapan, the other to Coyoacan. No road now follows the course of the causeway leading to Ixtapalapan, if the same were a direct line from Xoloc, nor does any go directly to Coyoacan from that point. The streets above named pass out of the modern city in a line nearly direct to Churubusco, where a branch road, by no means straight, leads to Coyoacan. The modern road to Ixtapalapan branches off a mile or so above.

A glance at the accompanying sketch (C), founded upon a topographical survey of the Mexican Valley made in 1885, will enable the reader to see the relation of these various localities to the ancient



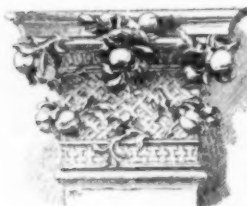
pueblo, and to note the extent to which the waters of Lake Texcoco have receded since the sixteenth century. It will likewise be seen how utterly impossible it would have been for a causeway constructed in a direct line from Ixtapalapan to Tepeyacac to have crossed the ancient pueblo, as the causeway of Acachinanco is repeatedly alleged to have done.

Neither the exact position of Tlatelolco with reference to Tenochtitlan, nor its extent, can be accurately determined. That it had access to the main-land by means of the northerly causeway may be assumed. In 1473, the right of separate tribal government was taken from Tlatelolco by the warriors of Tenochtitlan because of its efforts to merge the government of the latter pueblo into that of its own and become the dominant pueblo. It was the last portion of the double pueblo to hold out against the Spanish Conquerors.

ARTHUR HOWARD NOLL.

(To be continued.)

COMPUTING THE EXTERNAL OR "EXPOSURE" FIRE-RISK.



From the Musée de Lille, France.
From *La Construction Moderne*.

IN your recent issues you have placed before your readers the scheme of the so-called "Universal Mercantile Schedule" for computation of what might be termed a scientific insurance-rate for fire-risks of mercantile or semi-mercantile occupancy. A rate so adjusted is intended to be something approaching a true measure of the risk, considering its liability to fire originating on its own premises, or from some general external fire.

A similar schedule (not yet officially promulgated) aims to compute the external risk from buildings directly surrounding the one considered, or what is termed the "exposure."

The sum of the two makes the final rate. The adoption of this plan, which seems highly probable, is, of course, of prime interest to

insurance-men, as a correction of grave evils in their business, specially known to them. But it is, as you have intimated editorially, of scarcely less interest to architects, builders and owners of real-estate, inasmuch as, should it become an established code, it will influence to an important degree the building construction of the future. It is also of peculiar interest to the public of Boston at this time as indicating what remedy, if any, underwriters propose to apply to the conflagration danger, by the use of the only agency in their power, viz, rate-discrimination. Having lately been appointed by the Boston Board of Fire Underwriters to estimate the rates which would apply to the various risks in the mercantile section of their city, should the schedule be adopted, I am able to exhibit some comparative illustrations of its working as applied to a few leading and commonly-met types of construction, and these may be of interest.

Suppose a mercantile building to be proposed in Boston, to cover an area of fifty feet by one hundred feet, five stories high, of brick, fronting on a fifty-foot street, with buildings of similar occupancy and size opposite, adjoining by party-walls on either side and twenty feet distant across an alley in the rear (the "exposure" so described entailing a charge of, say, eight cents on the building and twelve cents on its contents). The building is to be occupied by a single tenant, wholesale boot-and-shoe stock. Assume the existing conditions which would go to make-up the "key-rate" for Boston, considering, among other elements, the trolley-system and the prevalence of narrow streets, except that the fire-department will be assumed as free from politics, and, for the purposes of the illustration, the previous fire-record of the city to entail no charge. The "key-rate" will, then, be twenty-eight cents.

In the proposed building, assume as fixed elements the following, conforming to the specifications for "standard building" of the Schedule, viz: elevators and stairways to be inclosed in fire-resisting walls, with standard fire-doors to all openings; no well-holes, and any pipe channels or similar vertical passages to be properly stopped at each floor; skylight, if any, to be of heavy glass on metal frames; flues to have eight inches thickness to walls, and properly lined, and floor timbers trimmed away; boiler, if any, in fireproof room; side-walls carried up to make four-foot parapets above roof; no openings whatever in side-walls; metal-covered roof and metal or brick cornice; heating by steam with pipes clear of wood; lighting by gas with safely arranged brackets and by electricity in accordance with underwriter's rules. Any hollow partitions and wall-furring to have proper fire-stops at each floor.

Now assume the following elements to vary from the "standard": Walls, instead of the heavy type of the "standard," to be of the lighter style prescribed by the present building-laws of Boston; columns of iron instead of wood, if desired, and not necessarily protected except in basement, but to have adequate sustaining power and to have approved caps; beams to be self-releasing. Only the rear windows to be protected by standard fire-shutters, but the front to have not more than say 50% of glass, except to the grade-floor. As interior fire-appliances, a dozen pails of water each floor. No telegraph-wires in front of building. Insurance to be kept up to 80% of value. Now, let other elements of construction vary.

First Case. The building described, but with floors of the "usual mill type," two-and-one-half inches of plank with hard-wood splines, covered with a seven-eighths-inch finish floor, with waterproof paper between. Floor timbers to be of reasonably massive type, with wide bays. No plaster or other finish on beams or ceilings, though walls may be plastered, but without hollow spaces.

Second Case. The same building, but with ceilings, close sheathed with metal or plaster on wire-lath, laid to follow the contour of beams and plank so as to leave no hollow spaces, proper precautions being taken to prevent dry-rot. Mortar or similar layer between rough and finish floors. Scuppers in side-walls and proper incline to floors to drain water. Columns, if of iron, to be properly encased in fire-resisting material. Partitions, if any, to be of incombustible material. In fine, what may be termed the "protected mill type."

Third Case. The same building as originally described, but having instead of heavy beams ordinary joints, not thinner, however, than three inches, but spaced as customary and with ordinary double floor of one-inch boards and no lining. No ceilings and a very few partitions, which should be of at least two-inch plank tongued-and-grooved and not varnished. Iron columns may be left bare (except in basement). In short what may be termed "joisted construction, open finish."

Fourth Case. The same as Case 3, but with ceilings, walls and partitions of ordinary lath and plaster: what may be termed "joisted construction, hollow lath and plaster finish."

Fifth Case. The same as (4) but with thin board ceilings, side-wall finish and partition: what we may call "joisted construction, hollow wooden finish."

Sixth Case. The same as last (5), but with wire instead of wooden lath, though still on wooden studs: what we may call "joisted construction, ordinary protective finish."

Seventh Case. The same as (6), but with metallic studs instead of wooden studs, and with waterproof floor-lining: what may be termed "joisted construction with superior protective finish."

Eighth Case. The building originally described but of modern fire-resisting construction, so-called "fireproof," with all structural metal securely encased in proper thickness of refractory material; walls, however, to be, as before, self-supporting and columns to be

cast-iron. Rear to be shuttered as before. No excess of glass in front above grade floor. Ceilings and side-walls not to be finished with wood except wainscot. Building may be eight stories instead of five without addition to rate, provided no merchandise be stored above seventh floor.

Ninth Case. The same as Case 8, but of "skeleton" type, the side-walls, however, being self-sustaining party-walls, though the front and rear may be sustained partly or in whole by the frame, columns of riveted wrought-iron or steel, provided structure is of adequate strength and stability, and all structural metal is absolutely and securely encased in a proper thickness of refractory material. Assume three stories to have ornate stone front with excess of glass over 70%.

Tenth Case. But such building would probably be eight stories high, in which case a considerable departure would be probably made from the "standard" in the construction of the side-walls.

The rate computed for each of the types described is

Case (8), "Fireproof"	Rate per \$100.	
	Building.	Stock.
(8), "Fireproof".....	8 cts.	44 cts.
(9), "Fireproof" skeleton type, 5 story.....	11 "	50 "
(10), "Fireproof" skeleton type, 8 story.....	15 "	62 "
(1), "Protected mill type".....	24 "	54 "
(7), Joisted const. with superior protective finish.....	25 "	56 "
(1), Usual mill type (unprotected).....	27 "	58 "
(6), Joisted const. ordinary protective finish.....	28 "	59 "
(3), Joisted const. open finish.....	29 "	60 "
(4), Joisted const. hollow lath-and-plaster finish.....	29 "	60 "
(5), Joisted const. hollow wooden finish.....	47 "	78 "

Most of the current types will be recognized among the above. The owner may indulge himself in the luxury of an open stairway by paying an addition to his rate of about six cents net. By the introduction of extraordinary fire-apparatus, like automatic fire-alarms or automatic-sprinklers, he may get a more or less liberal reduction.

It may excite surprise that the type (1) which has practically the floor-construction described in the "standard" should be halfway down the list. This fact indicates that in the estimation of the underwriter the more important precepts of "slow-burning construction," such as effective vertical subdivision, having been observed, the actual floor-construction should figure to a minor degree in determining the rank of the risk. The identity of the charges for 3 and 4 indicate the fact that the relative merits of the two are matters of dispute even among fire-chiefs, insurance-experts and others.

Then also the "mill type," pure and simple, as it prevails among the mills and warehouses of New England was offered by the underwriters, not as an "ideal," but as a "standard" approved by high sanction and from which departure could be made either way.

The "protected mill type" is rarely met with in practice, except in the picker-rooms of cotton-mills, even the cotton-storage warehouses of the highest class, erected under the direction of the mill-engineers, having unprotected plank ceilings. Yet the underwriters appear, judging from the small allowance in rate, to doubt whether for city blocks such floors are much better for combustible merchandise than ordinary floors, whatever the experience of the mill-engineers may have been with their isolated risks.

But slight change would be necessary to adapt the table given to the circumstances of New York or Chicago or St. Louis. The charge for wall deficiencies has excited some criticism. A five-story building with party-walls in accordance with the new Boston building-law will cost the owner about two cents net more on his rate than if he should build it according to the standard of the Schedule. This is no reflection on the Boston law, but merely means that the underwriters could afford to allow two cents on his rate to any man who might choose to make a wall so much better than the law allows that it would probably stand intact even after the buildings at each side should be burned down.

An interesting and pertinent question is, How would such a building as the "Partridge" Building, which caused the great fire of last month, fare under the new Schedule? This building, owned by Mrs. Ames, would have paid, under the Schedule, a rate of

Building, 135,
Contents, 175,

the latter being taken for an average mercantile tenant on, say, the fourth floor. Of the above rates thirty cents and forty cents respectively are figured for "exposure." [This building actually paid about one-fourth the rates named.] The building was six stories and basement, brick, with 28,000 square feet of area, divided by a fire-wall through the middle, with openings at each floor furnished with standard fire-doors. All four sides faced on streets or alleys, with immense window-openings and no shutters. All elevators and stairways were in brick shafts with fire-doors. There were no well-holes nor courts. Floors were of plank, over three inches aggregate thickness, on heavy beams, with wide bays. Columns were heavy cast-iron, protected in the basement only. No ceilings except in first and second stories, which had close-laid, varnished wooden ceilings and side finish. There were numerous varnished thin board partitions, especially on second floor. There were eleven mercantile tenants with heavy stocks of goods. One tenant only did any manufacturing and that of a light non-hazardous character, without power.

The various plans which might be proposed for rebuilding this structure may now be compared:

1. Rebuilt as before with but one dividing wall and that full of openings, and with floors of mill type, but omitting the varnished wood finish,

Rate on building, 128 cents
Average tenant, 144 cents.

2. As in last case, but with, in addition, an approved equipment of automatic-sprinklers,

Building, 105 cents
Tenant, 166 cents.

3. If as Case 1, but subdivided into four sections by fire-walls with-out openings and rising to four feet above roof,

Building, 60 cents
Tenant, 110 cents.

4. If as in last case, but in addition a complete protective finish of close-laid wire-lath and plaster, protected columns, waterproof floor-lining, scuppers in wall and shutters to windows on streets or alleys less than fifty feet wide,

Building, 50 cents
Tenant, 97 cents.

5. If of "fireproof" construction, skeleton type, but with one division-wall, agreement to insure up to 80% of value,

Building, 20 cents
Tenant, 95 cents.

6. As in last case, but carried up to eight stories, and used on all floors for mercantile purposes,

Building, 25 cents
Tenant, 110 cents.

For comparison take the extreme cases. Suppose the building as originally, costing, say, \$375,000 with contents worth \$1,000,000 (not far from the actual case), and suppose it rebuilt six stories high of "fireproof" type (Case 5), at a cost of \$700,000. Insurance at 80% of value in each case will be, then

	Building.		Contents.	
Original type at	\$1.35	\$4,050	at \$1.75	\$14,000
Fireproof type at	.20	880	at .95	7,600
Annual saving on insurance		\$3,170		\$6,400

Difference in cost = \$175,000 at 5% = \$8,750. This it is seen is more than covered by the saving on insurance, it being assumed that the owner can get most of the saving to tenants in increased rentals. Especially as in the old building, there was extreme difficulty in getting enough insurance, and such would not be the case in the new building. The owner would, however, probably adopt the skeleton plan and build eight stories. A short calculation will show that here again there will be a gain. Or, he may prefer some one of the other improved methods of construction described, at a smaller increase of first cost, interest on which will, however, be found to be covered by saving in insurance. It is plain, therefore, that the "Universal Schedule" would be a practical agency of great power for improving the dangerous district of Boston.

S. A. REED.



ENGINEERS' CLUB OF PHILADELPHIA.

At the regular meeting, April 1, 1893, the secretary read a paper by Mr. Pierre Giron, on "The Various Systems of Burning Portland Cement."

The author described in detail first, the ordinary dome kiln; second, the kiln with dryer and pre-heater, called the "Johnson kiln"; third, the Hoffman kiln; fourth, the Dietzsch kiln; and fifth, the rotary kiln; giving the distinctive features of each apparatus, and its method of operation, with the comparative qualities of the product, and concluding with a *résumé*, in which the possibilities in favor of the rotary kiln were emphasized at some length.

It can now be "successfully operated only in localities where crude oil is abundant and cheap, and it would seem that in the United States at least this kiln might become very extensively used. There remains the possibility of replacing crude oil by producer-gas, and when this has been successfully accomplished there will be no obstacle to the adoption of this admirable form of kiln in the cement districts of Europe."

DISCUSSION.

Mr. R. W. Lesley. — The two main points to be considered in the production of cement are, in my opinion, first, the quality of the product, and, second, the cost of producing it.

While the cement industry is becoming an important one in this country, the longer experience of other nations should not be disregarded. Portland-cement history began in England, the principal factories being located on the Thames. It then spread to Germany and Belgium, and various improvements were made in these countries in the form of kilns, several of the changes being made to avoid the patents covering the Hoffman kiln. In Europe, rotary kilns have not been successful, and I have in my hand Carey's paper on "Portland Cement," recently read before the English Institute of Civil Engineers, which gives the facts as to the throwing-out of the rotary

kilns in England, in the Gibbs and the Arlesly works. From my information, it would appear that this form of kiln was abandoned, not only on account of mechanical defects, but because of the poor quality of the product. The use of rotary kilns in this country for cement-making was begun under the patent of Matte, which was based upon driving granulated cement rock, passed through crushers only, to incipient vitrefaction in rotary kilns. This process was tried on the Hudson and, subsequently, on the Lehigh, and proved a failure. According to our experience, judged by the product, the particles of cement in going through a rotary kiln are not uniformly burned, and in every case where briquettes of the cement so made have been kept, we have found them to disintegrate and dust away at periods of one year and over. For this reason, I do not believe in the permanence of cement made in rotary kilns.

With regard to expense, taking the figures of the paper just read, the coke to burn a ton of cement would cost \$1.20, while by the new process, taking the same figures, the oil would cost about \$1.80 for the same amount; as against this 60 cents difference is to be set the labor of making the raw material in bricks, — an inexpensive item. The product of the kilns by the old process is porous and comparatively easy to grind, while, according to the paper read, the clinker by the new method is harder and more expensive to grind, this being due to the fact that the raw material as it goes to the kiln must be very high in lime, a fact which contributes to the disintegration of the cement at long periods. Therefore, as already stated, I am satisfied that, as to quality, the new process is not as good as the old, and I think it is yet to be proved that it is more economical.

Mr. Thomas D. Whitaker. — The oil would cost us only \$1.32 per ton of cement for the rotary kiln. The material is very small at the beginning of the burning, but rolling through the kiln makes it into lumps, which gradually increase in size, and are very uniformly burned. The small quantity of fine powder which comes out with these lumps is rejected. With the bricks the burning is done from the outside, which necessarily causes it to be burned harder than the inside.

Mr. Lesley. — Perhaps Mr. Whitaker can tell us how this cement lasts.

Mr. Whitaker. — I have only had an opportunity of testing it up to nine months and there is a steady increase in its quality.

With regard to power, we only use a five-horse-power Westinghouse engine to run one complete kiln.

Mr. Lesley. — Referring to Mr. Whitaker's remark, that he can clinker small lumps of his rock in a revolving cylinder and make a cement, I would say that there is no doubt that a great deal of the rock in the Lehigh region will make Portland cement if burned to a clinker just as it is taken out of the quarry, but it is a dangerous thing to do. It is out of such material as this that the cheap Belgian (natural Portland) cements are made, and this accounts for the lack of uniformity in them. The rocks in the Lehigh region are laminated and, possibly, nine times out of ten would make Portland cement when clinkered, the failures being due to the fact of the mechanical separation of the chemical ingredients in the laminae of the rock. With this possibility of failure, no manufacturer dare trust to using the rock in its natural condition, but must grind it into powder, and make out of it bricks or blocks, where all of the materials thitherto divided in the laminae will be mechanically rearranged and brought into close mechanical union in the "new rock," represented by the brick or blocks, and will thus be in a proper condition for the chemical change that goes on in the kiln.

Mr. Wm. G. Hartranft. — I would like to call your attention to the Shofer kiln for burning cement, which Mr. Giron has not described. It is a kiln that has recently been commanding the attention of the manufacturers of Portland cement on the continent of Europe. Mr. Chas. M. Saeger, general manager of the Saylor's Portland Cement Works, in company with myself, had the pleasure of thoroughly examining the clinker at the Aalborg Cement Works in Demark, where there were eight of these kilns in operation at the time of our visit. The clinker from these kilns was superior to that which we saw taken from the Hoffman or the Dietzsch kilns in the German mills; in fact, the clinker from these two last-named kilns was not as uniform in many cases as that produced by the ordinary dome-kiln used in this country. The Shofer kiln is somewhat similar to the Dietzsch kiln, it being of the continuous vertical type, the main difference being in the mode of firing. In the Shofer kiln the coal is fed into twelve cylinders, which encircle the kiln and lead to the crucible, it working on the principle of a self-feeding stove; i. e., when the clinker is drawn from the bottom the coal feeds down of its own accord, along with the cement bricks, which are dumped in through an opening farther up in the kiln, and are partly calcined before they reach the fire, as in the Dietzsch kiln. It is claimed by the parties using this kiln that there is a saving of both labor and fuel over the Dietzsch process. Referring to the president's remarks about the increase in the consumption of cement in this country, there seems to be still a very large field in this direction. While we were in Sweden, we examined large works which turned out girders, building-stone and all sorts of ornamental trimmings in cement, and we were informed by some engineers in Copenhagen that this ornamental work in cement cost 50 per cent less than in clay such as our terra-cotta ware. In Denmark and Sweden they use a much larger percentage of sand in cement than is customary in America. This is done by grinding a portion of the cement and sand together until it is very fine (the process is patented

in this country, I understand). Experiments have been made with 74 sand to 1 cement, but the average work was about 1 to 11.

Mr. James Christie. — What was the character of the lime that was used in past centuries?

Mr. Lesley. — The Romans, I believe, used a fat limestone and pozzolana, the volcanic product of Vesuvius, soaked in vats, this forming a mechanical mixture, which in time became chemically combined, the lime acting on the silicate in the pozzolana. The builder of the Eddystone Lighthouse was the first to find a natural hydraulic limestone with from 75 to 80 per cent of lime and the balance of insoluble residue (silica, alumina, etc.) that would answer his purpose and set well under water. The main distinction between a natural and an artificial cement is that the former consists in taking a natural cement rock, calcining it at low temperature in an open kiln, drawing the calcined product, and grinding the same into powder; while the latter consists in taking chalk and clay, or marl and clay, or argillaceous limestone, or limestone and clay, and mixing the same together in such proportions as to produce uniform chemical analysis. This raw product is moulded into bricks, blocks or other forms, making a new rock, containing the chemical ingredients finely ground and in close mechanical combination in the best form to be acted upon by the higher temperatures of a closed kiln, where a chemical process goes on that makes all the chemical ingredients active. This clinkered product is ground into powder and is the Portland cement of commerce. In a natural cement the low heat leaves a certain amount of the material inactive, while in the Portland cement, where the materials have been accurately proportioned, all the elements should be active.

Mr. Geo. S. Webster. — The cement that was used in the piers of the old Market Street bridge came from Holland, and was found in a splendid state of preservation when it had to be destroyed to make way for the new structure.

Mr. Lesley. — One of the large cities of Europe has a conduit 72 inches in diameter made of cement, with 1-roads of steel run lengthwise and others wound around them, forming a skeleton, over which the cement was cast.

The best test-results that I know of for Portland-cement mortar mixed 2 to 1, after four years, gave 600 to 700 pounds tensile strength per square inch. This was on the Sodom dam of the New York Aqueduct. In the Niagara Tunnel, Portland cement proved cheaper than natural cement, and the mortar made from it was harder than the bricks after seven months' setting.

The secretary announced that Mr. Giron had alluded to a second paper, on "The Grinding of Portland Cement," which would probably be presented at the next meeting.

AMERICAN INSTITUTE OF ARCHITECTS.

A MEETING of the Executive Committee was held in the rooms of the New York Chapter, Welles Building, 18 Broadway, on the afternoon of the 10th of April. Present, President Edward H. Kendall, Treasurer Samuel A. Treat, Messrs. Geo. B. Ferry, W. W. Clay and Secretary Alfred Stone.

As a result of the letter-ballot, the following persons were found to be elected Fellows of the A. I. A.:

John C. Worthington, Philadelphia, Pa.; D. Fred. Charlton, Marquette, Mich.; Samuel S. Godley, Cincinnati, O.; H. H. Bickford, Elmira, N. Y.; J. Walter Stevens, St. Paul, Minn.; Wilson Eyre, Jr., Philadelphia, Pa.; J. C. Hornblower, Washington, D. C.

The President and Secretary were directed to send a communication to the Secretary of the Treasury in regard to the operations of the Bill in relation to procuring designs for public buildings, and, from the reports of those who have interviewed the Secretary, it is believed that the provisions of the Bill will be carried out in such a manner as to insure a fair trial of its value.

Plans were discussed for the next annual convention, which will be held in Chicago, in conjunction with the International Congress of Architects, in the week beginning July 31st., 1893, and the Secretary was directed to issue a circular of information as soon as he could learn more in regard to the International Congress of Architects.

ALFRED STONE, Secretary, A. I. A.

THE MUNICIPAL ART SOCIETY.

THE first annual meeting of the Municipal Art Society was held April 24, at the rooms of the Architectural League in West Fifty-seventh Street. About seventy-five members were present, and a permanent organization was effected by the election of the following officers for the ensuing year:

President, Richard M. Hunt; Vice-President, William A. Coffin; Second Vice-President, W. S. V. Allen; Secretary, Edward Hamilton Bell; Treasurer, Cyrus J. Lawrence; Counsel, James H. Wood.

The following Executive Committee was chosen: Artists, Edwin H. Blashfield for three years, Will H. Low for two years, George W. Maynard for one year. Architects, Edward H. Kendall for three years, W. B. Bigelow for two years, J. H. Hardenburgh for one year. Sculptors, Augustus St. Gaudens for three years, J. Q. A. Ward for two years, Olin L. Warner for one year. Laymen, August Belmont for three years, J. Armstrong Chanler for two years, W. T. Evans for one year. The mayor of the city is an *ex-officio* member of the committee. It was decided by resolution that

the works of art be selected by competition, which shall be open to both sexes and governed by the rules adopted for the decoration of public buildings in Paris. The Executive Committee is to have entire control over all plans, and is empowered to buy existing works of art if it sees fit. The first prize will be the commission to execute the proposed work, the second and third being money awards.

A special committee of the Society will visit the municipal authorities to inform them of the purposes of the Society and to invite their coöperation. A committee has also been appointed to make arrangements for a public meeting to enlist general interest in the Society's work.



[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

THE SCARBORO' MANSIONS, W. 57TH STREET, NEW YORK, N. Y.
MR. A. J. HORGAN, ARCHITECT, NEW YORK, N. Y.

[Granochrome, issued with the Imperial and International Editions only.]

THIS building, which is owned by Messrs. Horgan & Slatery, was recently finished, at a cost of \$175,000, the work being done "by the day." The brickwork is of light-pink brick, made to special order by Messrs. Burns & Russell, of Baltimore. The first story is trimmed with light Indiana limestone, and the rest of the building with white terra-cotta, furnished by the N. Y. Architectural Terra-cotta Co.

BANKING AND OFFICE BUILDING OF THE FRANKLIN TRUST CO.,
MONTAGUE AND CLINTON STREETS, BROOKLYN, N. Y. MR.
GEORGE L. MORSE, ARCHITECT, BROOKLYN, N. Y.

The building is thoroughly fireproof throughout and is sumptuously finished. The material of the exterior is Jonesboro granite (for the basement), Indiana limestone, white flashed Perth Amboy brick and terra-cotta. Cost \$300,000.

FIRST REFORMED CHURCH, SEVENTH AVENUE, BROOKLYN, N. Y.
MR. GEORGE L. MORSE, ARCHITECT, BROOKLYN, N. Y.

The material of the exterior, including the window-tracery and spire, is Indiana limestone. The spire is 212 feet in height. The main front is 100 feet and the depth 168 feet. Cost \$225,000.

COMPETITIVE DESIGN FOR THE CITY-HALL, JERSEY CITY, N. J.
MESSRS. DETWILLER & MELENDY, NEW YORK, N. Y., AND
HUGH ROBERTS, JERSEY CITY, N. J., ASSOCIATED ARCHITECTS.

To this design was awarded the second place in the competition held last winter.

PLANS OF THE SAME.

STORE BUILDING FOR MISS KATE O'MEARA, WORCESTER, MASS.
MESSRS. EARLE & FISHER, ARCHITECTS, WORCESTER, MASS.

[Additional Illustrations in the International Edition.]

DOORWAY OF THE CHÂTEAU DE MOUCHY, FRANCE. RESTORED
BY M. DESTAILLEUR, ARCHITECT.

This plate is copied from *La Semaine des Constructeurs*.

"THE TRIUMPHAL PROCESSION OF AURORA," A CEILING DECORATION, BY HENDRIK SIEMIRADZKI.

HENDRIK SIEMIRADZKI was born in Russia of Polish parents, in 1843, and studied at the Academy of Fine Arts in St. Petersburg, and under Piloty at Munich. His great picture, entitled "The Living Torches of Nero," has gained him an international renown, having been exhibited in all the capitals of Europe. Less famous than this work, but deserving of special mention, are the artist's "Cremation of a Russian Captain in the Tenth Century," now in the Moscow Museum; "Phryne," and "The Sword Dance." In the Church of the Saviour, in Moscow, are seven enormous decorative paintings by Siemiradzki, and his "Ascension of Christ" is in a church in Warsaw. For a number of years he has lived in Rome, laden with the honors and medals everywhere bestowed upon him, and his genius and industry have doubtless been well rewarded pecuniarily also, as one may judge from the fact that there he has built himself a handsome house and studio, of which a cut may be found in the *American Architect* for January 30, 1892 (page 67).

This plate is copied from *Meisterwerke der Holzschneidekunst*.

"ANTOINETTE VAN ROSEMAIL AND THE EARLY FLEMISH REFORMERS." FROM THE PAINTING BY A. HENNELICQ.

OWING to the position of the Spanish Government, the power of the Inquisition in the Low Countries was intolerable, and was enough to urge the people into opposition against any system of which it was an agency. As a consequence, not only burghers but women were driven to take part in an agitation for a reform of the church. The Flemings still remember the influence of Antoinette van Rosemail, who was able to persuade not only monks, but scholars and men of science to coöperate with her, and there is no doubt her efforts had much to do with freeing the country from a foreign yoke.

IMPNEY, DROITWICH, ENG.

A VIEW IN BASLE. DRAWN BY SAMUEL PROUT.

INTERIOR OF THE CHURCH OF SAN FRANCESCO, RIMINI, ITALY.

DETAILS OF THE SAME.

CHURCH OF ST. PETER, ABBEYDALE, SHEFFIELD, ENG. MR.
JOSEPH NORTON, ARCHITECT, SHEFFIELD, ENG.

THIS church is designed to accommodate 750 persons, at a cost of 6,000*l.*, without the tower and spire, and will occupy a striking position on the southwest side of the city. The ground falls rapidly from west to east, and advantage has been taken of this feature to provide a large parish-room, in addition to the minister's, and choir vestries under the east end. The church consists on the ground-floor of a nave ninety-one feet long and twenty-six feet wide, north and south aisles, with outer and inner porches at west end of each aisle, the baptistery being in a projecting bay between them, chancel forty feet long, with morning chapel twenty-five feet by fifteen feet on the north, and organ chamber of similar dimensions on the south side. The height from floor to ridge will be fifty-five feet, and the whole of the roofs will have an inner curved ceiling of pitch-pine, that to chancel being groined. The floors under the seats are to be boarded, and the passages are to be of cement concrete very finely surfaced. Local stone will be used for walling and dressings, Monks Park Bath stone for nave, arcade and chancel-arches and green Westmoreland slates as roof-covering. The perspective, from which this plate copied from *The Builder* is taken, has been drawn since the competition was decided.

THE NEW GENERAL HOSPITAL, BIRMINGHAM, ENG. MR. W. HENMAN, A. R. I. B. A., ARCHITECT, BIRMINGHAM, ENG.

It is now some twelve months since the competition for this large undertaking was settled in favor of Mr. Henman, and we have reason to believe that the development of the design which has taken place during that period, added to the marked excellence which already characterized it, will produce one of the best examples of modern hospital construction in England. The building is now in progress and the cost will be somewhere about £100,000. A good deal of picturesque effect with pleasing color will be obtained by the characteristic use of red brick and terra-cotta with green slated roofs.

The view, which we copy from the *British Architect*, shows only one portion of the long range of buildings, viz, the entrance courtyard with the porch to the administrative block in the centre, and that to the out-patients' department on the right.

After the adoption of Mr. Henman's design certain modifications were necessitated by the decision of the committee to adopt Mr. William Keys's system of heating and ventilation by propulsion instead of relying on natural ventilation, as originally proposed by the architect. Beyond this very little alteration has been made either in the general arrangement of the plan or in the elevations. Mr. Keys's system of ventilation has been introduced at the Victoria Infirmary, Glasgow, and elsewhere with marked success. In the Birmingham Hospital provision has had to be made for the cleansing, warming and propulsion of no less a volume than eighteen million cubic feet of air per hour continuously. The heating will be effected by steam-tubing, all arranged in the basement of the building, so that the various wards or rooms may have the temperature regulated to the requirements. As a rule, a temperature of from sixty degrees to sixty-five degrees will be maintained both in winter and summer. The air will be propelled by fans turned by electric motors, and electric-lighting is to be employed throughout.

WALSALL TOWN-HALL, WALSALL, ENG. MR. H. H. MCCONNALL, ARCHITECT, WALSALL, ENG.

THIS design, which is copied from *Building News*, was placed first by the assessor, Mr. MacVicar Anderson, P. R. I. B. A. The chief requirement in the scheme was a large hall for public meetings and concerts, and for this purpose special attention has been given in the preparation of the plans to the arrangement of entrances, staircases and exits. The buildings are to be executed in brick with stone dressings, and the total cost is limited to £20,000.

COMMUNICATIONS

[The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.]

CORRECTIONS.

NEW YORK, N. Y., April 22, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs.—The two schools in your issue April 22, 1893, should have read Long Island City in place of Brooklyn, as therein given.

Very truly yours, GEORGE PALLISER, Architect.

BOSTON, MASS., April 22, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—We would like to call your attention to the mistake in printing our firm name in your last issue.

Very truly yours, PERKINS & BETTON.

NOTES AND CLIPPINGS

THE PROPOSED LIGHTHOUSE OFF CAPE HATTERAS.—The Lighthouse Board of the Treasury Department has not given up the project of erecting a lighthouse on the outer Diamond Shoal, off Cape Hatteras, which is regarded by mariners as the most dangerous point along the entire seacoast of the United States on either ocean. The shifting sands of the ocean-bottom at this point, the frequency and the violence of storms and the difficulty of getting material to the ground, all conspire to make the erection of a lighthouse there more difficult than any undertaking of the kind that has ever been attempted in the world before. Since the firm of Anderson & Barr, after their unsuccessful attempt to sink a foundation caisson for the proposed structure, gave up their contract, the engineer officers of the Lighthouse Board have been studying very carefully the problem of how to combat the forces of nature which expend all their fury on the wide expanse of shallow sea that stretches out from Hatteras. When the attempt was made to sink the caisson last year it was taken for granted by the contractors that the most favorable months for work on the shoal were the summer months. The Board has been looking into this and has found that the most unfavorable months in the entire year are from the end of May until the end of September. A graphic chart has been prepared from the records of the Hatteras Weather-Bureau station for the twelve years that it has been in existence, showing the percentage of wind from all points of the compass for each month in the year. The most unfavorable wind is that from the southwest, which is the prevailing wind in the summer months, reaching as high as thirty-two per cent of the whole during July and falling to eleven per cent in October. The most favorable wind is the off-shore wind from the northwest, which prevails only three per cent of the time during the summer months of May, June, July and August, and rises to nearly seventeen per cent in October. There is never much calm weather in that locality; that is, there is not much time when there is not a perceptible wind blowing, but the percentage of calm is slightly greater in November than at any other time of the year. A careful study of the chart has led the Lighthouse Board officials to conclude that the best time to begin work on the shoal is during the mild Indian-summer weather of the late fall, when there is more probability than at any other time of the year that they will have light off-shore winds for a sufficient time to enable them to get a foundation caisson down and get the structure far enough advanced to withstand the buffeting of a severe storm. — *Correspondence Baltimore Sun.*

ELECTRIC BLASTING.—According to a paper recently read before the American Society of Civil Engineers by Mr. William L. Saunders, the electric method of firing cartridges in blasting is much more common in America than in Europe. In the United States the current is always supplied by a magneto machine, the fuse having a platinum wire imbedded in the fulminate, and this wire is rendered incandescent by the current. Frictional machines, in which a spark is passed between two platinum points in the fulminate, are not there used. The fuses, under ordinary conditions, should, he holds, be placed about the centre of the length of the cartridge by making a hole in the latter with a pointed wooden stick. A knife ought, in his opinion, not to be allowed near the powder-house. If the fuses have to be waterproofed, this is best done by means of cobbler's wax, which, after being warmed, should be allowed to cool to the consistency of a jelly before being applied to the exploder. These exploders should only be bought from firms that test the resistance of each supplied, so as to insure uniformity, otherwise misfires may occur. For insulating bare portions of the connecting wires where necessary, ebonite tape was very useful and was cheap. For tamping, dry sand was as good as anything, save, perhaps, pebbles, the worst material of all being wet clay. The tamping material was best placed in a tamping bag of paper made the diameter of the hole, and about 12 inches to 30 inches long, as these bags could be filled with the best tamping material some time before required, instead of having to use, otherwise, the nearest stuff that would do. Dry clay, moistened broken brick, and the dust from the drill-hole could be used if nothing better was at hand. When the drill-hole was ready for the cartridge, it was best to put in first a handful of rubbish, such as dry grass, to form a cushion for the top of the cartridge. — *Engineering.*

THE GHIZEH MUSEUM, CAIRO.—The condition of the famous Ghizeh Museum at Cairo has occupied the attention of the Egyptian Government for some time, and not long ago a commission was appointed to examine the building. The report shows that the condition is even more dangerous than it was supposed to be. With the masses of timber in the masonry of the walls, the many flimsy partitions and wooden floorings, and the spacious exterior verandas, a fire would inevitably complete the destruction of the building in a few hours. The Government has rejected a proposal for removing the museum into a building, to be constructed for the purpose, on a more accessible site, on the score of expense, estimated at \$650,000, and prefers to incur a probable expenditure of \$450,000, for alterations to render the present structure fireproof, although the result is not expected to be satisfactory. The Caisse de la Dette is disposed to pay the cost from its reserve fund. The collection, representing the art and history of ancient Egypt, has been gathered with enormous pains, is increasing yearly, and is of interest to the entire scientific world. The Egyptian Ministry, however, according to local opinion, does not appreciate its full value and importance, and the Premier, it is said, considers it mere waste to spend money on such objects instead of devoting it to the reduction of taxation, instruction, etc. — *N. Y. Evening Post.*

ERRORS IN WATER-METERS.—The errors of water-meters are discussed by Superintendent Charles F. Chase, of the Taunton (Mass.) Water-works, in a recent report. He states that during the last ten years 92 tests of meters have been made in that city by the Water Department. In 21 cases the meter registered correctly, in 36 cases it showed an over-registration, and in 35 cases an under-registration. The maximum error against the consumer in any case was 4.6 per cent, the minimum error was 0.1 per cent, and the average error 1.69 per cent. In the case of under-registration, the minimum error in favor of the consumer was 0.2 per cent, the maximum error 25 per cent, the average error about 4 1-4 per cent. The average of the whole 92 tests was 0.97 per cent in favor of the consumer. — *Engineering Record.*

TRADE SURVEYS

SPECIAL efforts made to ascertain what effects, if any, the existing financial stringency is having and is likely to have on the prosecution of new work reveal the uncomfortable fact that harm is already done, and more may be done, to quite a percentage of new enterprises depending for execution on money to be obtained from banks. There has been as yet no relinquishing of new enterprises, but simply a halting. Banks and promoters both want to see farther. The spectacle of such a gold and silver producing country as the United States, after thirty years of protection, not being able to keep enough gold to preserve the purity of the metal and pay in merchandise for what we buy is an unusual and surprising one. As before stated, however, more importance is being attached by all to the condition than it deserves. The foundation-fact must not be lost sight of,—that there is a need for more work, more iron, coal, lumber, textile goods, machinery and equipments than were produced last year,—and the fact that the Government has 95-100, or \$105,000,000 gold reserve, has, in truth, very little to do with the fact whether this desired production will be put on cars for shipment or not. The amount of new work done, new enterprises undertaken, and so on, may be affected, and no great harm will be done if the boomers who boom business as long as the banks are willing to lend are prevented from going to extremes at others' expense. There are two sides to the so-called financial depression. No other instrumentality but a depression could discipline the restless agencies that expand productive capacity regardless of legitimate needs. The outcome of the present experience will be of advantage to all. Legitimate productive interests have been hampered for two years by undue competition, against which trade combinations were helpless. Another effect of this stringency will be to check the growth of new firms or traders, but not to check production. The danger always is to have too many shop and store keepers. Reports from many trade-centres show increasing business, despite the difficulty of collecting. Distributing agencies anticipate, or, rather, they discount the outcome, and see in the near future restored confidence, steadier prices and a probable improvement in margins. The greater industries are healthy, though hampered by the evil referred to of too many people trying to play proprietor. In the iron trade, rails for electric roads are wanted, and plate and angle iron for elevated work. In lumber, there is a heavy demand for Southern wood. In coal, demand is urgent for all kinds, especially in the West, where the expansion of little industries has grown so rapidly during the past two years. In textile goods, New York importers and agents of home mills say the distribution up to date has been beyond previous years' averages. The New England mills have had very little interruption. In clothing, business has been over the average. Throughout the South there is a depressed feeling among planters. As to solvency, the commercial agencies think that it will be maintained. The insolvency of individuals does not mean a decrease in commercial vigor. Small distributors throughout the country are in better condition, have less dead or old stock, handle more cash, and make quicker payments. Jobbers frequently comment on the improved condition of the small traders. This, of course, is due to better railroad facilities, a perfect trade-soliciting system, reduced freights and better banking facilities. The quick exchange of farm and mine and shop products for cash is a strong factor in the improvement in progress. Reports received within a week from Western cities show great activity in building and an unusual demand for all sorts of building-material. Real-estate is not advancing for building-purposes, the explanation being that in most cities the means of transit to suburban localities are multiplying rapidly. Persons qualified to speak for savings-banks report an increase of deposits from wage-workers beyond the average of deposits. Economists who are presumed to know of what they speak have been figuring out a reduction in the cost of living of wage-workers as compared to three years ago, and they mention what is more to the point,—that the costs added by petty middlemen to wholesale prices are declining, and that fewer exactions are now practised on the poorer classes of the larger cities. These indirect influences partially account for the greater contentment of spirit manifested among the toilers.

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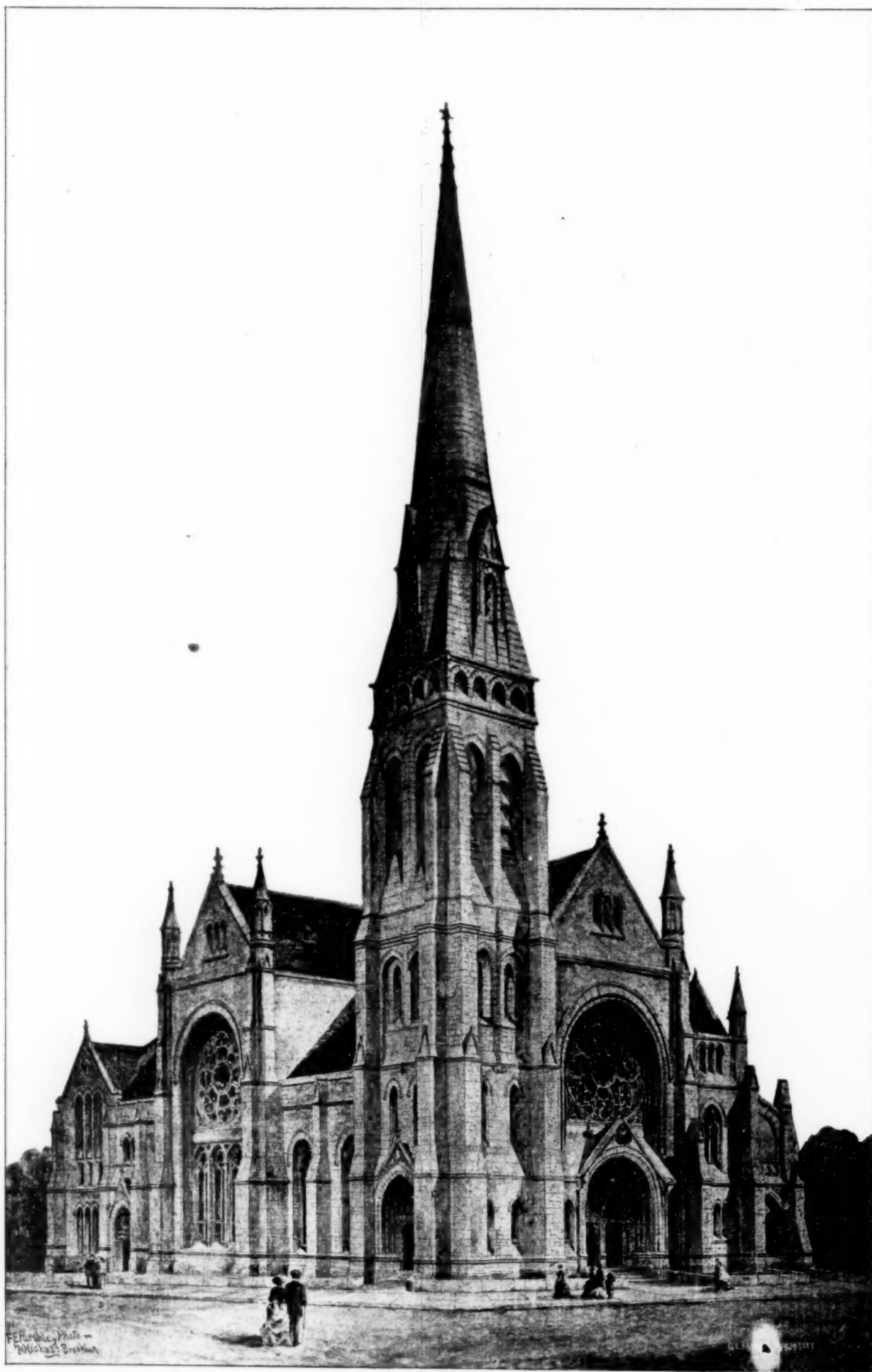


J. A. JOHNSON 98

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FIRST REFORMED CHURCH: BROOKLYN: N. Y.

GEORGE L. MORSE ARCH'T.

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FRANKLIN TRUST CO'S BUILDING: BROOKLYN: N.Y.

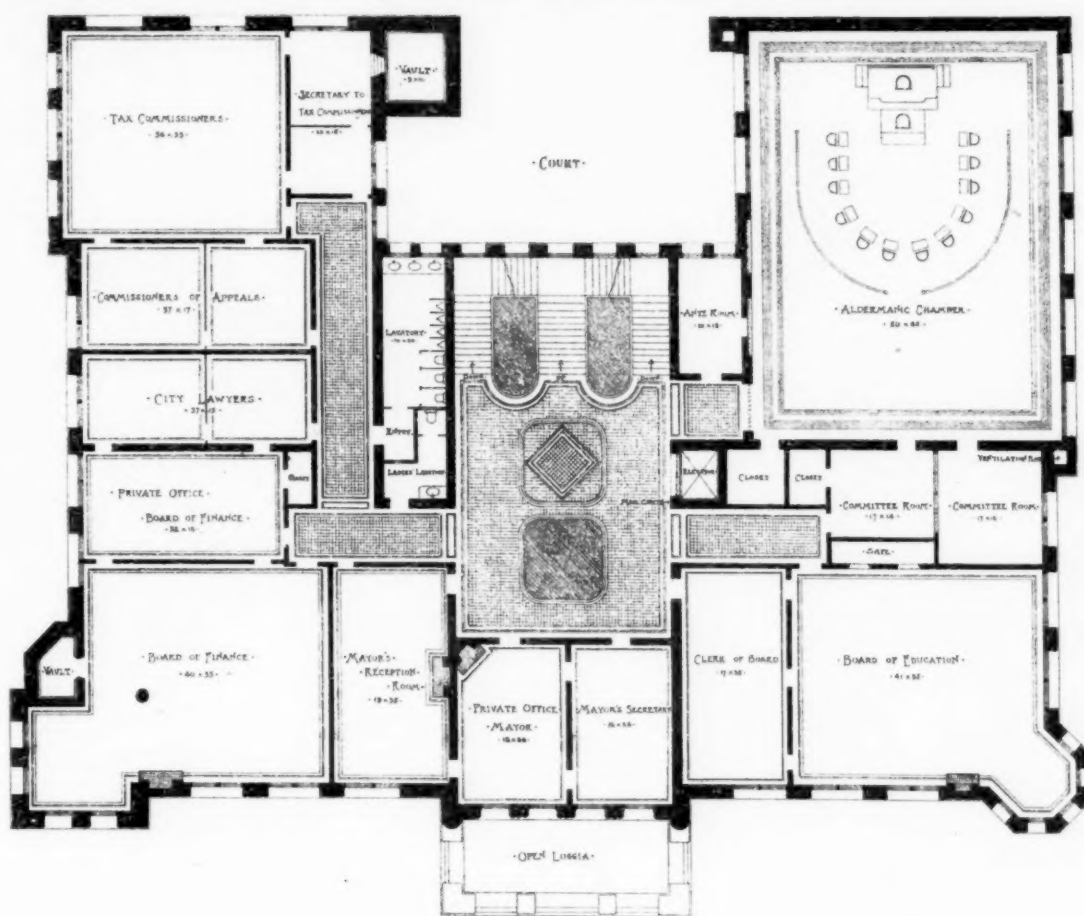
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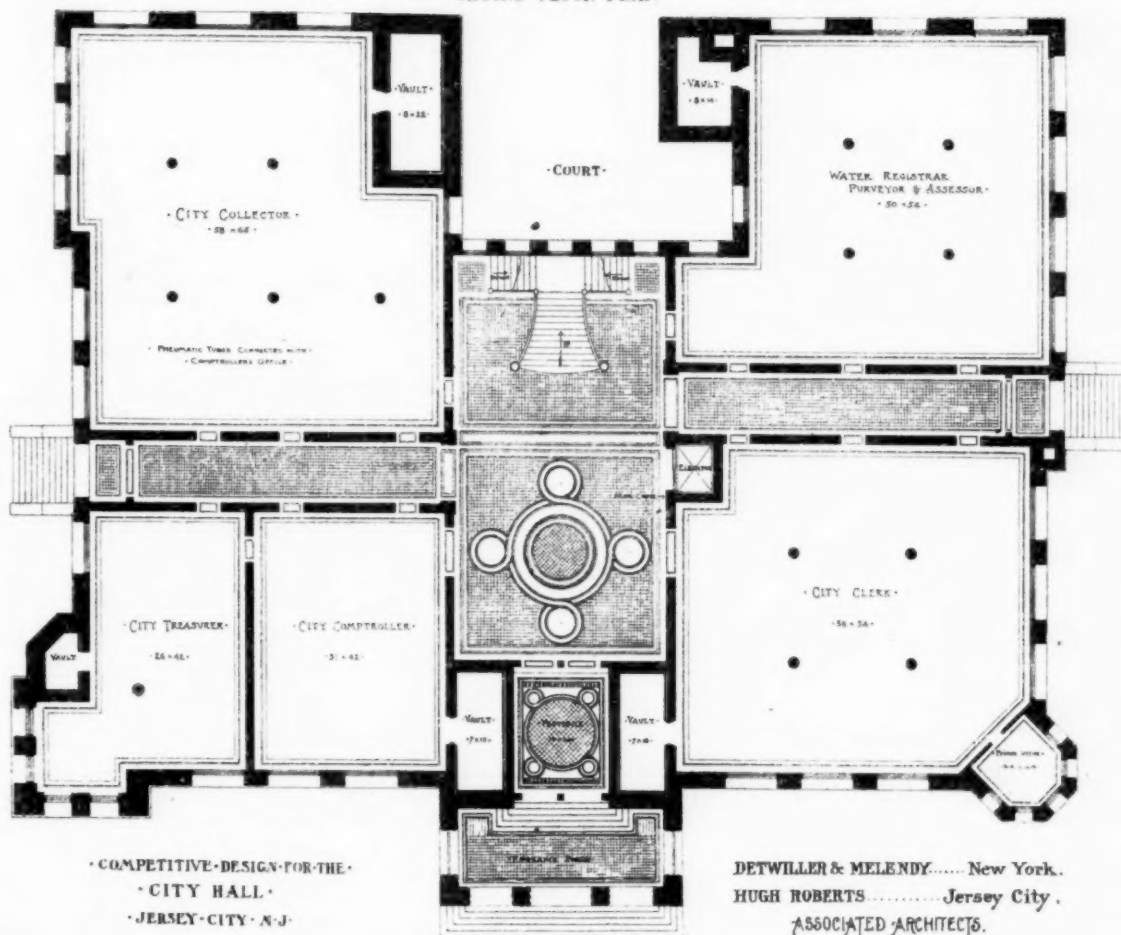
STORE BUILDING FOR MISS KATE O'MEARA
WORCESTER MASS

EARLE & FISHER ARCH'TS
WORCESTER MASS

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• CITY HALL •
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