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CONTENTS



THE New York Departments have some queer ways of treating the public. It will be remembered that, a few months ago, an order was sent out by the Commissioner of Public Works, directing that the fees payable to the city for the privilege of constructing vaults under the sidewalks should be raised from seventy-five cents per square foot, the rate which had been maintained for many years, to two dollars. This order produced a good deal of dissatisfaction, and not without reason. It is doubtful whether any tax at all can legally be demanded for such use of the space under the sidewalk as does not interfere with the comfort and security of the public, and, while owners will pay seventy-five cents a square foot rather than quarrel with the city authorities, a tax of nearly three times that amount is a serious matter. The opposition made to the new imposition, instead of leading the city officials to inquire more carefully whether they were in reality illegally oppressing the public whose servants they are, seems to have infuriated them, and the next step taken by them can only be characterized as a high-handed outrage. One of the municipal regulations, which applies to all the newer part of the city and has been for many years in force, provides that a space, usually, five feet in width, shall be reserved in front of the building-line, in which may be constructed the steps leading from the street down to the basement door, or the whole of which may be sunk below the level of the sidewalk, to give light to the front basement windows, the only condition attached to its use in this way being that a railing must be constructed around it, to prevent people walking on the sidewalk from falling in. In cases where residential streets have been invaded by business, it has been customary for the owners of stores fronting on them to carry out the spirit of this regulation, with more convenience, both to themselves and the public, by covering this area with sidewalk lights, and using the space under it for their own purposes, at the same time that the public has the benefit of the extra width added to the sidewalk. So well understood was it that the area space belonged to the owner of the building to use as he pleased, so long as the front of the building did not encroach upon it, that in many business streets there are steps along the "area line," dividing the sidewalk proper from the portion intended for the use of the abutting owner; and, while the seventy-five-cent tax was paid to the city in case the owner desired to use space under the sidewalks beyond the area line, no one dreamed of demanding or paying any tax for the use of space within the area line, for the obvious reason that the owner was legally entitled to use this space for light and access to his basement, and could have left it open to the air, with a railing; and it was desirable to encourage him to add it to the sidewalk space by means of a covering which was, as a rule, far more advantageous to the public than to him.

A FEW days ago the Department of Public Works, without notice or hearing, issued an order to the effect that all covered areas, even though covered only with gratings, should be considered as vaults under sidewalks, and that the new tax of two dollars per square foot should be applicable to them, as well as to space under the sidewalk proper. As the legality of this ruling is, to say the least, extremely questionable, and as it contravenes the practice and precedent of something like thirty years, one might suppose that the first case under it would be treated in a reasonable and considerate manner, in such a way as to test its legality without unnecessarily injuring property-owners, or involving the city in suits for damages; but the Commissioner of Public Works, who seems to prefer to do his reasoning with a club, thought otherwise. Mr. Charles Buek, a well-known builder, is erecting an apartment house on Amsterdam Avenue. The rules of the Building Department provide that an area shall be constructed on all street-fronts of such buildings, to give light to the basement, and that a staircase shall be placed in this area, for access from the basement to the street; but that "where stores are located on the first floor the area may be covered with suitable vault-lights or gratings." Mr. Buek made his contracts in accordance with this regulation, including gratings over the areas. Some of the gratings were in place, and others were being set by the contractors, when an order was sent them to desist. No previous notice had been given to them, or to Mr. Buek, of the new rule. Mr. Buek wrote to the Department, and, while naturally questioning the legality of the ruling, offered, rather than open a long legal controversy, to submit the matter to any court that the Commissioner of Public Works might select, and abide by its decision. At the same time, by the advice of his counsel, he permitted his contractor to finish the work of setting the gratings, in pursuance of the contract, and of the express permission given by the rules of the Building Department. The Commissioner of Public Works paid no attention to his offer to submit the matter to any court, and, apparently, did not even take the trouble to make a demand for the tax-money, upon which the question could have been brought before some sort of tribunal, but, as alleged, simply sent a gang of men, who tore up the gratings, broke them to pieces, and threw the fragments into the area, where they still lie; and we venture to predict that, if Mr. Buek will stand up for his rights, the City of New York will have to pay for taking them out, and repairing and replacing them, with a substantial bill of damages besides, and that Mr. Buek will not have to pay two dollars a square foot, or any other sum, for the privilege of keeping them there.

THE New York *Herald* makes some observations as to the probability of a general settlement of the high buildings on the lower part of Manhattan Island, which have an unnecessarily alarming look to people not accustomed to dealing with large figures. Adding up approximately the weights on the foundations of the highest buildings, it finds that something like "a hundred billion pounds" weight has been imposed upon the alluvial gravel which consitutes the subsoil of the island below Canal Street. Although sand or gravel form good foundations when prevented from escaping, it is possible for them, under certain contingencies, to escape, and the buildings imposed upon them are in that case likely to settle. With the gravelly part of Manhattan Island, the probability of such an accident is, it seems to us, diminished, rather than increased, by the modern methods of building. Although sand will try to escape laterally under a heavy load, its tendency to lateral movement is resisted by the weight of the earth resting upon the sand just outside the footings; so that, while a building set upon top of a layer of sand would soon sink, through the almost unopposed escape of the sand from beneath the footings, it would stand firmly on the same sand, if its footings were laid so far beneath the surface that the tendency to lateral movement of the sand under them would be counteracted by the resistance due to the increased weight upon the sand just outside the footings. With heavy buildings, unless their cellars are excavated to the rock, the principal object of making deep foundations is to secure as much lateral resistance as possible to oppose any tendency to escape of material from under the footings. Keeping this in mind, it will be seen that the load of buildings on the lower part of Manhattan Island diminishes, instead of increases, the probability of the settling of any one through lateral escape of the subsoil; just as a skilful architect, where a building shows signs of settlement through insufficient depth of foundation, will often apply a temporary remedy by piling up earth immediately around the building, for the purpose of increasing the lateral resistance of the subsoil. In the case of buildings of extraordinary weight, standing on foundations which extend to a great depth, there is a real danger that the excavation for the deeper cellar may allow the soil under the neighboring buildings, less deeply planted in the ground, to escape; but this danger is well understood, and so carefully guarded against that, so far as we know, few accidents attributable to such a cause have occurred in connection with the erection of any of the lofty office-buildings; and, once safely poised upon their deep foundations, the high buildings form, in a certain way, buttresses, which add to the security of the lighter structures about them.

THE true danger to be apprehended in regard to the modern office-buildings of mixed steel and masonry construction is from rust. No one knows exactly how the metal in such structures is going to behave, for the reason that such combinations have never before been exposed in the same manner to the action of the elements. We know that iron, buried in the heart of thick stone walls, laid in lime mortar, has remained unchanged for seven or eight centuries, presumably through the alkalinity of the lime, which has been known for ages as a powerful preventative of rust. Our high buildings are, however, built with cement instead of lime, and not much is known in regard to the action of cement on iron. Chemically, cement is much less alkaline than lime, and as it is insoluble in water, what alkalinity it possesses can hardly have much chemical effect on the metal. Its insolubility, however, makes walls built with it more impervious to water than those built with lime, and, if the steel structure is well grouted with cement, as is customary, there is reason to suppose that the metal, guarded from moisture by its impervious sheath, which, if it does not contribute alkali, at least contains no acid, may last uninjured for a very long period. Such experience as is available confirms this view, and, although architects will watch with great anxiety for any signs of deterioration of metallic structures used in the new manner, as an indication which may assist in devising precautions against such action in future, they have certainly neither forgotten nor neglected anything that the present condition of knowledge affords in the way of information on the subject.

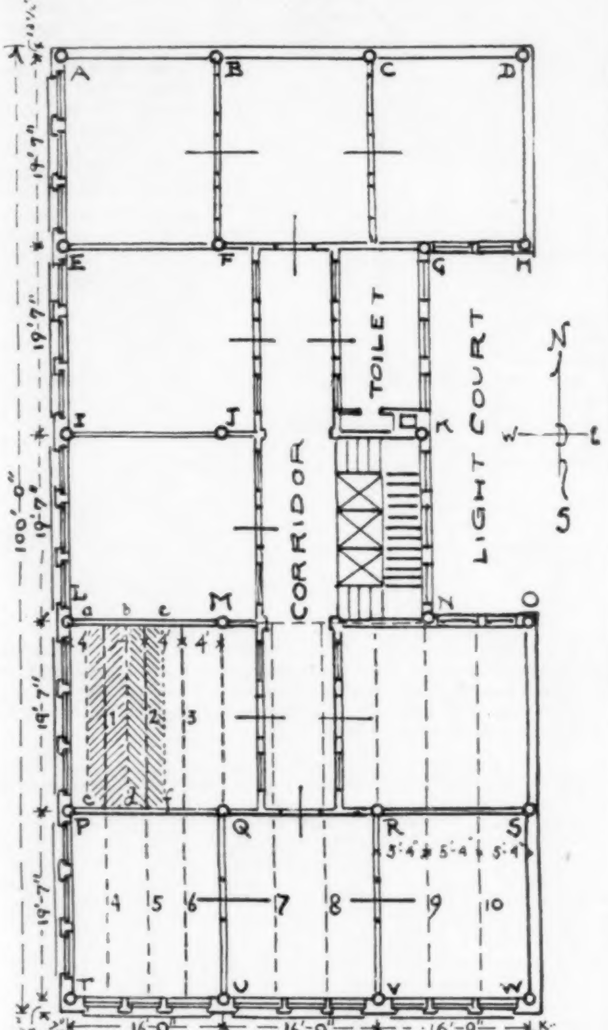
WE often have inquiries as to whether there is any redress against the practice, followed by certain builders, and some owners of the baser sort, of getting plans from an architect, copying them, and using the copies for duplicating the building shown on the original plans. Country builders, entrusted with the execution of plans made by an architect for a house, not unfrequently appropriate the drawings, or surreptitiously copy them, and utilize them to reproduce the house for other customers; while owners of bad character have been known to get drawings "on approval" from weak-minded architects, copy them, and after returning the originals as "not approved," proceed to carry out the building from the stolen copies. Most city architects have a provision inserted in their contracts, to the effect that the last payment to the builder under the contract shall not be payable until all the drawings have been returned, but this does not prevent surreptitious copying, and it is very much for the interest of architects and owners that some principle should be laid down, in accordance with which such betrayals of confidence may be promptly punished without the uncertainty which now attends the cogitations of lawyers as to the form of tort which is involved. It seems not impossible that to such cases the law of copyright might be found by the courts to be applicable, by an extension which is undoubtedly within the general principle of copyright, and only needs to be specifically made by a court of record to take its place in jurisprudence. Of course, the copyright established by statute is not applicable, for such copyright can only be secured by compliance with the formalities prescribed by the statute, but there is what is known as common-law copyright, to which no formalities are attached, but which protects in a general manner the rights of authors of literary or artistic works against unwarranted infringement. In 1849 or 1850, a case involving this principle was decided in England, to which very august personages were parties. The Queen of England and the Prince Consort, among the occupations of their younger days, had amused themselves by making some etchings, of which a few copies had been printed and given to their friends. An enterprising individual, named Strange, got hold of the etchings in some way, and undertook to exhibit them to the public, and suit was successfully brought in the name of Prince Albert, to restrain him from doing so.

IN a somewhat later case involving the same principle, but applying to a literary work, the Court said that "The right of the author before publication we may take to be unquestionable; he has the undisputed right to his manuscript; he may withhold or he may communicate it, and, communicating, he may limit the number of persons to whom it is imparted, and impose such restrictions as he pleases upon the use of it; and the fulfilment of the annexed conditions he may proceed to enforce, and for their breach he may claim compensation." It was pointed out in this case that the same principle applied to all literary and artistic work, and it would be hard to find any such work to which it would be more appropriate than the plans of an architect, which are obviously intended to be communicated to a limited number of persons, and in regard to which there could be no presumption that they were intended for the benefit of the public, or that their author desired to waive his property-rights in them. There might be a question whether the passage of a copyright statute, providing specified means for securing a monopoly in literary or artistic work, on compliance with certain formalities, did not supersede common-law copyright in matters to which it was applicable, so that a person who neglected to avail himself of his statutory rights, by compliance with the prescribed formalities, could not fall back on the common-law to give him similar protection; but, even in the case of literary works, where it is to be presumed that the author would seek statutory copyright if he wished to keep the monopoly of his work, it is doubtful if he would divest himself of his property rights without a more positive waiver than the mere neglect to seek protection of a certain kind, and with architects' drawings the presumption is entirely in favor of the idea that common-law protection for them, as private property, is all that is desired. What our courts would think of the matter is yet to be shown, but English precedent, where no other is available, has much weight in our jurisprudence, and it certainly seems as if a definite theory upon which such cases could be argued and decided would do much to protect architects and owners against a form of robbery which is, apparently, becoming more and more prevalent.

ALL lovers of popular natural history will remember that, according to that science, English oysters owe their "coppery flavor" and greenish tinge to their habit of absorbing the waste-water from the Cornish copper mines, which flows into the sea not many miles from the oyster-beds, and it is sad to learn that the coppery flavor, as well as the pleasing color, of these expensive mollusks is threatened by certain discoveries which have been made far away from the seashore, in the mines of Montana. From the Anaconda mine flows out a stream of waste-water, which is colored of an emerald green by the compound of copper which it contains. As there are no oysters in the neighboring mountains to consume the liquid, it runs to waste, or rather, it did so until a little while ago, when the managers of the mine took it into their heads to collect the water in immense tanks, covering several acres of ground, and to put into these tanks such old wheelbarrows, railroad iron, rusty pipes, dilapidated elevators and battered tin-ware as they found available. The result of this simple chemical process is to precipitate the copper, by solution of the iron. The action takes place slowly, so that about three weeks is necessary for the complete removal of the copper in a vat of water, but it needs no attention, and the copper is thrown down in the form of a grayish mud, which is nearly pure copper, and is mixed with the other ores for smelting.

## STATICS OF STRUCTURES. — THEORETICAL AND APPLIED.[1]—II.

### SIMPLE BEAM WITH UNIFORM LOAD. — PRACTICAL APPLICATION OF CHAPTER I.




— FIG: 11 —

33. LET us proceed to apply the foregoing to the practical problem of a twelve-story office-building. Suppose a typical floor plan, as shown in Figure 11, had been determined upon, and that the sizes of the floor beams were now to be calculated.

For the sake of good elevations, more than anything else, the fifty-foot front was divided into three bays, and the hundred-foot front into five.

This subdivision results in 23 columns, lettered $A, B, C, \ldots W$, on the plan; between these columns we decide to place girders, parallel to the narrow front of the building, framing the floor beams between them.

34. To calculate the strength of these floor beams, we shall first apply Equation 6, namely:

$$M = \frac{P\,l}{8}$$

In which M = maximum bending-moment for uniformly distributed load in inch-pounds.

P = total load, *i. e.*, static plus live load;

$l$ = span in inches.

35. The static load, or "dead weight" (§ 7), varies with the kind of material used in the construction of the floor. It is made up of the weight of the flooring or tiling, the cinders or concrete used for levelling, the floor arches, the plaster, the floor beams and such fireproof (thin) partitions as may be carried directly on the floor. It is best, in every case, to calculate as closely as possible the weight of each of these substances, and from this to deduce an average weight of so many pounds per square foot.

Thus a floor in a first-class dwelling-house, if steel beams and very light patent arches are used, would weigh from 50 to 60 pounds per square foot. On the other hand, the floors in most of our modern office-buildings have been calculated for a static load of 100 pounds per square foot; so that the reader had best exercise his judgment and select that weight between 50 and 100 pounds which the case under consideration would seem to call for.

36. The live load to be assumed per square foot is, according to the New York Building-law, as follows:

TABLE I.

Live loads to be assumed, for different types of buildings, per square foot of floor area, according to the New York Building-law:

| | |
|---|---|
| Dwelling-houses, Apartment-houses, Hotels | 70 lbs. |
| Office-buildings | 100 " |
| Places of Public Assembly | 120 " |
| Stores, Factories, Warehouses | 150 " |

37. In our case we shall assume the static and the live load each at 100 pounds per square foot, so that we have a total load of 200 pounds per square foot. Each beam sustains a load proportional to its span multiplied by the distance between beams on centres; thus, Beam 1 carries that portion of the floor, marked $a\,b\,c\,d$; Beam 2, $b\,c\,d\,f$; and so on. But $a\,b\,c\,d$ is equal to 19′ 7″ by 4′ 0″, or 78.3 square feet. This multiplied by 200 gives the total load on each beam as 15,660 pounds.

Our span is 19′ 7″ or 235″.

Inserting these several values in Equation 6, we get:

$$M = \frac{15{,}660 \times 235}{8} = 460{,}000 \text{ inch-pounds.}$$

The next step is given by Equation 10:

$$\frac{M}{S} = R$$

In which $M$ = bending-moment as above, $S$ = allowed maximum stress, or safe stress in extreme fibre, or safe modulus of rupture; all meaning practically the same in this case.

$R$ = required moment-of-resistance of cross-section in inches.

Accordingly, we divide 460,000 inch-pounds by the safe modulus of rupture for steel (the material of which we intend to make our own beams), which is 16,000 pounds per square inch, and get as the required moment-of-resistance 28.8″.

38. Before proceeding any farther, let us take this opportunity to explain more fully the meaning of some of the terms just used.

From tests which have been made of beams under different loads, a constant has been derived which may in a measure be said to represent the combined action of the compressive and tensile stresses (§ 10) existing in a loaded beam; this constant has been termed the modulus of rupture.

This modulus, therefore, is the measure for the resistance of a beam against transverse or cross-breaking strains; the *ultimate modulus* is the *greatest* amount of stress that the material is capable of exerting; it would just balance the *ultimate load;* the least load in excess of this would cause the beam to fail.

It would obviously be very foolish to calculate a beam for the ultimate load, thus making it carry all that it possibly could; for our knowledge of the strength of most of the materials being comparatively limited, and the actual loads never quite agreeing with the assumed ones, the chances in such a case would be, that, while the beam might be safe theoretically, practically it would fail.

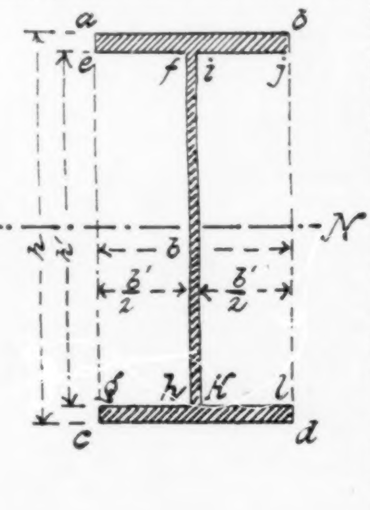



Fig. 12.

Therefore, instead of basing our calculations on the ultimate modulus of rupture, or any other kind of ultimate stress, for that matter, we calculate so that the beam will have to carry at the utmost, say, only $\frac{1}{5}$ of the ultimate load, by decreasing the modulus of rupture to $\frac{1}{5}$ of the ultimate modulus. This decreased modulus necessary to resist this so-called *safe load* is, in its turn, known as the *safe modulus of rupture.* And the ratio of the ultimate load to the safe load, or the ultimate stress or modulus of rupture to the safe stress is called the *factor-of-safety.*

39. Thus if, the ultimate modulus of rupture of steel being 80,000 pounds per square inch, we were to calculate with a safe modulus o

[1] Continued from No. 1093, page 81.

rupture of 16,000 pounds per square inch (as we are actually doing in our problem), we should be using a factor-of-safety of $80,000 \div 16,000 = 5$.

Had we used a safe modulus of rupture of 12,000 pounds per square inch, our factor-of-safety would have been $80,000 \div 12,000$ or 6.66. As a matter of fact, the former factor is used in calculating beams for buildings, and the latter for bridges.

The less we know of a material, or the more it is liable to differ, practically, in its consistency, from what it is assumed to be theoretically; or the more the actual loads are liable to vary from those assumed in the calculations, the larger is the factor-of-safety to be taken.

Thus, for cast-iron we use a factor-of-safety of 8; for yellow pine, 7; for limestone, 10, and so on.

40. Tables of the ultimate and safe resistance of materials may be found in all the hand-books of engineering; we shall give such values as are necessary to our calculations as we go along. At this place we insert the values for steel and iron.

TABLE II.

ULTIMATE AND SAFE RESISTANCE OF IRON AND STEEL IN POUNDS PER SQUARE INCH.

| | Compression. | | Tension. | | Shearing. | | Modulus of rupture. | |
|---|---|---|---|---|---|---|---|---|
| | Ultimate. | Safe. | Ultimate | Safe. | Ultimate. | Safe. | Ultimate. | Safe. |
| Cast iron....... | 97,500 to 145,000 | 15,000 | 16,300 | 2,500 | 19,500 to 25 000 | 2,500 | 40,000 | 5,000 |
| Wrought-iron.. | 36,000 to 40,000 | 12,000 | 48,000 to 57,000 | 12,000 | 40,000 to 45,000 | 8,000 | 43,000 | 12,000 |
| Wrought-steel. | 90,000 | 16,000 | 60,000 to 117,000 | 16,000 | 52,000 | 12,000 | 80,000 to 100,000 | 16,000 |
| Cast-steel...... | 150,000 | 25,000 | 91,000 | 16,000 | 57,000 | 12,000 | 125,000 | 16,000 |

41. To return to our problem: We found the required moment-of-resistance to be 28.8″. We could now find the necessary cross-section of the beam by using Equation 8:

$$R = \tfrac{1}{6}\, b\, h^2.$$

But this applies only to rectangular cross-sections, and as steel beams are invariably I-shaped, the equation must be changed to conform to that section.

The I-beam may be considered as a rectangular section *a b c d* (Fig. 12) with the parts *e f g h* and *i j k l* cut out; its moment-of-resistance will, therefore, be equal to the difference between the moments of the whole section *a b c d* and the moments of the parts *e f g h* and *i j k l*.

The moment of *a b c d*, according to § 29, and with the lettering as in Figure 12, is:

$$\tfrac{1}{6}\, b\, h^2.$$

That of *e f g h*:

$$\tfrac{1}{6} \cdot \frac{b'}{2} \cdot h'^2$$

And of *i j k l*:

$$\tfrac{1}{6} \cdot \frac{b'}{2} \cdot h'^2$$

The sum of the last two is:

$$\tfrac{1}{6}\, b'\, h'^2.$$

Therefore the moment of the shaded or I part is:

$$\tfrac{1}{6}\,(b\, h^2 - b'\, h'^2). \qquad (11)$$

42. If, now, we make use of a rule-of-thumb which says that the depth of a beam in inches is numerically equal to one-half the space in feet, we should arrive at the conclusion that our beam would have to be about 10″ deep. Proceeding farther, we should say that 5″ would be a good width of flange for a 10″ beam, and assuming — just to begin with — a web thickness of $\tfrac{1}{4}$″, and a flange thickness of $\tfrac{1}{2}$″, we get the cross-section shown in Figure 13, to which we can now apply Equation 11, and so discover whether we have designed a beam having the required $R$ or not.

Substituting in Equation 11 for $b$, $h$, $b'$, $h'$, their respective values 5″, 10″, $4\tfrac{3}{4}$″, 9″, we get

$$R = \frac{5.10^2 - 4.75 \times 9^2}{6} = 19{,}2$$

Our required $R$ is 28.8″; therefore this section is not strong enough, and we must try again. Increasing the thickness of the flange to $\tfrac{3}{4}$″ and that of the web to $\tfrac{3}{8}$″, we get the following moment-of-resistance:

$$R = \frac{5.10^2 - 4\tfrac{5}{8} \times (8\tfrac{1}{2})^2}{6} = 27.6''$$

Which is still too small, but very much closer than the first value.

43. We shall, however, proceed no further, as a calculation of this kind, in the case of I-beams, at least, is obviously of no practical value; for we might spend a long time in designing and calculating a section, only to find in the end that a beam in any way resembling that worked out is not manufactured at all; so that all our labor would prove to be wasted. In the case of "built-up" sections, such as plate or box girders, however, this method of reasoning becomes of great value, as will be seen later on.

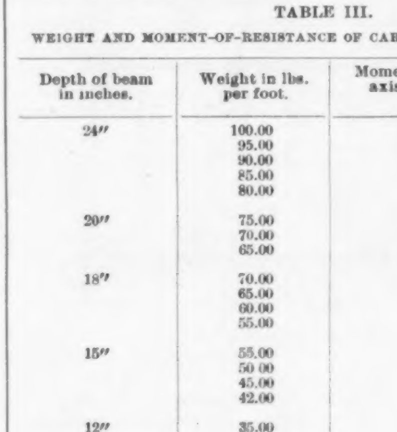



*Fig. 13.*

The right mode of procedure, therefore, is to look over the beams actually put on the market by the iron companies, and to select the one whose moment-of-resistance equals or comes nearest to that required.

For this purpose the several companies have published catalogues or hand-books containing tables of the "shapes" rolled by them, giving the size, weight per pound, cross-sectional area, moment-of-inertia, moment-of-resistance, of each I-beam, channel, etc.

44. Thus the "*Pocket Companion,*" issued by the Carnegie Company, of Pittsburgh, gives such a table on Page 105, entitled "Properties of Standard I-beams."

The second column of this table contains the depth of the cross-section in inches; the third, its weight per foot, and the eleventh, its "Section modulus" (moment-of-resistance), "neutral axis perpendicular to web at centre." For the convenience of the reader we insert these three columns here.

TABLE III.

WEIGHT AND MOMENT-OF-RESISTANCE OF CARNEGIE STANDARD I-BEAMS.

| Depth of beam in inches. | Weight in lbs. per foot. | Moment-of-resistance. Neutral axis perpendicular to web at centre. |
|---|---|---|
| 24″ | 100.00 | 198.4 |
| | 95.00 | 192.5 |
| | 90.00 | 186.6 |
| | 85.00 | 180.7 |
| | 80.00 | 174.0 |
| 20″ | 75.00 | 126.9 |
| | 70.00 | 122.0 |
| | 65.00 | 117.0 |
| 18″ | 70.00 | 102.4 |
| | 65.00 | 97.9 |
| | 60.00 | 93.5 |
| | 55.00 | 88.4 |
| 15″ | 55.00 | 68.1 |
| | 50 00 | 64.5 |
| | 45.00 | 60.8 |
| | 42.00 | 58.9 |
| 12″ | 35.00 | 38 0 |
| | 31.50 | 36.0 |
| 10″ | 40 00 | 31.7 |
| | 35.00 | 29.3 |
| | 30.00 | 26.8 |
| | 25 00 | 24.4 |
| 9″ | 35.00 | 24.8 |
| | 30 00 | 22.6 |
| | 25 00 | 20.4 |
| 8″ | 21.00 | 18.9 |
| | 25.50 | 17.1 |
| | 23.00 | 16.1 |
| | 20.50 | 15.1 |
| | 18.00 | 14.2 |
| 7″ | 20.00 | 12.1 |
| | 17.50 | 11.2 |
| | 15.00 | 10.4 |
| 6″ | 17 25 | 8.7 |
| | 14.75 | 8.0 |
| | 12.25 | 7.3 |
| 5″ | 14.75 | 6 1 |
| | 12.25 | 5.4 |
| | 9.75 | 4.8 |
| 4″ | 10 50 | 3.6 |
| | 9.50 | 3.4 |
| | 8 50 | 3.2 |
| | 7.50 | 3.0 |
| 3″ | 7.50 | 1.9 |
| | 6.50 | 1 8 |
| | 5.50 | 1.7 |

All we need do now is to select the I-beam whose $R$ approaches most closely to that required, which is 28.8″.

45. We find that there is a 10″ 35-pounds I with an $R$ of 29.3″, and a 12″ 35-pounds beam with an $R$ of 38.0″. We might use the latter, since it would give us greater strength without increased cost, its weight being the same; but it would be but poor practice to make the beams so much stronger than is really necessary, the more so, as we have based our calculations on a very high load (200 pounds per square foot), which the floor will hardly ever be called upon to carry.

The best thing to do in a case like this is to increase the distance between beams. There will then be fewer beams, and each will have a greater load to carry, thereby requiring a greater $R$.

By spacing the beams 5′ 4″ on centres, as shown at 7, 8, 9, 10, Figure 11, we shall have one less in each bay, while the area carried by each will be equal to 5′ 4″ times 19′ 7″, or 103.88 square feet.

In short, we require the following $R$:

$$\frac{5.33 \times 19.58 \times 200 \times 19.58 \times 12}{8 \times 16{,}000} = 38.3''$$

This $R$ is a little larger than that of the 12″ 35-pounds I, but having assumed very large loads, as has been said before, we need not hesitate to adopt this section.

46. The last equation represents the manner in which these calculations ought to be made; it combines two operations in one, and can, by means of the *slide-rule*, be solved in a twinkling. The reader, if he is as yet unfamiliar with the use of this instrument, ought to provide himself with one at the earliest opportunity, and learn to use it, as without it life becomes a burden to the engineer. The best and most practical are those of mahogany faced with celluloid. The French rules of boxwood are not as good, in spite of their being more expensive.

To make the floor complete, we still require tension-rods, girders, floor-arches, and connections, generally; these can, however, be taken up only after a preliminary discussion of the theoretical problems involved. O. F. SEMSCH.

[To be continued.]

## THE "ASPHALEIA" STAGE AT BUDA-PESTH.[1]

Fig. 1. Plan of Stage Floor.

WHEN speaking of the stage at the Halle Theatre, I remarked on the fact of this building taking a prominent position in the annals of theatre construction, thus making it a pioneer in the consideration of the safety of the audience and the introduction of modern methods and appliances. I also remarked on the excellent planning of the architect, Herr Seeling, and congratulated all concerned on their having taken the fearful lesson of the "Ring" Theatre to heart, with the result of a general advancement in the arrangement of playhouses and the movement known as "stage reform." Besides the theatre at Halle I mentioned the Opera-House at Buda-Pesth as a playhouse in which a stage built on the "Asphaleia" system will be found in full working order. It was, in fact, at the Buda-Pesth Opera-House that the "Asphaleia" system was first introduced, and though this house by no means compares favorably with the Halle Theatre in its planning, no doubt owing to its much earlier conception, it is certainly creditable to the promoters of the building that, after the catastrophes at Vienna, Nice and Boston, every effort was made to keep in touch with the improvements of the time. While the idea of the Halle Theatre was conceived and carried out at a time when the "Ring" Theatre catastrophe had but shortly occurred, the Opera-House at Buda-Pesth was designed as early as 1873, when a limited competition was held, and plans were invited by the Hungarian Home Secretary. The premium in this case fell to Von Ybl, who was charged with the execution of his competition design, and commenced building operations in 1875. The carcase of the building was practically complete when the "Ring" Theatre disaster occurred, in 1881, so that it has not been designed under the influence of any great catastrophe, and hence shows features of the period preceding the great reform in Continental theatre-building. Nevertheless, the Buda-Pesth Opera-House takes a very prominent place in the history of theatre-construction, and this is due mainly to the eventual introduction of appliances which are the subject of these articles, as well as other technical innovations in other parts of the building. When the Opera-House was opened in September, 1884, amid great festivities, it was the first playhouse to have a fully equipped hydraulic stage, and this date hence marks the new era of stage-mechanism.

As in the case of the Halle Theatre, the financial aspect of the Buda-Pesth enterprise may be of some interest. The original estimate for the building in 1875 was about 245,000*l.*, which figure was reduced to 183,000*l.* After the "Ring" Theatre fire, numerous alterations were made in the arrangement of the building, and the stage under consideration, which alone cost approximately 15,000*l.*, was added. The total expenditure eventually reached 266,000*l.*, inclusive of the stock of scenery, upholstery and furniture; that is to say, about 200*l.* per head of the audience, as the seating accommodation provided in this house is only about 1,250. The amount of space allotted to each spectator is exceptionally large; in fact, I know of no other instance where the seating of the audience has been carried out on so sumptuous a scale. The sum of 15,000*l.* for this stage is certainly something extraordinary from an English point-of-view, the more so if we consider that an average London theatre is often built for this price. Of course, it must be remembered, and sufficient stress can hardly be laid upon this fact, that we are dealing with playhouses in which there is a constant change of bill, making every facility for the easy working of the stage a greater boon. I do not believe that the "Asphaleia" stage could be considered otherwise than as a great luxury, if introduced into an average London playhouse where a run of 100 nights, or more, is to be expected. In such cases, the arrangement of provisional lifts or other appliances would probably suffice. It would be primarily suited to the requirements of our Covent Garden Opera, where the same play is but seldom given on two successive nights during the season. It would even be more suitable (were it not for the initial outlay) for large suburban theatres which frequently change their programme. I hold it would, however, be yet more valuable for the great variety theatres, such as the Empire and the Alhambra, which are at present but very poorly equipped, and would find the more modern appliances a boon for the quick change of the cumbersome scenery of their magnificent ballets.

While in a former article I have shown some diagrams illustrating the main lines on which the "Asphaleia" stage is designed, and in the last article have shown a series of plans and sections of a stage erected by the syndicate, with the view of explaining the system as actually adopted for practical purposes on a stage of average dimensions, the present article is supplemented by some engravings to a larger scale, showing the working-drawings from which the appliances at Buda-Pesth were constructed. The Buda-Pesth stage, I should add, ranges among the larger Continental stages. We are indebted for these drawings to one of the engineers in charge of the stage in question, M. Christofani, to whom we have frequently referred as an expert of considerable authority on the Continent. A small general plan of the Buda-Pesth example shows the divisions of the stage floor as taken from one of the printed forms on which the stage engineer sets out the scenery of his different plays to facilitate the management of the various scenes. The large plan shows the stage floor and joists, as well as the mezzanine cellar, etc., at different levels, and it will also be seen from this illustration that the part underneath the back stage is taken up by the boiler-room. One of the regular illustrated pages this week shows half-sections taken on two different lines, one section being taken near the proscenium opening and the other towards the back stage. Figures have been added, marking some of the principal dimensions.

As in the case of all "Asphaleia" stages, perhaps the principal feature at the Buda-Pesth Opera-House is the "horizon," which takes up three sides of the stage, as already described. Here the height of the "horizon," *i. e.*, the depth of the actual cloth when seen "hung," is 17 metres, the bottom hem being 2 metres above the stage floor, so as to allow the actors to pass underneath it if necessary. The total length of the "horizon" is 150 metres, while the vertical rollers stand 24 metres apart. The cloth is hung on wires and is worked by two ordinary winches placed on the second "fly" gallery. As will be seen from the section the winch is at the upper end of the vertical roller, and the "fly" gallery from which it is worked has a width of 2.20 metres. Of course the "horizon" can be wound up entirely on either of the rollers, and this is done when the back stage is used, but, as a rule, the "horizon" in an "Asphaleia" stage is considered a semi-fixture, as it is a somewhat cumbersome appliance to handle. When hung, it can, of course, be raised or lowered bodily.

Referring to the small plan of the stage floor (Fig. 1), it will be seen that a sequence of *coulissengassen* has again been provided for, with the minor sequences of "traps," "sliders," "chariot slits," etc. There are five *coulissengassen* in the ordinary sense of the term, besides the spaces between the first *coulissengasse* and the proscenium opening, and between the last *coulissengasse* and the back wall, the former of which spaces has two "star-traps," as in the case of the Halle Theatre, whilst the last has the same series of broad "traps" as the ordinary *coulissengasse.* In the large diagram showing plans at various levels it will again be easily seen, as in the Halle example, on what a few points the stage floor really rests, and also how the large "traps" running across the stage are divided into six sections, to each two of which there is an hydraulic ram. It will be seen how the central one of each set of three rams supports the "trap" proper, while the two rams on either side can be made to work the large "slabs" containing openings for traps, sliders, etc., bodily. A reference to Article XVII, of this series

[1] One of a series of articles by Mr. E. O. Sachs on "Modern Theatre Stages," now publishing in *Engineering*.

will assist the explanation of the Buda-Pesth stage, as the several perspective views therein portrayed will show clearly how the large rams can be worked, and how again the smaller rams can be utilized to work minor sections. It would almost suffice a very large part of the stage floor can be moved bodily. Each *coulissengasse*, besides being raised or lowered vertically, can be so moved that the "slab" slopes; in fact, a see-saw movement can be obtained for either one *coulissengasse* or all five together.

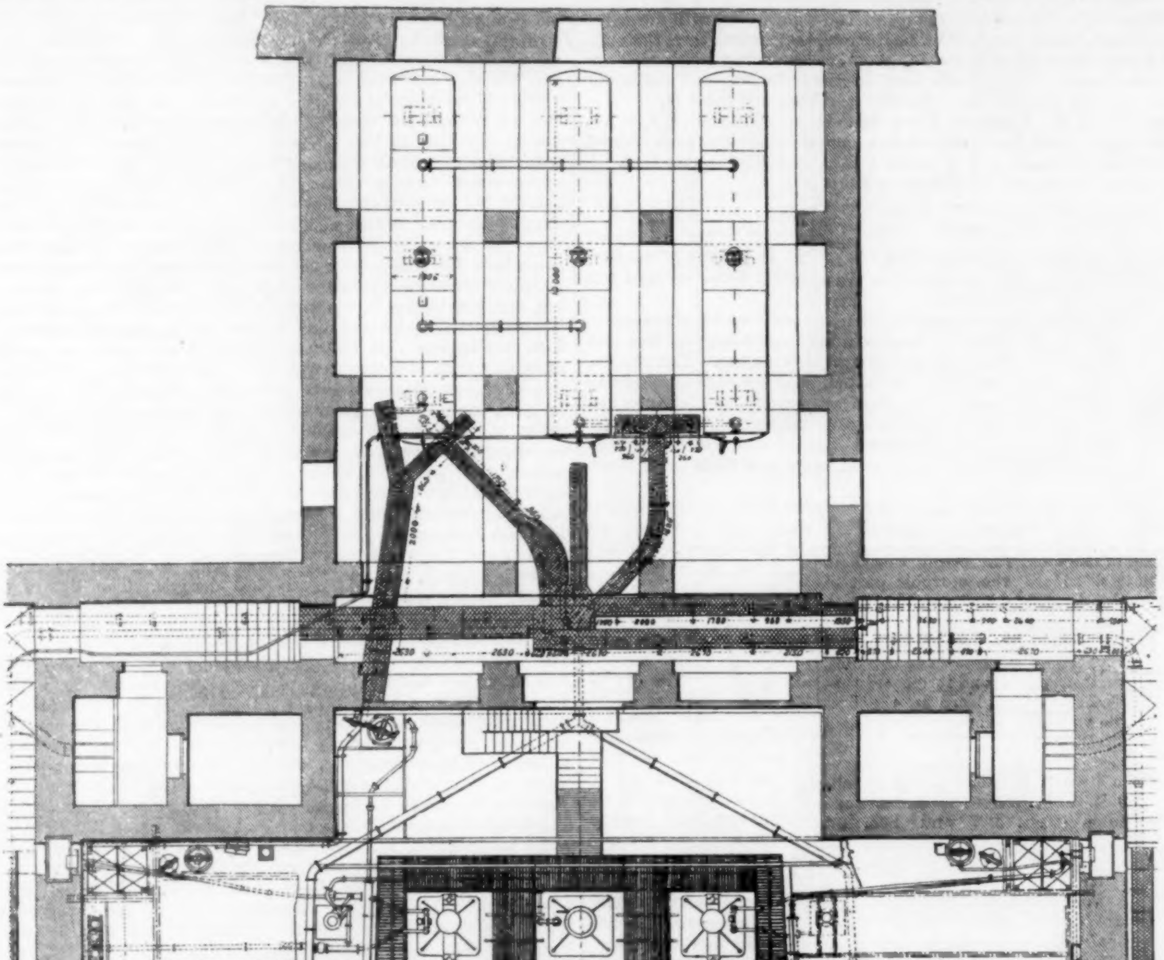


Fig. 2. Asphaleia Stage in the Buda-Pesth Opera-House.

to say that the combination of the set of three rams, with its minor rams to each trap, divided into six sections, gives innumerable possibilities to the scenic artist. Of course, the whole area of all the *coulissengassen* can be sunk or raised bodily together, *i. e.*,

It would lead too far to describe the installation of the hydraulic power for the rams or the other mechanical appliances, but the arrangement of motive power practically comprises large storage-tanks with a capacity of 75,000 litres in the roof of the building, fed from a large well, the pump being worked by a 12-horse-power gas-engine. The pressure in the installation is seven atmospheres, and I may add that the same installation also feeds a large number of hydrants for fire-extinguishing purposes. There is a second gas-engine in reserve on the premises in case of a failure, or an extra supply of water being required on an outbreak of fire.

I have already stated that there are five *coulissengassen* with a space at front and back, and that the latter has a large "trap"

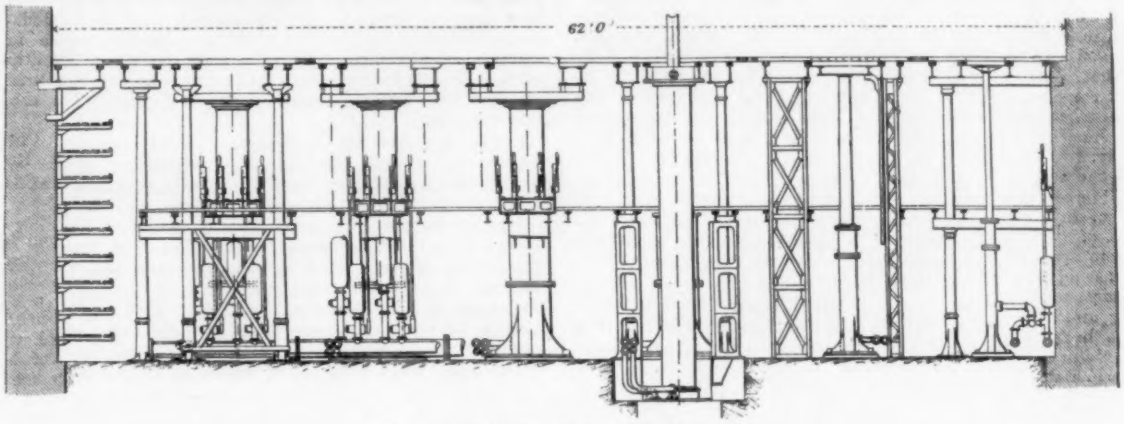



Fig. 3. Asphaleia Stage in the Chicago Auditorium.

like the ordinary *coulissengassen*. The total number of principal rams is, hence, 18, and these are fed by two services from the reservoirs above mentioned. The diameter of the rams is 650 millimetres. The width of the main "slabs," *i. e.*, the depth of the ordinary *coulissengasse*, which of course includes the width of the "trap" proper, sliders, slits and framing, is 3 metres.

The width of each "slab" is about 12 metres. The dimensions of the opening for the "trap" proper in each *coulissengasse* is 11 metres by 1.3 metres, while the "slider slits" are 0.20 metre wide. There are five iron joists to each "slab," fitted parallel to the proscenium curtain, and these are supported by the outer rams, as already mentioned. Each "slab" can be raised 4 metres above stage-floor level, or lowered 2.3 metres below it. The bearings of the five joists of each "slab" are movable, so that the "slope" of the slab would not interfere with the vertical position of the rams proper. In respect to the main trap of each slab, which, as already stated, is divided into six sections, I would add that the two central sections can in each case be raised 6 metres above stage-floor level.

I have referred to the difficulty of tying the main joists of a wooden stage, and have mentioned the various makeshifts adopted, such as iron hooks, etc. In the "Asphaleia" stage no attempt whatever is made to tie the various parallel sections of the stage together. Each *coulissengasse* works individually, and stands, if I may say so, on its own legs, and there are no ties from front to back of the "under-machinery." No doubt this arrangement, if perfect, would be a boon to those in charge of a stage, but, if we are rightly informed, the absence of "ties" in the "Asphaleia" system

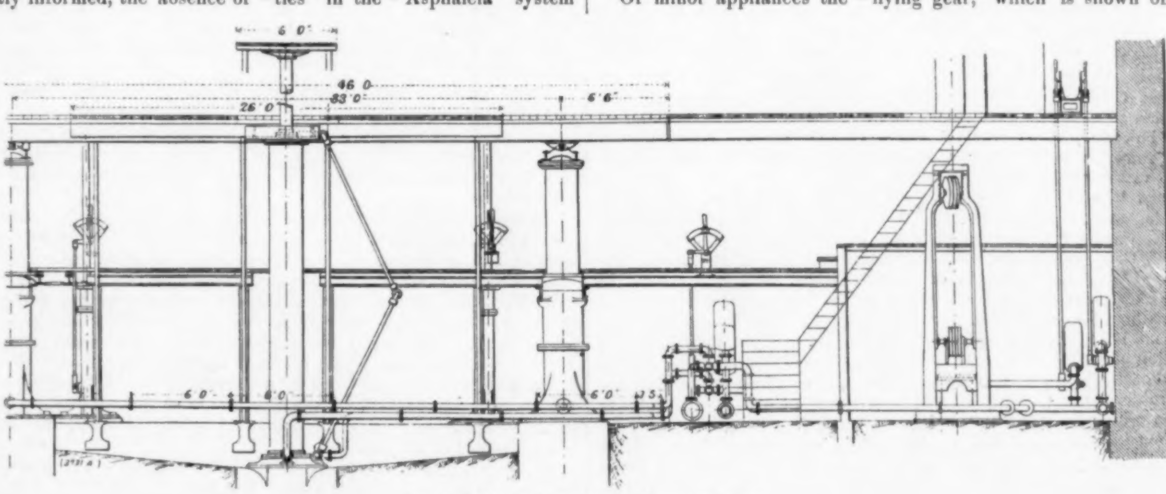


Fig. 4. Asphaleia Stage in the Chicago Auditorium.

is by no means as satisfactory as the promoters would have it. Each slab or *coulissengasse*, when in its usual position, forming part of the stage floor proper, has a remarkable tendency for vibration, so that the makeshifts of wood struts and cords have frequently been employed where a regular movement, such as a dance or march, etc., takes place. Protracted regular movements are almost impossible.

In respect to the "top machinery" of the Buda-Pesth example, though perhaps not generally acknowledged to be of equal interest as the "under-machinery" of an hydraulic stage, to my mind in this instance it takes a position of equal importance in the system. The whole of the top machinery is practically supported by two main lattice girders running from front to back of the stage, parallel to the side walls, and only about 2.3 metres away from the latter. There are five secondary lattice girders resting on these two, and running parallel to the proscenium curtain. The two sections shown amongst our illustrations distinctly show the arrangement. Why the five girders do not rest on the side walls direct I am unable to explain, for these are over one metre thick at the top, and should be able to carry a considerable weight. The two principal girders appear quite unnecessary, unless there was a distinct purpose in transferring the weight of the "top machinery" to the front and back walls. It is, however, plain, as already stated, that the two principal girders practically support the whole of the upper appliances, and these in the first place comprise a system of 416 pulleys of 104 "battens" with 104 sets of roping or "wires." These 104 sets are worked by 36 small hydraulic rams placed on the left wall when looking "up" the stage. Pulleys, sets of roping, and the hydraulic rams are shown on our engravings. The battens, it will be seen, are in each case fastened at three points only about 6 metres apart. There is one hydraulic ram to every three battens. The roping is wire cable of 7 millimetres diameter. The whole of the hydraulic rams are worked from a set of levers on two switch-boards in the front part of the stage, where there is a small raised gallery fitted for the mechanic.

In respect to the working of the "horizon" referred to above, I would only add that the canvas is hung from 13 points running over 39 rollers, the roping or wires being gathered together in such a manner that the appliance can either be bodily raised or lowered by means of an hydraulic ram. The whole "horizon" can be taken "up" out of sight, as the dimensions of the design allow for raising the bottom hem of the canvas to 8 metres above the stage-floor level.

Of minor appliances the "flying gear," which is shown on the sections, is, perhaps, considered the most interesting. It allows the clever imitation of flying movements in curved sweeps.

It is not my intention to describe technical details. There is but little that is complicated even in advanced stage-mechanism, the principles of the various designs being the main points at issue, and not the methods of execution. Given certain requirements and the basis on which they are to be fulfilled, the engineer will, as a rule, find no great difficulty in solving his problem if he is versed in stage-mechanism. The "programme" for the design will, however, be hard to determine, not only for any one class of playhouses, but more particularly for each individual example, owing to the very different purposes stages are put to, not only on the Continent, but also in this country. It would, for instance, not be easy to find another theatre in which exactly similar requirements would be made, as in the case of the Opera-House at Buda-Pesth under consideration.

In the case of the "Asphaleia" at Halle I quoted at some length the opinions of Herr Richter, the engineer who had had considerable experience in working the appliances of the German example. I should now also quote the opinions of the engineer in charge of the "Asphaleia" stage at Buda-Pesth, were it not for the fact that on examining my notes, I find there is a wonderful similarity in the criticisms of this expert with those of Herr Rudolf, the engineer of the Vienna Opera-House, whose comments I also recorded in a former article. Reference to Herr Rudolf's remarks will suffice to explain the views of the Buda-Pesth engineer, M. Christofani, whose opinion in this instance carries even greater weight than that of his Vienna *confrère*, owing to its being founded on practical experience, due to being in charge of the appliances under consideration. There is one point, however, on which M. Christofani's views are distinctly severer than Herr Rudolf's, and this refers to the acoustic disadvantages of the "Asphaleia" stage. He states that the resonance of the Buda-Pesth stage is most disagreeable, and that he can only prevent his stage from being useless by hanging a large number of extra cloths to his "gridiron" to make the rendering of a play possible. These extra cloths are a source of danger in the case of an outbreak of fire, and he recognizes them as such. We here have an instance of one of the principal advantages of the "Asphaleia" stage as described in the syndicate's prospectus as being entirely annulled, for we find exactly the opposite to the much-advertised statement that there need always only be a minimum of inflammable material at the "back of the house." There is, no doubt, less wood in the "Asphaleia" stage, but, on the other hand, more canvas, and the noxious fumes of burning canvas are even more dangerous than those from burning timber.

It is not my intention to lay special stress on the various defects of the system under consideration, for, as I have already remarked, the stage at Buda-Pesth and the "Asphaleia" system generally were the pioneers of the "Stage Reform" movement, and we are indebted to the enterprise of the syndicate for the great progress made of late in stage-construction. It is by no means remarkable that the first examples of a new system should show considerable defects. Nevertheless, where promoters use such high-flown language in the laudation of their wares, and promise so much that their appliances are unable to fulfil, it is essential to point out faults in a more decided manner than would otherwise be the case. The prospectus of the syndicate, which was given at some considerable length in a former article, produces a too highly-colored view of the advantages of the "Asphaleia" system. The following recapitulation of defects should be read in connection with it.

In the first place, the great risk of fire, so evident on all stages, is only partially lessened, for while the risk of conflagration is minimized so far as the catching alight of structural parts is concerned, the necessary greater storage of canvas on the top machinery is a source of danger. The great heat of a large quantity of burning canvas would, on the one hand, involve the speedy collapse of the girders and main structural parts of the design, whilst on the other hand, as already said, the noxious gases are particularly disastrous in their effect on the audience. In the second place, the acoustic properties of an "Asphaleia" stage are far from satisfactory, even if the makeshift of canvas storage, just referred to, is applied. Thirdly, the division of the stage floor does not allow the scenic artist sufficient scope to fulfil the requirements of a well-mounted play. Considerable use has to be made of the old makeshift of movable platforms, etc. A fourth defect comprises the excessive centralization of the levers for working the appliances. The fact that the whole "top machinery" is worked from one point appears very satisfactory to the layman, but in reality, full control of the "cloths" becomes almost impossible, and the risk of accident is increased. Another serious fault consists in the want of elasticity in the construction of the traps as far as the risk of accident in the raising and lowering of artists is concerned. The mechanical appliances do not allow an accident to be easily averted, as in the case of the old wooden "trap." The want of rigidity of a stage floor supported by a few hydraulic rams becomes a serious defect directly plays are rendered which require large crowds on the stage, marching, dancing, or other regular movements. The last, though by no means least, important disadvantage of the "Asphaleia" stage to be here recorded is the excessive initial outlay, and the fact that there is by no means that saving of working-expenses so boldly advertised, whilst the depreciation of the value of the appliances is very rapid. Of course, I have only touched on the main features of the system for these criticisms, and not on any points relating to the actual construction.

Though I do not propose giving particulars of other examples carried out by the "Asphaleia" syndicate, I do not wish to omit mentioning that a stage has been set up according to their system at the Auditorium Building, in Chicago, which is well known to be one of the most interesting blocks in the United States. Here the movable part of the stage has a depth of 18.8 metres and a width of 14 metres, the depth being divided into six *coulissengassen*. Four of the *coulissengassen* can be moved bodily, whilst the other two can only be raised and lowered in parts, and it appears that the levers in this case are all placed in the first "mezzanine." The various sections can be raised as much as from 12 feet to 15 feet above the stage-floor level. The reservoir which supplies the necessary power for the hydraulic rams is in the well known tower 200 feet above street level. I have added two diagrams (Figs. 3 and 4), to explain the principal features of the under-machinery. They show that the design is very similar to that of the example already given. It would lead too far to go into detail in respect to further examples of the same type, whatever small variations each may show. The Buda-Pesth and Halle examples are not only typical, but also the best specimens of the "Asphaleia" system under consideration.

I must now pass on to designs evolved from or based on the "Asphaleia" system. Stages thus executed are frequently known as "Bastard Asphaleian," but I shall prefer to not use this name, for, among other reasons, comparison of dates and facts have, for instance, shown me that much that is attributed to being directly evolved from the "Asphaleia" system has been designed quite independently of work done by the syndicate, and has even been designed at an earlier date than the formation of that company. The stage of the Hofburg Theatre at Vienna must have been planned (if not partly constructed) considerably earlier than the important date in September, 1884, when the appliances of the first "Asphaleia" stage were set in motion at Buda-Pesth Opera-house.

## ELECTRIC RULES.

THE architects of the country are familiar with the National Code of Rules for Electrical Construction and Operation principally through their publication and dissemination by the National Board of Fire Underwriters, and have often been perplexed and annoyed by the want of uniformity between them and municipal and other codes, and have found them, as was natural, illogically arranged and containing requirements which belonged to the earliest stages of the use of electricity, which had become obsolete with the advance of the science and growth of invention.

To remedy this condition an invitation was sent out, about a year ago, for the appointment of delegates to a "Joint Conference of Electrical Insurance and Allied Interests looking toward the adoption, promulgation and enforcement of uniform rules of electrical construction and operation." The first meeting of this Conference was held March 18 and 19 of this year at the headquarters of the American Society of Mechanical Engineers in New York, at which a large amount of work was done, and after organizing as the "National Conference on Standard Electrical Rules," with headquarters at 12 West Thirty-first Street, New York, it was decided to place the work of draughting the final Code in the hands of a Committee of eight, including the President (*ex-officio*). This Committee consisted of the following gentlemen:

Professor Francis B. Crocker, Chairman, Delegate American Institute of Electrical Engineers; Frank R. Ford, Secretary, Delegate American Street Railroad Association; William Brophy, Delegate National Electric Light Association; William H. Merrill, Jr., Delegate National Board of Fire Underwriters; E. A. Fitzgerald, Delegate Underwriters' National Electric Association; Alfred Stone, Delegate American Institute of Architects; E. V. French, Delegate American Factory Mutual Insurance Companies; W. J. Hammer, (*ex-officio*).

This Committee met in New York in October and spent two days upon the preparation of the Code, and assigned to each member of the Committee a certain portion of the rules for further consideration, with instructions to each to codify the portion referred to him and to send the same to all the other members for criticism and suggestion.

These rules were then taken up at a meeting of the National Board of Fire Underwriters, held in New York from Monday, December 7th, to Thursday, December 10th, inclusive, to which had been invited a number of electrical engineers and experts. The rules were then very carefully considered and reviewed, and elicited much discussion and not a little criticism, resulting finally in the adoption of nearly all of the suggestions of the Committee of the Joint Conference, and a plan for their rearrangement.

They were then considered by a Committee of Underwriters, the electrical experts and the entire Committee of the Joint Conference in New York on Friday, December 11th, and received the unanimous support of all present.

These rules, as finally adopted, will be printed as a National Code, and will be issued by the National Board of Fire Underwriters and other bodies to give information on electrical construction and operation, and the several societies which have sent delegates to the Conference will be asked to endorse or adopt them.

The work thus accomplished by the Conference with the co-operation of the National Board of Fire Underwriters will, it is expected, be of great assistance to architects, who will now have a positive and uniform standard of rules to which they can confidently specify that all work shall conform, resting assured that they will, if lived up to, result in satisfactory, up-to-date work, fulfilling the requirements of safe construction and the best electrical practice.

## BOOKS AND PAPERS.

THE man who asserts that the book he has written was intended "to show that the history of architecture is a study of absorbing interest" has made use of a most dangerous adjective, since it is sure to challenge the critic's attention and turn his attention somewhat to the discovering whether or no the book before him has really absorbed him. Ordinarily speaking, writers on architectural history generally succeed in being prosy in style, for it is almost inevitable that a writer who undertakes to describe the genesis and development of schools and styles, one after another, should fall into a somewhat see-saw use of words and phrases as he approaches and then leaves behind him the correlative *indicia* of succeeding architectural developments. This is especially likely to be the case where the writer attacks his subject analytically from within, deducing his causes from the resultant facts, while it is less likely to be the case when he approaches his field and works it synthetically, establishing first his causes, after an exposition of the contemporaneous manners and customs, and showing how certain requirements of the civilization of the day were satisfied by the architects and artisans charged with the task.

We believe it will be conceded that the writer who adopts the second method rather than the first more easily achieves such success as lies in producing so living a picture that its mere depiction holds the reader's attention, since, feeling for the time being a contemporary with the workers, as he has been made to feel their needs, their manners, their aspirations, he readily understands their difficulties and sympathizes heartily with their successes, or laments as sincerely over their failures.

Those who have had the pleasure of hearing Mr. Sturgis talk or lecture know with what breeziness of manner and affluence of words he can hold his listeners' attention, and will feel, as we did, that if any one can write an "absorbing" history of architecture, he is as likely to be that man as any other in this country. In a very considerable degree he has succeeded in doing this, and if one cannot fairly say that he has difficulty in laying the book aside because of an interruption, he can, at least, say truthfully that the book can be read without a sense of weariness, in spite of the fact that the subject is approached from the inside rather than from without.

In a very marked degree is the book [1] the production of an architect, as distinguished from a book treating the same subject as it might have been presented by an artist, an archæologist, or a mere *littérateur*. With singular and commendable tenacity of purpose Mr. Sturgis has never once lost sight of the architect's true interest and purpose: his creations must be built; must be built with the ordinary building materials, and must be built to stand and endure the assaults of time and weather, and withstand internal and external strains and stresses. He approaches his subject in the spirit of the constructor — a Gothic, and therefore a scientific, constructor at that — and in his examination refers every accomplishment to its proper structural basis, so that the reader feels the assurance that every link in the chain of development has been properly tested before it is allowed to bear the weight of the other links that are going shortly to depend upon it.

As the book is devoted entirely to a consideration of European architecture, the reader is spared the usual introductory chapters, that describe with great obscureness the art as it was practised in various uninteresting — because obsolete and non-modern — countries of Asia and Africa. The architecture of the Greeks and of the Roman Empire is covered with a sort of hop-skip-and-a-jump movement in about one hundred pages. In this portion of the book the writer's style is so simple and so lucid that the reader involuntarily asks himself whether it is a school-book for children or for the most superficial of amateurs that he has before his eyes. In this part of the book occurs a stylistic peculiarity that calls to mind the author's eagerness when speaking. Instead of using, as illustrations to point his morals, the buildings that are generally mentioned — so often that it must be quite common to believe that they alone illustrate the points under discussion — Mr. Sturgis adopts the refreshing innovation of using the less well-known buildings to substantiate his assertion. This course might be held a bit pedantic were it not for the breathless eagerness with which he piles Pelion on Ossa. He seems to be saying: "Yes, this building exhibits the point, and then there is another one here and another one there,— and hold on a minute, don't interrupt, there's another yonder and still another over beyond." It may have the air of pedantry, but is really good-natured eagerness to share with others the results of much reading and acute examination. But what is pedantry, and of a form which is to us extremely offensive, is his yielding to the modern fad that is seeking to introduce into English literature the Græcizing of geographical and biographical names that for centuries have stood in our literature in their Latinized forms. It is discomfiting enough to have a writer indulge this fad, but it only excites one's desire to ridicule to find how seldom can a votary of this absurdity write a dozen pages and be thoroughly consistent. Mr. Sturgis has been quite as successful as others, but no more. He sometimes writes "Samothrace" and sometimes "Samothraki," sometimes it is "Xanthus" and again "Xanthos." The same lack of persistency in adhering to a definite form of nomenclature appears later in the book, where a reference to "St. Paul's outside the walls" (lower-case o and w) is followed not long after by a mention of "S. Lorenzo Fuori le Mura" (upper-case F and M). It is hard to be consistent in intention, and proof-reading is not an easy art, but the large type and double-leaded lines used in this book make these trivial slips rather conspicuous.

While the estimable qualities of Greek and Roman architecture are clearly and logically explained, and while the reader has as yet no inkling that the writer's personal interest centres rather on the Gothic period, he becomes aware of certain omissions of things that might be expected to have a place in a book that makes its appearance in this current year. In some sense, the writer's own words offer an explanation of these *lacunæ*, where he says that "Roman archæology, in the sense of the study of the whole Empire, and not of the city and its surroundings alone, is still in its infancy, but it is probable that if the civic buildings of the third and fourth centuries, from Britain and Mauritania to the Euphrates, were compared and their dates ascertained by inscriptions and by the comparison of one with another, it would be recognized that a late Roman imperial style was in full process of formation." Realizing that there was, perhaps, a general lack of information as to the imperial work done in the outlying countries, Mr. Sturgis has evidently sought to afford a remedy for this state of ignorance by drawing an unusual number of his cited examples from the outskirts of the Roman Empire. In so doing, he has somewhat lost to sight the archæological discoveries that have been made in Rome itself. Thus we find in the description of the Pantheon no mention of M. Chedanne's interesting discoveries as to the method actually employed in building the great dome, or of the no-less-clever deductions by which he establishes the fact that the present portico is but the abbreviation of a former octostylar one. Nor in the description of the Theatre of Marcellus is any mention made of the measurements by one of the recent American travelling-scholars which establish quite a different proportion for the orders used from that which has usually been assumed for them. To be sure, these slight omissions do not establish either ignorance or carelessness; they do but prove that the study of archæology, not only in Rome, but elsewhere, is in its infancy, but growing with a vigorous development which produces continued surprises and traps for unfortunate writers who are handicapped by the length of time which elapses between the writing of a statement and its public appearance in print.

In innumerable places the writer has very happily expressed himself, and in so doing has exhibited the purely architectural — that is, structurally speaking — bent of his own mind. As for instance, when he writes: "It is a curious result of this [the habit of building first and ornamenting afterwards] that Roman architecture has prevailed over the European world ever since 1550 (in Italy since 1450), and that the architects generally have liked nothing so much; while the archæologists of art, being students of the refined and expressional in sculpture, and caring little for building and for the stately and the vast, give all their attention to Grecian remains. Less is known of Roman than of Greek architecture, although the Roman remains are more abundant, and are scattered over the Mediterranean world, and even as far north as England and North Germany." This expansion was due to, and ceased with, what he styles the "irresistible supremacy of the imperial officials."

Writing his work in the second method (that is, from the outside), examining the causes and then stating the results, many a writer at this point would have introduced a very interesting historical chapter, but with praiseworthy singleness of purpose our author leaves all such sociological changes to be inferred and accepts downfall and dissolution on the evidence of their structural remains, and mourns the passing of a great race of builders, and of artists, so far as the workers of the Eastern Empire are concerned, only by declaring that it is "a strange and not perfectly explained process of decay, this of the artistic power of a whole world of men."

While he evidently has great respect for the achievement of the Romans, it is the work and logical reasoning of mediæval craftsmen that most command our writer's regard and commendation, and to them and their work he has devoted the greater portion of his space, and has treated the rational development of Gothic styles with admirable simplicity and perspicuity. From the outset he makes it clear that those who developed Gothic styles worked as builders and not as ornamentalist artists. As he says: "To thoroughly enjoy the architecture of a French cathedral, one must have the natural or acquired sense of organism. The structure before him must appeal to his sense of what is perfectly understood and well thought out as a system of building, or he will find it too complex." Here, as elsewhere, like a good teacher of figure-drawing, he insists on his pupils' having a full working knowledge of structural anatomy. He goes on to say that "Italian buildings, with their unconsidered, careless structure, as of a style only half understood and not thought important to study out; with their broad sun-lit surfaces of plain wall and their beautiful details, set here and there as if by accident, will please such an art student better than the perfections of Bourges Cathedral or the Sainte Chapelle."

Of this Italian work he speaks elsewhere in the same fair-minded, but seemingly rather slighting way, saying that "the Italians have

[1] "*European Architecture.*" An Historical Study by Russell Sturgis, A. M., Ph. D., F. A. I. A., President of the Fine Arts Federation of New York; Past President of the Architectural League of New York; Vice-President of the National Sculpture Society; Honorary Member of the Mural Painters, etc. New York: The Macmillan Company, 1896. Price, in cloth, $4.00.

never been an architectural people in the highest sense. No great style of architecture has originated in Italy; nothing that can compare with the Greek or the Byzantine, early Egyptian or Gothic. An artistic race is not necessarily great in architecture, nor, on the other hand, are good builders necessarily good architects." This last statement we commend heartily to the attention of numberless American practitioners.

Yet, while the structural qualities command his chief regard, Mr. Sturgis admits that architectural results based on other than structural requirements are often deserving of admiration, for he says: "It appears that the architecture of construction and organization, of reason and logic, of perfect proportion and harmony of part with part, is but one, and that there is also the architecture of huge masses, hardly organized, piled up without much reference to the significance of their parts, roofs and walls thought satisfactory if they give shelter, and then adorned richly with what the arts of color and of form can give after the construction is finished."

Taken all in all, the book is an enjoyable one to read, and if clearness and simplicity of statement, an agreeable style and a capacity for introducing philosophical reflections that have something of the ring of real philosophy about them, if such things go to constitute a book that has proved that the "history of architecture is a study of absorbing interest," then this writer may fairly assert that he has proved his point.

The book is somewhat weak in the matter of illustrations, for though there are more than two hundred and fifty text-cuts and though they properly illuminate the writer's several statements they all — with the exception of those borrowed from Viollet-le-Duc and other well-known sources — have the appearance of being the work of amateur performers, or of draughtsmen whose sense of line has become deteriorated through working over photographic salt-prints. Still, such as they are, they are useful and the credit of the several draughtsmen who have been associated in the work has been carefully preserved in a most elaborate index of illustrations. The book also has a fair index and an admirable glossary of terms — terms that are actually used by the writer and of which it is well for the reader to have a precise definition close by his hand.

## BOOKS RECEIVED.

"*The Story of Architecture*": An Outline of the Styles in all Countries. By Charles Thompson Mathews, M. A., F. A. I. A., author of "*The Renaissance under the Valois.*" New York: D. Appleton & Co. 1896.

"*The Castles of England*": Their Story and Structure. By Sir James D. Mackenzie, Baronet of Scotwell and Tarbat. With forty plates, one hundred and fifty-eight text illustrations and seventy plans. 2 vols. 4to. New York: The Macmillan Co. 1896. Price, $25.

"*Berlin und seine Bauten.*" Bearbeitet und herausgegeben vom Architekten-Verein zu Berlin und der Vereinigung Berliner Architekten. With 2150 text-cuts, 18 gelantine plates and 5 maps. 2 vols. 4to. Berlin: Wilhelm Ernst & Sohn. 1896. Price, bound, 60 marks plus charges.

"*Etude des Ornaments.*" Dauphins, Écailles, Bucranes, Grecques, Guirlandes et Flots grecs. Par Jules Passepont, Professeur à l'École régionale des Arts et à l'École pratique d' Industrie de Sainte-Etienne. Illustrated with 651 text-cuts. Bibliothèque des Arts décoratifs, publiée sous la Direction de M. Victor Champier. Paris: Libraire J Rouam et Cie. 1896. Price, unbound, 10 francs plus charges.

"*Theatre Fires and Panics*": Their Causes and Prevention. By William Paul Gerhard, C. E., Consulting Engineer for Sanitary Works. New York: John Wiley & Sons. 1896.

"*A Text-book of the History of Sculpture.*" By Allan Marquand, Ph. D., L. H. D. and Arthur L. Frothingham, Jr., Ph. D., Professor of Archæology and the History of Art in Princeton University, being No. III of the "*College Histories of Art,*" edited by J. C. Van Dyke, L. H. D. New York: Longmans, Green & Co. 1896.

"*The National Electrical Code*": An Analysis and Explanation of the Under-writer's Code intelligible to non-experts. By Pierce & Richardson, Electrical Engineers. Chicago: Charles A. Hewitt. 16mo. Price, in flexible leather, $2.

## SOCIETIES

### NEW JERSEY SOCIETY OF ARCHITECTS.

A MEETING of the New Jersey Society of Architects was held at 842 Broad Street, Newark, Friday, December 11th, President L. H. Broome in chair, George W. von Arx, Secretary.

The Constitution was amended so as to provide two vice-presidents instead of one, and five trustees instead of three.

The annual election of officers resulted in the following choice: *President,* —— Albert, Hoboken, N. J.; *First Vice-President,* Robert C. Dixon, Union Hill, N. J.; *Second Vice-President,* Paul Botticher, Newark, N. J.; *Secretary* and *Treasurer,* George W. von Arx, Jersey City, N. J.; *Trustees,* three-year terms, Charles P. Baldwin, Newark, N. J.; Thomas Cressey, Newark, N. J.; Benjamin F. Hurd, Newark, N. J.; F. F. Martinez, Jr., Bayonne, N. J.; *Hold-over,* Charles F. Zachau, Jersey City, N. J. The aforesaid officers constitute the Board of Governors. Next Board of Governors' meeting, December 22d, at above rooms.

GEORGE W. VON ARX, *Secretary.*

## THE ILLUSTRATIONS

[*Contributors of drawings are requested to send also plans and a full and adequate description of the buildings, including a statement of cost.*]

### REAR VIEW OF ALEXANDER HALL, FOR PRINCETON UNIVERSITY, PRINCETON, N. J. MR. W. A. POTTER, ARCHITECT, NEW YORK, N. Y.

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

THIS building, which is intended for the holding of Commemoration exercises, is the gift to the college of Mrs. Charles B. Alexander, of New York City, and was opened for use in June, 1894, after an expenditure of $250,000. The auditorium within will seat 1,500.

### THE ASPHALEIA STAGE IN THE OPERA-HOUSE, BUDA-PESTH, HUNGARY.

FOR a description of this stage, which is here reproduced from the pages of *Engineering,* see article elsewhere in this issue.

### LONGWOOD AVE. BRIDGE FOR THE PARK COMMISSIONERS OF THE TOWN OF BROOKLINE AND THE CITY OF BOSTON, MASS. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BOSTON, MASS.

### CHURCHES ON THE ISLE OF WIGHT AT SHOREWELL, FRESHWATER, AND BRIGHTSTONE. SKETCHED BY MR. A. B. BIBB, ARCHITECT.

### PULPIT IN ST. PETER'S, SHOREWELL, ISLE OF WIGHT. SKETCHED BY MR. A. B. BIBB, ARCHITECT.

### THE PETIT TRIANON, VERSAILLES, FRANCE. JACQUES-ANGE GABRIEL ARCHITECT.

**[The following named illustrations may be found by reference to our advertising pages.]**

### ACCESSORIES OF LANDSCAPE ARCHITECTURE, NO. XXXVII: THE TERRACE: ST. GERMAIN-EN-LAYE, FRANCE.

### ACCESSORIES OF LANDSCAPE ARCHITECTURE, NO. XXXVIII: AVENUE DES LOGES: ST. GERMAIN-EN-LAYE, FRANCE.

### THE PROPOSED NEW MARKET BUILDING, ST. LOUIS, MO. MR. LOUIS MULLGARDT, ARCHITECT. — THE COURT OF HONOR, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL.

**[Additional Illustrations in the International Edition.]**

### ENTRANCE PORCH OF ALEXANDER HALL, PRINCETON UNIVERSITY, PRINCETON, N. J. MR. W. A. POTTER, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print.]

### GABLE END OF SAME BUILDING, SHOWING SCULPTURES BY MR. J. MASSEY RHIND, SCULPTOR, NEW YORK, N. Y.

[Gelatine Print.]

THIS interesting and very unusual piece of decorative sculpture shows in life-size figures an allegorical treatment of those intellectual processes with which a great institution of learning naturally has to do. In the spandrels below the great rose-window are shown figures typifying "Study" and "Play." In the great horizontal supporting band is the seated figure of "Learning," supported on the one hand by the sciences — Language, Theology, Law, History, Philosophy and Ethics, and on the other by the arts — Architecture, Sculpture, Painting, Poetry, Music and Astronomy. The vertical series of panels upon the right typify Religion, while those upon the left represent Law. The sculptor's work was based upon the architect's sketches and suggestions.

### DESIGN FOR CASING CARFAX TOWER, OXFORD, ENG. MR. H. T. HARE, ARCHITECT.

BY a special Act of Parliament passed in 1890, the Oxford Corporation was empowered, on the vacation of the living of St. Martin, Carfax, to acquire the church for a much needed street improvement, the parish being united with that of All Saints. The Act also provided that the tower should be retained and maintained as marking an historic site. On the acceptance by the Vicar of another living last year, the Act came into operation, and the Corporation purchased the adjoining properties in order that the whole might be dealt with in a comprehensive scheme.

The church, which was rebuilt in 1820, was an uninteresting example of the Gothic architecture of that period, and has now been removed, together with the adjoining properties, which latter are now being rebuilt to new frontage lines. The only portion of the scheme remaining to be dealt with is the tower. The lower part of this, up to the belfry stage, has always been buried in the church, and is constructed of ancient rubble masonry of the roughest description, plastered over, and, therefore, concealed from view, and devoid of any architectural features. The belfry stage was remodelled some ten or twelve years ago, and, as the view shows, is of no interest architecturally. Having regard to the facts that the tower will now occupy a most important and conspicuous position at the western termination of the High-street, that the lower part has never been intended to be seen, and contains no features worth preserving, and that the upper story is modern in design and construction, I have considered it justifiable to propose the entire remodelling of the design in order to make it worthy of its position. This was proposed to be effected by casing the lower portion, and reconstructing the belfry stage. It is evident that some such repair must be done to the lower part to ensure its stability, and casing appears to be the only feasible method of dealing with it. These proposals were accepted by the Committee appointed, and recommended to the Council, who have, however, rejected the scheme by a large majority, and referred the matter back to the Committee with instructions to submit a scheme for the mere repair of the tower as it stands. This the Committee have declined to do, and have placed their resignation in the hands of the Council. For the present the question rests in this position, and there is every prospect that a fine opportunity will be lost through a mistaken antiquarianism. The accompanying illustration is copied from the *Builder*.

TOMB OF THE PELSER-BERENSBERG FAMILY, LEMIERS, HOLLAND. PROF. L. SHUPMANN, ARCHITECT, AIX-LA-CHAPELLE.

THIS plate is copied from *Architektonische Rundschau.*

TWO COMPETITIVE DESIGNS FOR A MONUMENT AT LYONS, FRANCE, TO PRESIDENT CARNOT. M. LEFEBVRE AND MM. HUGUET & DELORME, ARCHITECTS.

THESE illustrations are copied from *La Construction Moderne.*

"INDUSTRY": BY HUGO VOGEL.

THIS decoration is to be found in the Bank für Handel und Industrie, on the Schinkelplatz, Berlin, of which the architects were Ende & Böckmann. The illustration is copied from *Moderne Kunst.*

NEW PREMISES, LONDON & COUNTY BANK, WIMBLEDON, ENG. MESSRS. CHESTON & PERKIN, ARCHITECTS.

NEW SENIOR SCHOOL, WEST CALDER, N. B. MR. J. G. FAIRLEY, ARCHITECT.

## DUNWICH BENEATH THE WAVES.

THERE are few sections of the British coast-line which have been subjected to greater change and devastation than that of East Anglia, lying between Aldeburg and Lynn. Century after century, the sea has slowly but surely gained its victories over the land, and to-day carries on the siege with unabating energy. The East Anglian shores offer but a frail barrier against the swinging North Sea rollers, often but a narrow ridge of marram-grown hillocks of drifted sand lies between the fretting beach surf and low-lying marsh land, stretching inland for many miles. Already the ocean bed off Norfolk and Suffolk is strewn with the ruins of villages, towns and even cities that once were conspicuous landmarks of the coast, and fitted out many ships to fight their country's battles in England's early wars.

Between Southwold and Aldeburg on the Suffolk coast, in an out-of-the-way corner of the country, where the shriek and roar of the railway are as yet unheard, is a sparsely populated village of about two score cottages, all that now remains of Dunwich, the old-time seat of Government and capital of East Anglia. Once the largest and most flourishing city in Eastern England, the residence of kings, the see of a bishop, a seat of learning and a port of considerable trade, now its glory has departed, its palaces, churches, monasteries, streets and markets have disappeared beneath the waves. Before the Norman Conquest the sea had commenced its work of devastation, nor did it cease its siege when the ruin of the great city was accomplished.

There are grounds for belief that the old city of Dunwich stood on the site of a settlement of the Roman legions who conquered the Iceni and their queen, Boadicea. Subsequent to the Norman invasion it increased rapidly in population and prosperity. Of the importance of the place in the time of Richard I some idea may be gained from the fact that it was fined 1,000 marks for unlawfully supplying the king's enemies with corn, while Ipswich and Yarmouth, now two of the three principal towns in East Anglia, were only ordered to pay the sum of 200 marks each. In the reign of Henry II it was a town of good note, "abounding in much riches and sundry kinds of merchandises." At the beginning of his reign, King John granted a charter of liberties to the town, by which its inhabitants were allowed to marry their sons and daughters as they pleased, and to give, sell or dispose of their property as they thought fit. Under this same charter, which cost the men of Dunwich 300 marks, ten falcons and five gerfalcons, they were granted "all wrecks of the sea."

About this time Dunwich was probably at the height of its prosperity, and is described as a large city, with many roads, streets, public buildings and churches. The greater part of it stood upon a hill, the base of which was washed by the sea. Its town-hall was an imposing building, its port was crowded with shipping. In addition to numerous churches, it had monasteries of the Franciscan and Dominican friars, each with its own church. In the reign of Edward I, Dunwich sent two members to Parliament.

All this time the sea was carrying on a ceaseless and irresistible siege of the coast. Each succeeding winter saw fresh breaches made in the sand dunes between the beach and the marshes, and frequent falls from the crumbling cliffs. On the night of January 1, 1286, a violent storm wrought great havoc upon the borders of the town. The sea made extensive encroachments and several churches were submerged. During the next twenty years more than four hundred houses collapsed. Later on, the church of St. Leonard disappeared, and before the end of the century two other churches were undermined by the waves. St. John the Baptist's was the next to go, to be followed before the year 1609 by the chantries of St. Anthony, St. Francis and St. Catherine. By this time two of the city gates, the South Gate and the Golden Gate, had been washed away, and only about a quarter of the old town was left standing. The church and buildings of the Knights Templar disappeared during the reign of Charles I, and in 1677 the sea reached the market-place, when the townsmen sold the materials of the old cross. At the beginning of the eighteenth century the gaol fell a prey to the sea, which, in 1729, destroyed the last traces of the church-yard of St. Peter's, the church having previously fallen over the cliffs.—*Pall Mall Gazette.*

## NOTES AND CLIPPINGS

MODEL OF THE EGLISE DU SACRE-CŒUR.—Two of the workmen engaged in the erection of the great church of the Sacré-Cœur at Montmartre have been occupied during fourteen years in preparing a model, on a scale of one-twenty-fifth, of a longitudinal section of the building. It is four metres in length and a metre in width. The model is complete with the exception of the central dome and the bell tower, which is to be 100 metres in height. It is to be among the contributions to the Exhibition of 1900.—*The Architect.*

OPORTO A VERY UNHEALTHY CITY.—According to the figures published in a local newspaper, Oporto holds the unenviable distinction of being the most unhealthy city in Europe, a statement (writes Mr. Hay-Newton, the English consul) which no one who has walked in its streets will have much difficulty in believing. The sanitation of the city is a subject which, nevertheless, would appear to have been for a long time neglected, but it is a matter which is now receiving some attention from the press, and it is hoped that something will shortly be done to provide the city with a proper system of drainage, owing to the fact that the municipal chamber have now at their head a gentleman of well-known scientific attainments and noted for his energy and administrative capacity.—*St. James's Gazette.*

HYDRAULIC POWER FOR CITY SUPPLY.—The distribution of hydraulic power in London is the biggest thing of its kind in existence. It is not only unique in the sense of being the largest distribution of power from central stations in any city in the world, but it is, excluding smaller installations in other cities, the only instance of a power distribution which furnishes exclusively a power supply. In other systems, viz, gas, electricity and steam, the main intention is to supply light and heat, the supply of power being only subsidiary. Even the compressed-air supply in Paris, which is the nearest in idea to the hydraulic supply in London, is dependent largely upon its lighting business. Hydraulic power in London and other cities is also interesting in another way, in so much that it depends not only exclusively or mainly on the supply of power alone, but that the supply was originally intended to serve and is, in fact, almost entirely used for one special class of business, viz, that of lifting. The lowest rate charged for hydraulic power in London is 1*s.* 6*d.* per 1,000 gallons. The pressure is 750 pounds per square inch, so that each 1,000 gallons contains 8.738 horse-power hours of energy; 1*s.* 6*d.* per 1,000 gallons is, therefore, equivalent to, say, 2*d.* per horse-power hour. It is only the largest hydraulic plants, pumping 20,000,000 or more gallons per quarter, which are capable of pumping at this cost, if to the actual pumping expenses are added the interest and depreciation on the capital value of the plant and the value of the space occupied by it. The largest private pumping plants existing in London are at the railway goods-depots, and at one of the principal and most modern of these depots, at which over 100,000,000 gallons per year are pumped, the pumping cost, exclusive of interest and other charges, is 9*d* per 1,000 gallons, and the total cost would be very little, if at all, below 1*s.* 6*d.* per 1,000 gallons. —*E. B. Ellington in Cassier's.*

End of an Archæological Quarrel.—After ten years of antagonism, Flinders Petrie has become reconciled with the Egypt Exploration Fund Society, accepted a place on its committee, and is going to work under its auspices. He declined at a recent meeting to disclose the scene of his next excavations, but it will be in a hitherto untouched region and connected with the period of the Libyan invasion that took place 3,000 years before the Christian era.—*N. Y. Times.*

Attendance at European Universities.—German universities ranked as follows, regarding the number of students last summer: There were 4,649 in Berlin, 3,777 in Munich, 2,876 in Leipsic, 1,863 in Bonn, 1,425 in Breslau, 1,415 in Halle, 1,379 in Freiburg, 1,339 in Würzburg, 1,172 in Tübingen, 1,164 in Heidelberg, 1,138 in Erlangen, 1,007 in Göttingen, 965 in Marburg, 948 in Greifswald, 938 in Strassburg, 761 in Jena, 708 in Kiel, 700 in Königsberg, 630 in Giessen, 500 in Rostock, and 420 in Münster.—*N. Y. Evening Post.*

The Iron Rings of 1813.—A great inquiry is now being made in different German towns for the iron mourning-rings of 1813. The history of these curious memorials of German patriotism may not be generally known. During the national awakening against Napoleon in 1813, the princesses of the royal house made an appeal to the people for the sacrifice of personal ornaments, not unlike that made by the Long Parliament at the beginning of our civil wars. Gold mourning-rings were consequently sent in immense numbers to the treasury in Berlin, and each sender received in acknowledgment an iron ring upon which was inscribed, "Gold I give for Iron." From Swinemünde alone no fewer than 114 gold rings were sacrificed to the Fatherland, and iron rings sent thither in exchange. Specimens of these iron rings are now worth more than their weight in gold.—*Westminster Gazette.*

Eating a Church.—Bishop Williams, of Marquette, was recently invited to serve his alma mater, Cornell University, as university preacher. He did so, coming straight from the Synod of the Canadian Church at Winnipeg and bringing this story with him: "There was a missionary Bishop there," said Bishop Williams, "who had been six weeks in coming, most of the way by canoe. He rose and began by saying that he would speak for himself and for a brother Bishop, who, unfortunately, could not be present. He was sorry to say that his brother's diocese had gone to the dogs! A general gloom followed these words. He went on to say that the Bishop had found so many inquiries after religion among the Esquimaux north of Hudson Bay that he had to build a church. As there was no wood he used whales' ribs for rafters, covering them with tanned walrus hide, and so made a church to hold eighty persons. 'All went merry as a marriage bell' for a time, until—the dogs grew famished and ate the church."—*Troy Times.*

Buried Cities in Central Asia.—The Norwegian traveller, Sven Hedin, has contributed to a German Journal, *Globus*, an interesting account of his journeyings in Central Asia in the district north of the Kwenlung Mountains. Ruins of large towns were discovered which had been buried by successive sandstorms spreading over a thousand years, hence very modern from a Petrie point-of-view. Separate houses were uncovered of very fragile construction, consisting of wooden pillars, while the walls were put together of plaited reeds covered with mud. The latter were rendered at once impervious and suitable for decoration by being coated with white plaster. Drawings were discovered on these walls, and well executed, of human figures, horses, dogs, and flowers, and judging by the copies which have been brought back, of no small artistic merit. Small figures of Buddha were also dug up, as well as various fruit trees which told a tale of the bygone days when this arid surface was once made fertile by the waters of the River Kerija.—*Exchange.*

Ventilating the New Memorial Church in Berlin.—The ventilation of a large number of churches is notoriously bad, and bad ventilation has frequently more to do with sleepy congregations than even the dulness or the length of the sermon. Wide interest has been created by the description of a new departure in the system of combined warming and ventilation introduced by Professor Fischer, in the new Memorial Church at Berlin, Germany, which in its general plan resembles St. Paul's Cathedral, in London. To the height of 80 feet from the floor the walls are traversed by hot-air chambers, so that from the ground to the galleries, 22 feet above, there is no perceptible difference of temperature, the air being kept constantly at 15 degrees Cent. (60 degrees Fahr.). The aim of the engineer has been the removal from the space occupied by the congregation of the paths followed by the currents of air conveying the warmth from the sources of heat to the radiating-surfaces by placing the heating-apparatus high up in the neighborhood of the cooling surfaces, maintaining, in reversal of the usual procedure, a higher temperature in the upper portion of the building, and intercepting and reheating the cooled air in its descent toward the lower part occupied by the congregation. There are thus four strata of air of different temperatures. Professor Fischer maintains that the system of heating the upper more than the lower regions of the air is the only proper course in such lofty buildings as churches, for whereas with the ordinary method the air heated on or below the ground-level is cooled on reaching the roof and, fouled by the products of respiration, descends again onto the heads of the congregation, unless withdrawn by an exhauster, in his system the fresh air is warmed to an agreeable temperature in its passage through the channels in the walls. Furthermore, its ascent is encouraged by its being led through two sets of heating-coils. In the dome there is a third set of coils, which, although they do not contribute to the warming of the parts occupied by the worshippers, serve effectually to prevent the descent of the foul air by promoting its continued ascent toward and escape through the apertures in the lantern that crowns the edifice.—*St. Louis Globe-Democrat.*

Artesian Wells in Kansas.—Artesian wells, instead of being expensive luxuries, are cheaper than pumps in the Great American Desert—an elliptical oasis, of which one focus is at Wilburn, Kas., and another at Meade, its long axis being formed by Crooked Creek, a winding stream. This little lozenge-shaped district is probably the best-watered portion of the earth's land surface. So easily is water attainable that a farmer may have artesian wells all over his property and at any spot on his premises he pleases—none needing to be more than fifteen or twenty feet deep and none costing more than fifty dollars. Of such wells there are over two hundred and fifty in the district, yet so unintelligently is the water-supply managed, that in nearly every case the greater part of the flow simply runs away into Crooked Creek. A few of them yield forty-five gallons a minute; others, from twelve to twenty; the majority grading on, down to eight or ten gallons. The total amount yielded would submerge 12,000 acres a foot deep every year.—*Fire and Water.*

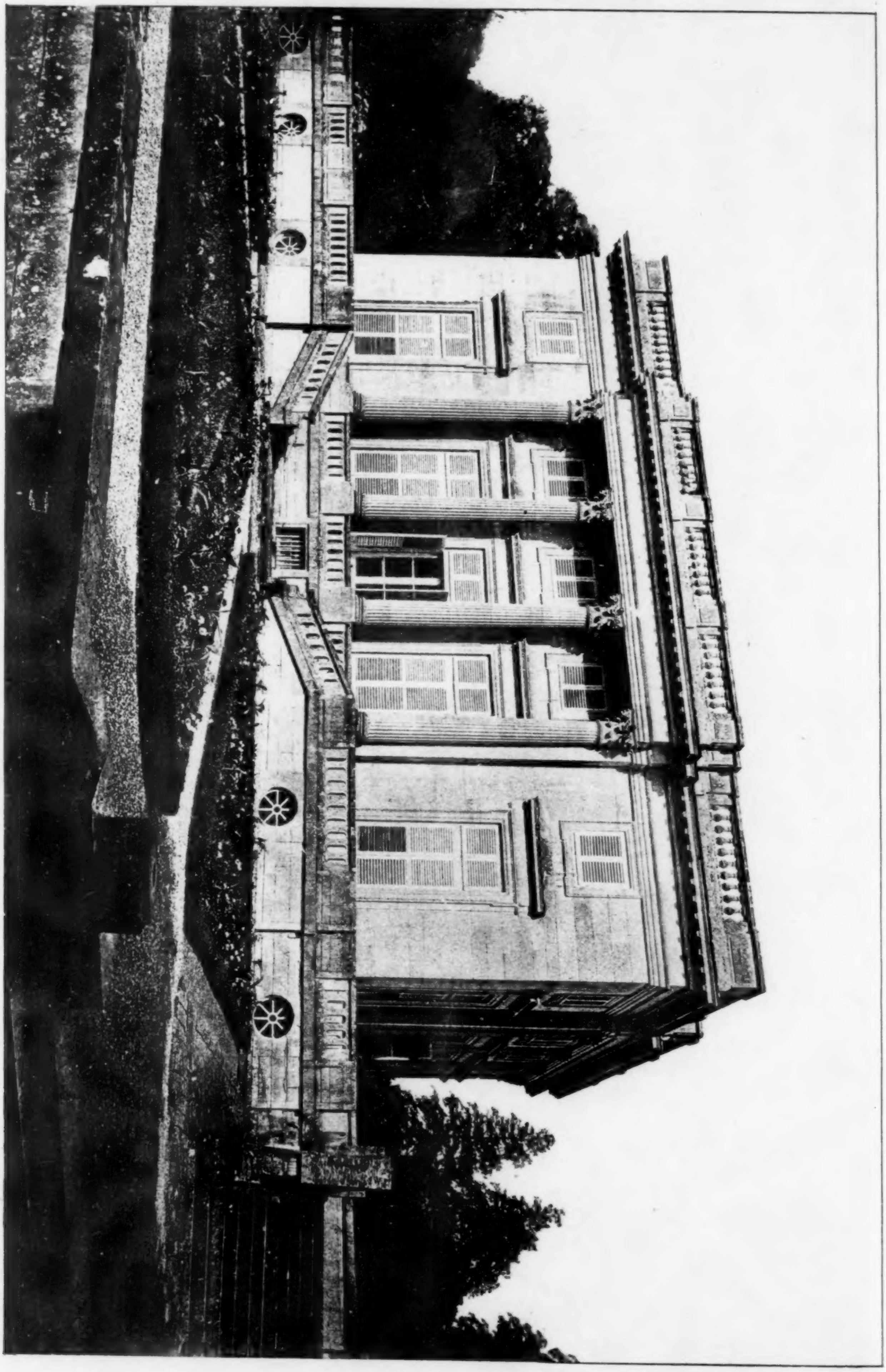
The Destruction of Architectural Landmarks.—At the recent meeting of the Royal Institute of British Architects, held at London, the President, Professor Aitchison, inveighed against the destruction of so many notable architectural landmarks in England. He said: "To wantonly destroy these built records was worse than to burn unpublished written records. 'The accursed greed of gold' was, however, destroying all the virtues of our people, as it did those of the Romans, and making it hold nothing as sacred where gold was to be got by its destruction. The beautiful Hanover Chapel, in Regent Street, designed by C. R. Cockerell, the most refined and accomplished of modern English architects, was now being pulled down to make way for shops, which paid heavier rates and taxes. The magnificent Church of St. Mary Woolnoth, the masterpiece of Nicholas Hawksmoor, and a proof of the former piety of London, was threatened with destruction for a railway station. If this ignorance of the value of architectural monuments were not dispelled, and the greed of gold continued, those who lived long might witness the conversion of St. Paul's Cathedral and Westminster Abbey into railway stations!"

The Inventor of the Lucifer Match.—France is about to honor with a statue the man who did not invent lucifer matches. In 1830, it seems, M. Nicolet, professor of chemistry at Dole in the Jura, was illustrating before his class the explosive properties of chlorate of potash, when it struck one of his pupils, Charles Sauria by name, that a combination of phosphorus with the detonating chemical might furnish a far more satisfactory means of kindling a fire than the old flint and steel. He set to work upon the problem, and his experiments and those of his friends were attended with success. A year or two afterwards M Nicolet visited Austria, and gave the discovery away to German manufacturers. Without wishing to rob M. Sauria of the posthumous glory which appears to be the only reward of his ingenuity, patriotism compels us to claim the merit of being the real inventor for one of our own nation. Mr. Walker, of Stockton, by the use of chlorate of potash and sulphide of antimony, was making friction matches as early as 1829. Young Sauria very likely never heard of his process, but the Germans certainly did, and it was from his original idea that their trade sprang up and fructified.—*London Chronicle.*

Almshouses due to Racehorses.—During the ten years that the Duke of Portland was on the turf, he won the Derby of 1888 with "Ayrshire," and again in 1889 with "Donovan." In 1888, moreover, he won the Two Thousand Guineas race, and in 1889 the St. Leger. In 1890 he won both the Oaks and the St. Leger, and at the close of the season he was at the head of the list of the year's winners of stakes. These amounted to a very considerable sum, and at the request of the Duchess he devoted the entire amount of his year's winnings to the construction of a row of almshouses for the benefit of the widows of the Welbeck estates. These houses are models of architectural taste and of interior comfort, and are within easy reach of the Abbey, so that they are under the personal superintendence of the Duchess. On the central gable of the building runs the inscription:—"These houses were erected by the sixth Duke of Portland at the request of his wife, for the benefit of the poor and to commemorate the success of his race horses." Then follow the names of the latter as well as of the races which they won.—*Marquise de Fontenoy in the Philadelphia Press.*

One Way of Looking at Things.—"Gerrymandering" has become so prevalent in the United States, it is hard to say where the practice begins or ends. One testimony to its power is seen in the resolution passed at the Congress of the American Architects on October 22, viz, "That the permanent headquarters of the American Institute of Architects be located in the City of Washington at as early a date as is possible, and that the executive committee be empowered to make such arrangements as are necessary." It may seem strange for architects to seek a place where the principal industry is politics. But there is reason for the change. The architects have been trying in vain to obtain a change in the law by which non-official architects could be enabled to compete for designing Government buildings. It is supposed that by having the headquarters of the Institute in Washington there would be more facility for diplomatizing with congressmen. It is also contemplated to make the licensing of architects necessary, and influence in Washington would be of use for this purpose. Although the War, Navy and Agricultural Departments have instituted experiments on materials more elaborate than any known in Europe, there is a desire to persuade Congress to vote money for special tests under the direction of the Government architect, and that is not likely to be agreed to without perseverance in lobbying.—*The Architect.*

S. J. Parkhill & Co., Printers, Boston, U. S. A.

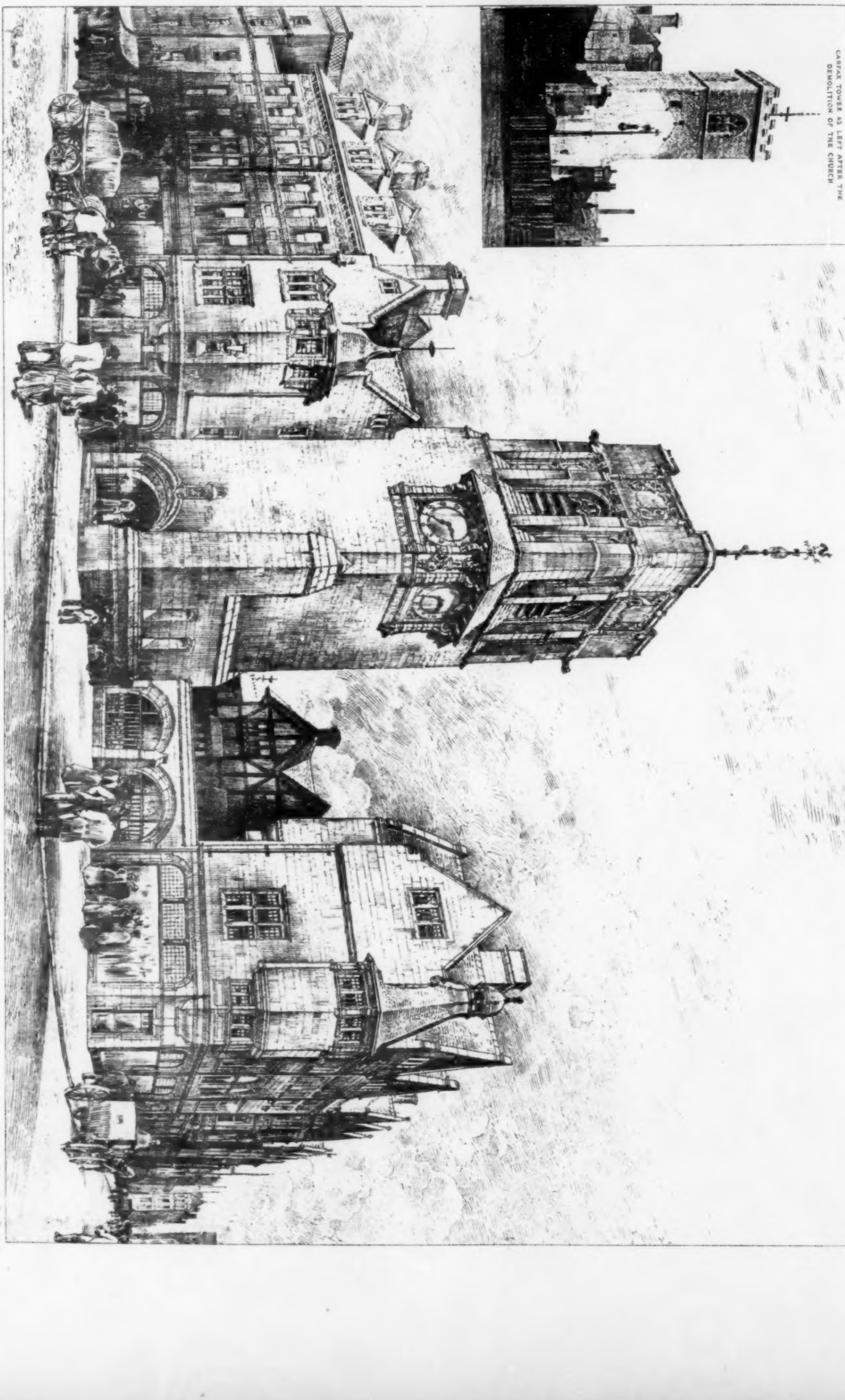


THE PETIT TRIANON, VERSAILLES, FRANCE.

J. A. GABRIEL, Architect.

No. 1095. American Architect and Building News, Dec. 19 1896.





From the Builder.

CARFAX TOWER AS LEFT AFTER THE DEMOLITION OF THE CHURCH

DESIGN FOR CASING CARFAX TOWER, OXFORD, AND TREATMENT OF THE SITE OF THE FORMER CHURCH &c

Mr H. T. Hare A.R.I.B.A., Architect

Moderne Kunst.


Heliotype Printing Co. Boston.

Hugo Vogel: Industrie.

AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 19 1896. No. 1095.



Grabmal der Familie Pelser-Berensberg in Lemiers (Holland); entworfen von Professor L. Schupmann in Aachen.

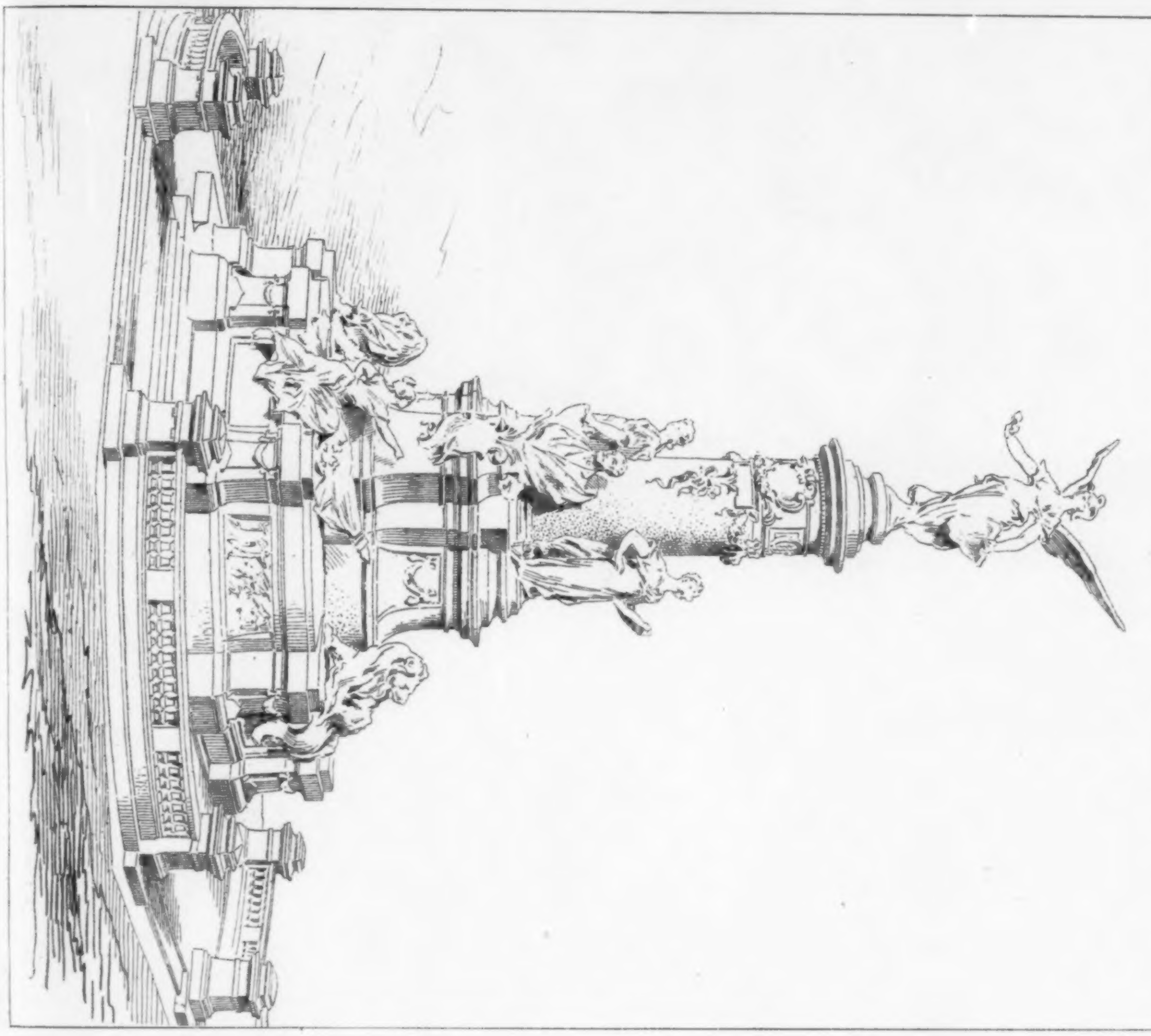
From Architektonische Rundschau

From La Construction Moderne

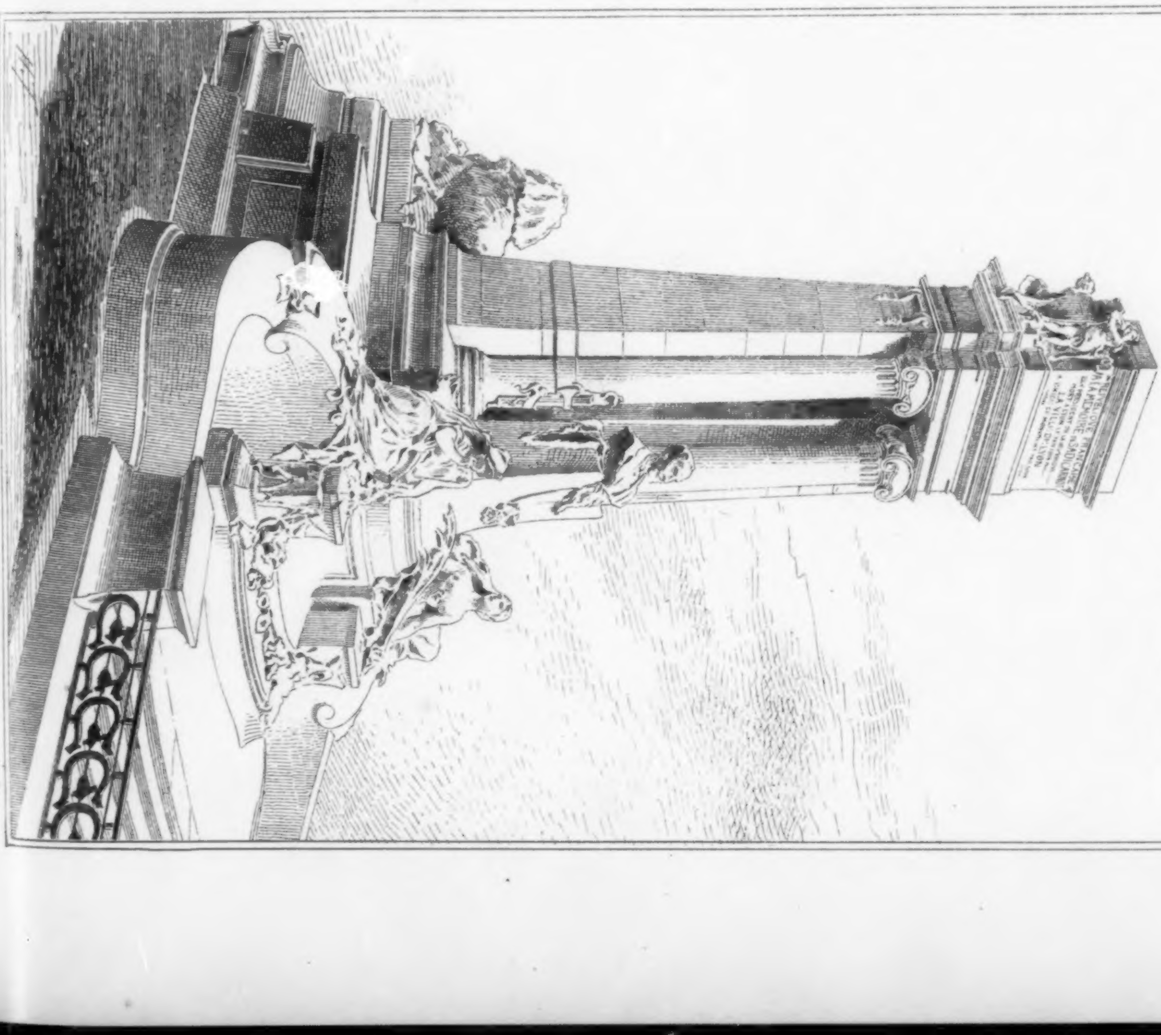
Heliotype Printing Co. Boston

AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 19 1896. No. 1095.





Concours à Lyon pour un monument à la mémoire du président Carnot. — Projet de M. Lefebvre.

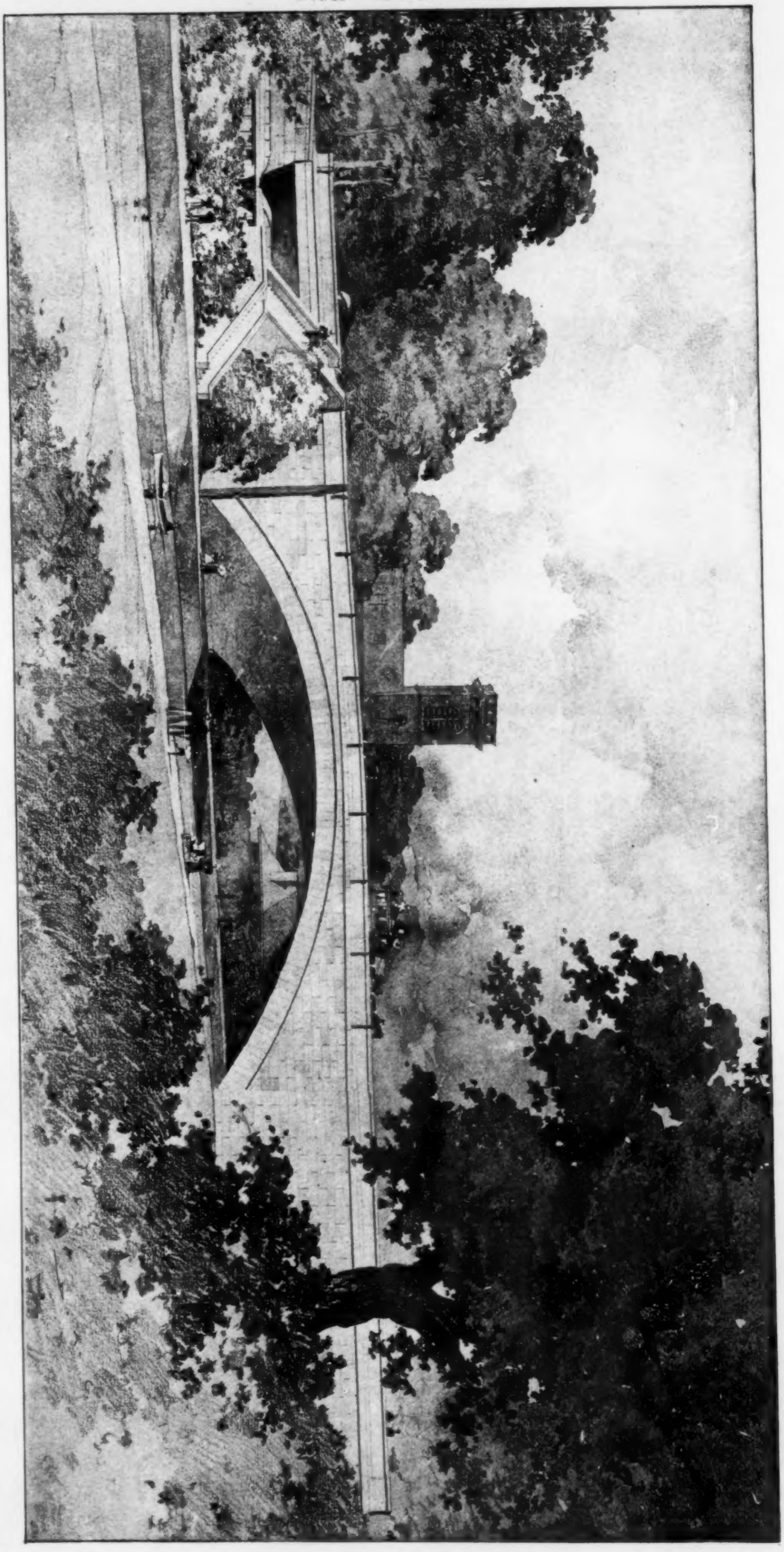


Projet de MM. Huguet et Delorme.

From La Construction Moderne.

LONGWOOD AVENUE BRIDGE, BETWEEN BROOKLINE AND BOSTON.

SHEPLEY, RUTAN & COOLIDGE, Architects.



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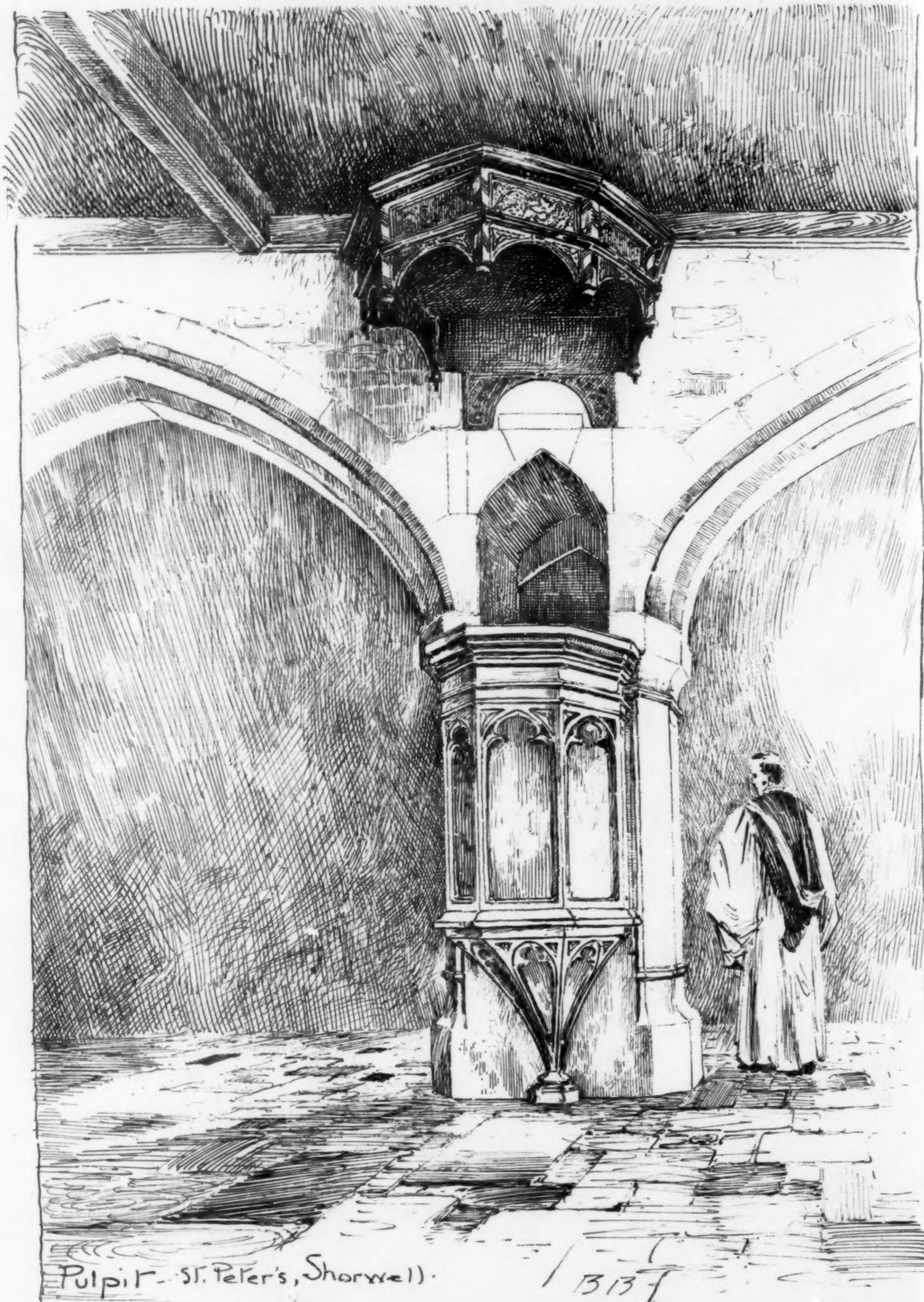


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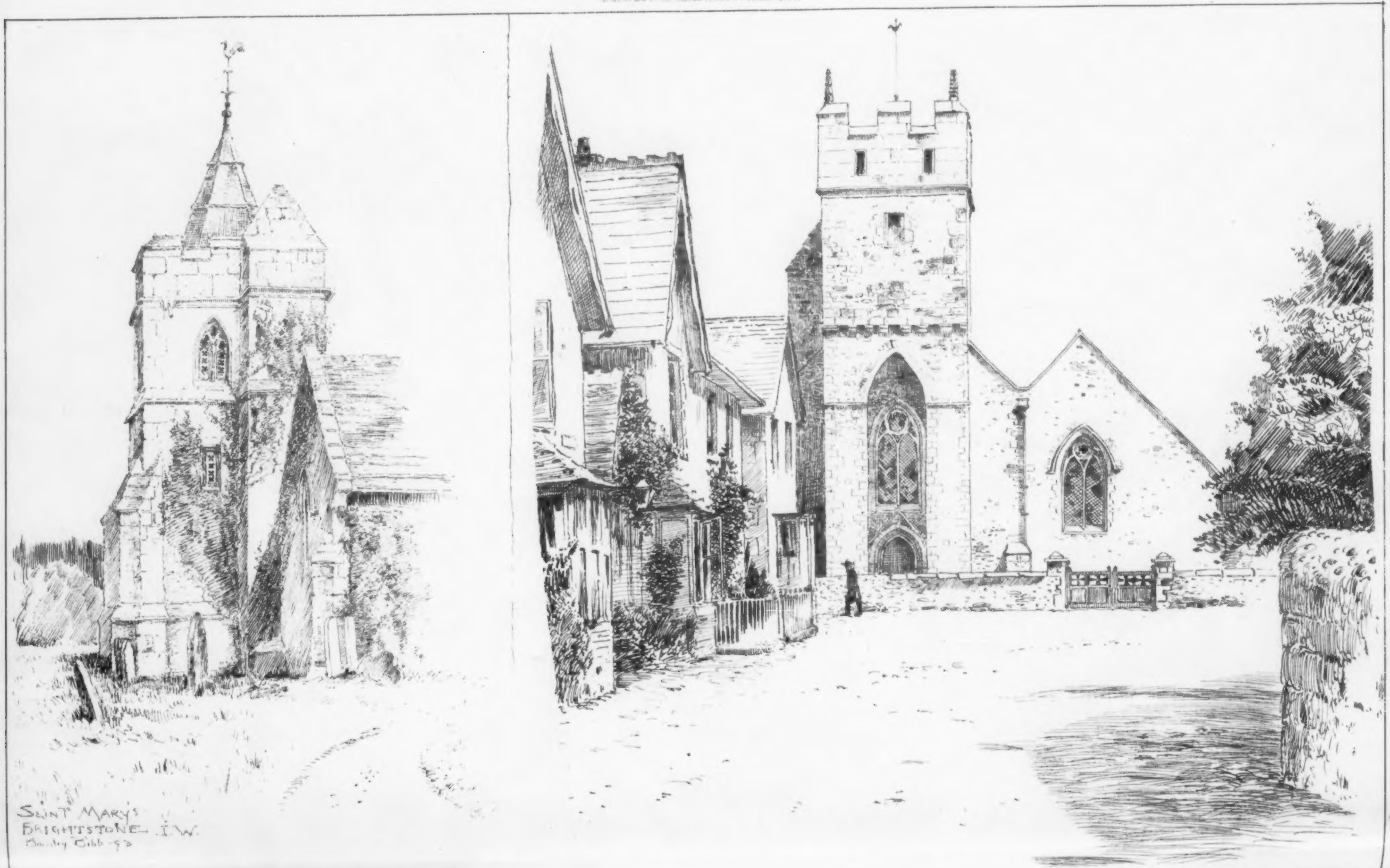
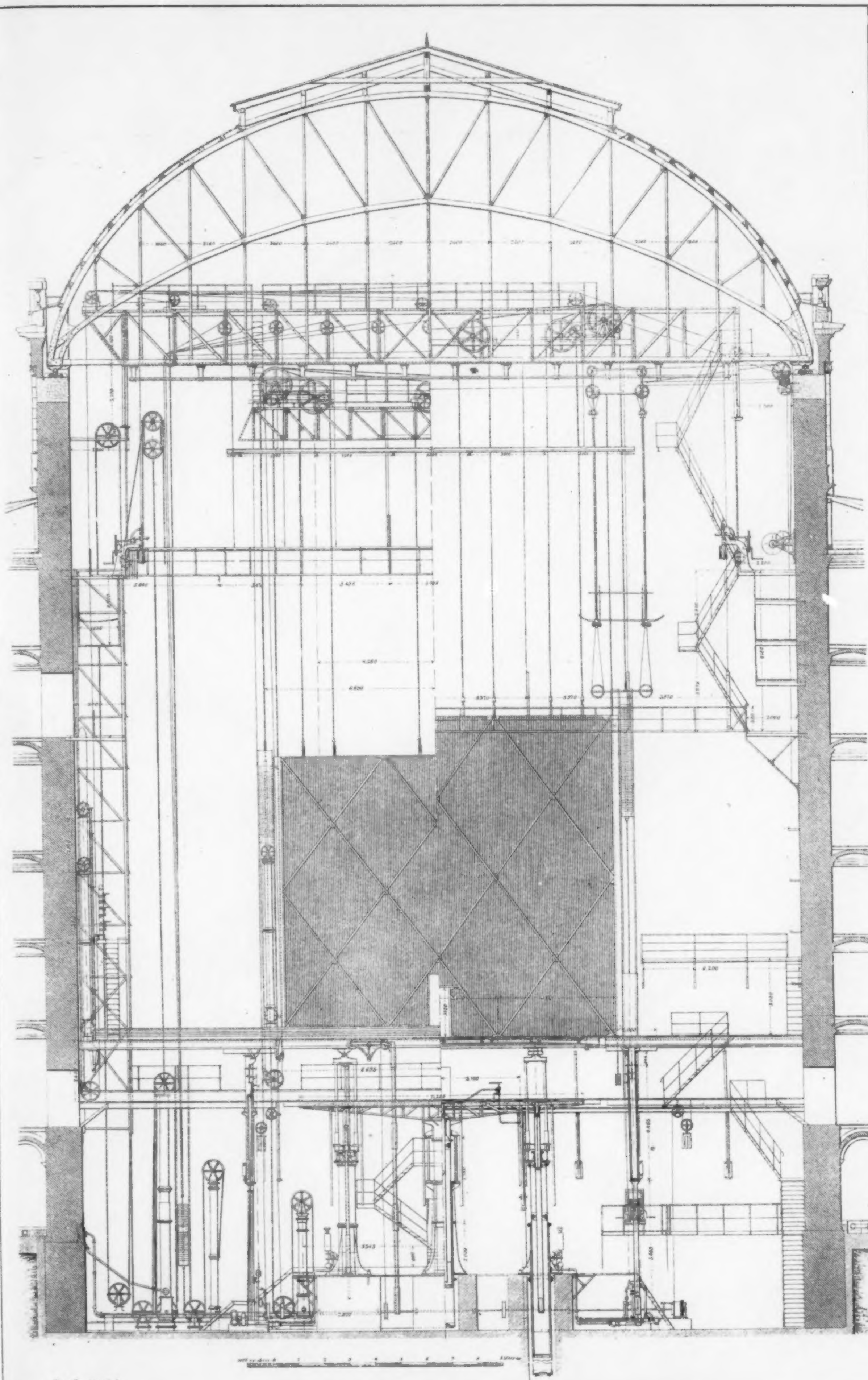
CHURCHES IN THE ISLE OF WIGHT.


SAINT MARY'S
BRIGHTSTONE. I.W.




THE "ASPHALEIA" STAGE AT THE BUDA-PEST OPERA HOUSE.

REAR VIEW OF ALEXANDER HALL, PRINCETON UNIVERSITY, PRINCETON, N. J.

W. A. POTTER, Architect.

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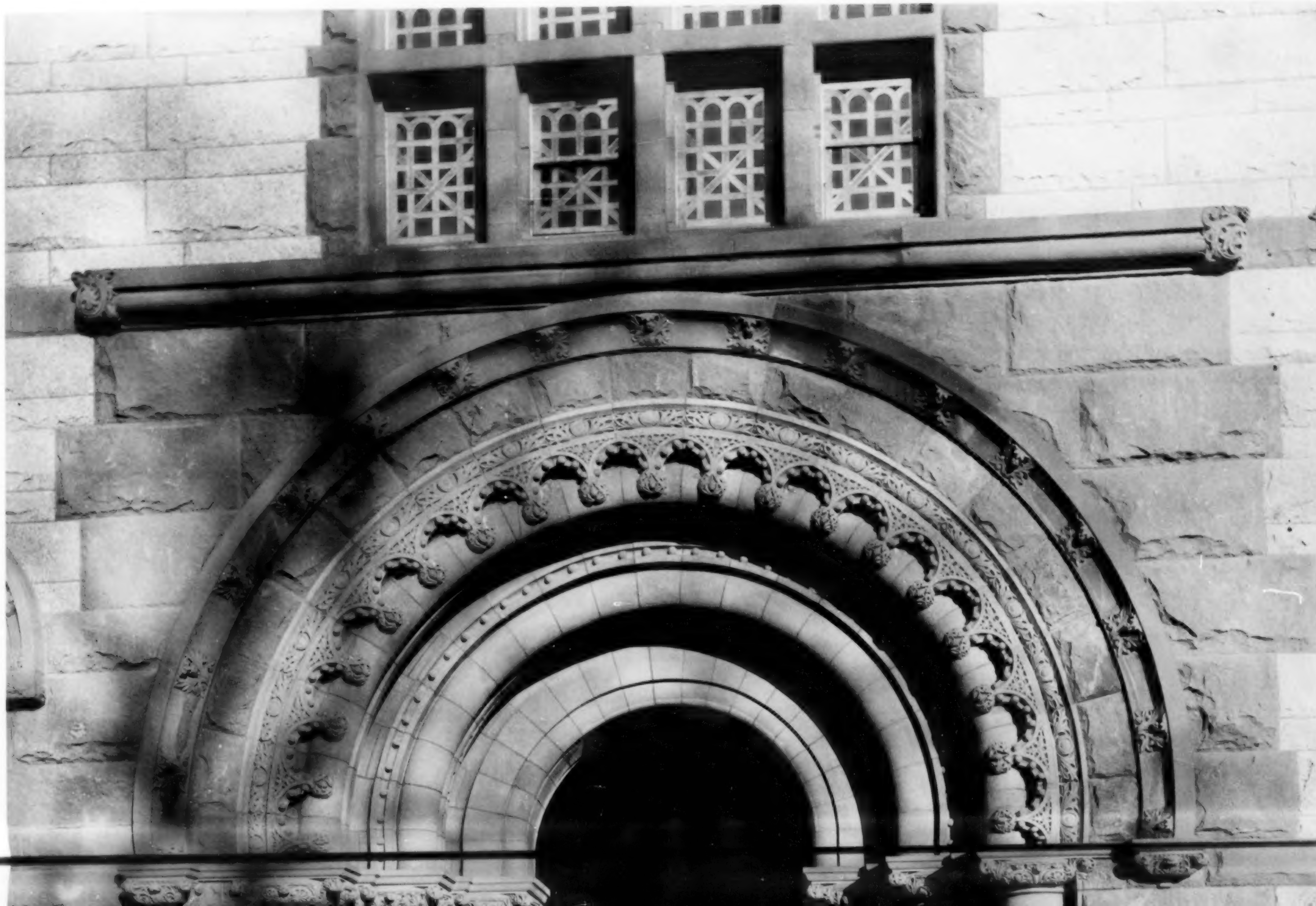

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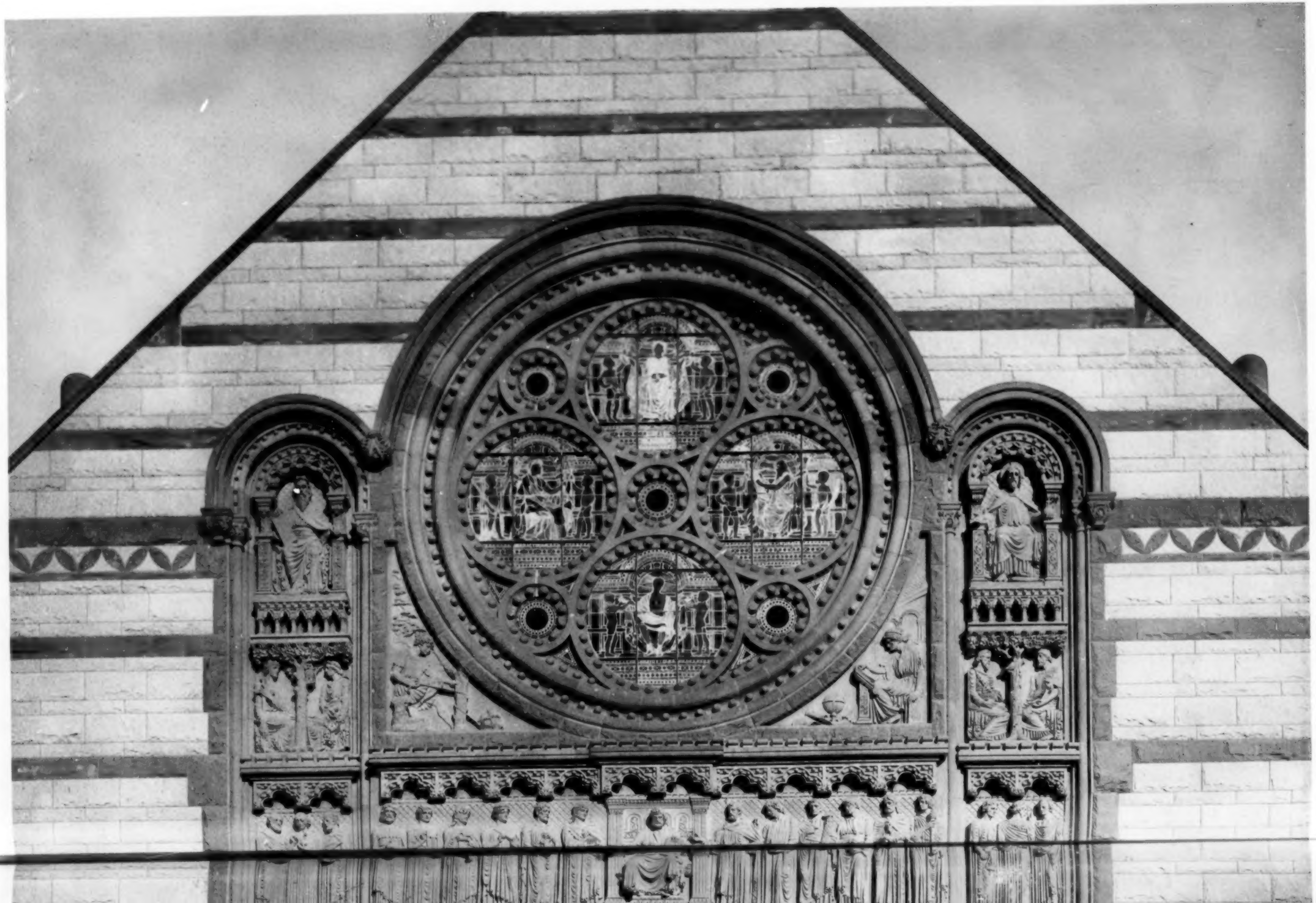

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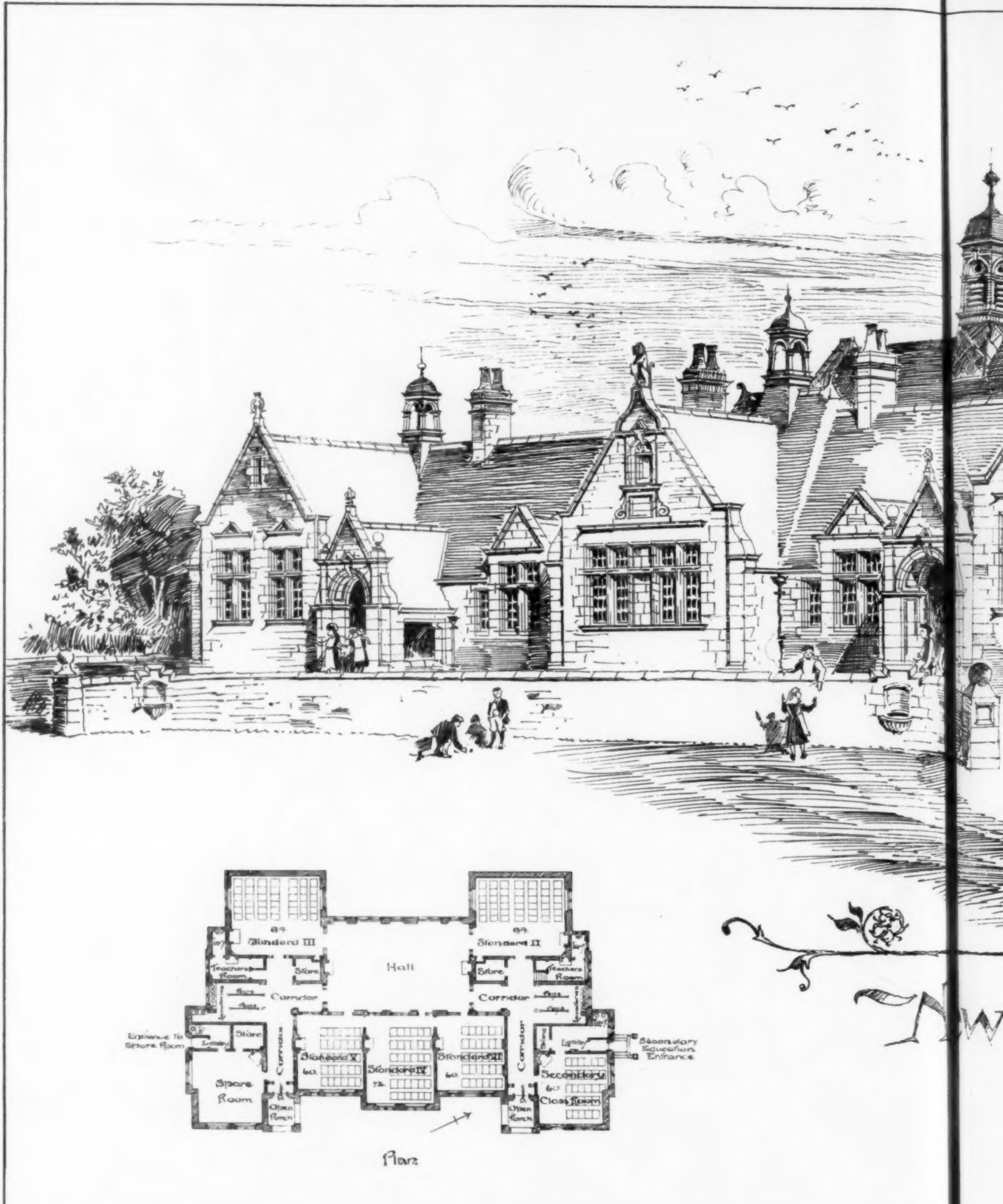


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