PRICE 15 CENTS.

5-5-2289

JUNE 16, 1894.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XLIV. * REGULAR EDITION * NO. 964.

ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

211 TREMONT ST.

BOSTON, MASS.

CONTENTS.

EDITORIAL SUMMARY.
THEATRES. — III.
WHAT COEFFICIENTS SHOULD BE ADOPTED FOR THE TRANSVERSE STRENGTH OF TIMBER.
THE RESPONSIBILITY OF GERMAN ARCHITECTS.
THE POSITION OF THE CHOIR AND ORGANS IN CHURCHES. — II.
LONDON EXHIBITIONS.
OUR PUBLIC BUILDINGS: A SUGGESTION.
CHURCH FURNITURE.
COMMUNICATIONS.
EXHIBITIONS.
NOTES AND CLIPPINGS.

ILLUSTRATIONS.

SIDE ENTRANCE OF THE CABLE BUILDING, BROADWAY AND HOUSTON STREETS, NEW YORK, N. Y.
[Gelatine Print issued with the International and Imperial Editions only.]
ACCEPTED DESIGN FOR FIRST PRESBYTERIAN CHURCH, NEW HAVEN, CONN.
A TRIO OF ITALIAN ORGANS.
THE CATHEDRAL AT AUCH, FRANCE.
HOUSE AT CHESTNUT HILL, PHILADELPHIA, PA.

Additional Illustrations in the International Edition

SOUTHERN CENTRAL PORCH OF THE MANUFACTURES BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL.
[Gelatine Print.]
CHAPEL OF THE GERMAN GOVERNMENT BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL.
[Gelatine Print.]
A HOUSE IN BEDFORD PARK, CHISWICK, ENG.
THE GARDEN FRONT, "ASHCROFT," ENG.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XLIV. Copyright, 1894, by the AMERICAN ARCHITECT AND BUILDING NEWS COMPANY, Boston, Mass. No. 964

Entered at the Post-Office at Boston as second-class matter.

JUNE 16, 1894.

SUMMARY: —
Rules Governing the Responsibility of German Architects. — Differences between American and European Ruling on Some Points. — The Report of the National Association of Builders and its Compiler. — How the Association helped a "lowest Bidder" in San Francisco. — Programme for a Church Competition and its Blundering Stipulations. — Iron *vs.* Wood for House-building. 117
THEATRES. — III. 119
WHAT COEFFICIENTS SHOULD BE ADOPTED FOR THE TRANSVERSE STRENGTH OF TIMBER. 121
THE RESPONSIBILITY OF GERMAN ARCHITECTS. 123
THE POSITION OF THE CHOIR AND ORGANS IN CHURCHES. — II. . 124
LONDON EXHIBITIONS. 125
OUR PUBLIC BUILDINGS: A SUGGESTION. 126
CHURCH FURNITURE. 126
ILLUSTRATIONS: —
Side Entrance of the Cable Building, Broadway and Houston Streets, New York, N. Y. — Accepted Design for First Presbyterian Church, New Haven, Conn. — A Trio of Italian Organs. — The Cathedral at Auch, France. — House at Chestnut Hill, Philadelphia, Pa.
Additional: Southern Central Porch of the Manufactures Building, World's Columbian Exhibition, Chicago, Ill. — Chapel of the German Government Building, World's Columbian Exhibition, Chicago, Ill. — A House in Bedford Park, Chiswick, Eng. — The Garden Front, "Ashcroft," England. 127
COMMUNICATION: —
The Use of Needles in Tunnelling. 127
EXHIBITIONS. 127
NOTES AND CLIPPINGS. 128

WE print in another place a series of rules defining the responsibility of architects and engineers toward their employers, according to the civil law, issued by the Association of German Architects and Engineers, for the information of its members. The present translation was, by the courtesy of the officers of the Association, made for presentation at the Congress of Architects, held last year in Chicago, but the sudden death of Herr Kümmel, to whom the matter had been entrusted, prevented this; and the translation, which was found among the papers of the deceased, has only just been forwarded to the President of the Institute. It is to be understood that these rules do not, by any means, form a code which has been adopted by the German architects and engineers, or which it would be desirable for any body of architects or engineers to adopt: — they are simply intended to give, in a condensed form, the present condition of the German law in regard to the responsibility of professional men, as deduced from the decisions of the courts. Somewhat similar presentations of the subject have been made in France, in manuals drawn up for the use of architects, and it is hardly necessary to say that they are of great value in enabling professional men to direct their attention to the points where it is most required, besides, perhaps, in giving them courage to resist successfully the extravagant assumptions often made by clients in regard to the responsibility which, as they claim, architects incur. American architects, however, should remember, in reading the German rules, that they are not applicable to this country, and reliance upon them here would be likely to lead to serious trouble.

FOR example, in Section 4, it is shown that, according to German decisions, "an architect or engineer is not liable to his employer for damages arising from his neglect to comply with laws and statutes which are not in force at his place of domicile, unless such have been previously made known to him by his employer, or it can be shown that he had previous knowledge of the same from other sources." Although we think there are no authoritative American decisions on this point, we doubt very much whether our courts would agree with those of Germany in their views. Undoubtedly, an architect would not be expected to be familiar with local customs in a strange place, in which he was building for the first time; but it seems to us that our law would consider him bound to acquaint himself with the matters of public record, such as the statutes and ordinances relating to building, which he must know in order to carry out his designs without bringing his employer into conflict with the public authority. It is true that, as the German law appears to require, an owner may acquaint himself with the local building regulations, and communicate them to the architect, and it would be a wise precaution for him to do so; but the architect, as the man of science, is the one who can study them most intelligently, and to best advantage, and it is hard to see how he can do his full duty to his client unless he makes himself familiar with them; or, at least, takes the precaution to have his plans and specifications reviewed by some one competent to see that they comply with such regulations. On the other hand, the doctrine of the French and German codes, that, where the architect is entrusted with the supervision of the work of mechanics, and the mechanics succeed in doing their work badly without detection, the architect is bound, if the builder is insolvent, and unable to pay the cost of making his bad work good, to pay it for him, is not held, or rather, is distinctly repudiated by our courts. In the admirable charge to the jury in a Maine case, which we printed, from the notes of the Court stenographer, a few weeks ago, it was stated at the outset that to the contract between the owner and the builder the architect is not a party; and the insolvency of the builder could not make the architect a party to his contracts, or a guarantor of his liabilities, unless the architect had agreed to assume such a responsibility, or unless, as by the French Code Civil, and presumably, by the German Code, the statute law expressly laid it upon him. So far as we are aware, no statute exists in any of our States imposing such a burden on architects and engineers, and the members of those hard-worked and ill-paid professions may be tolerably sure that, if they do their work with faithfulness and skill, they need not fear ruin through the sudden imposition on them of the liabilities of a bankrupt contractor.

IN regard to superintendence of work, the German rules, following, no doubt, local professional customs which have been upheld by the courts, distinguish between general and special superintendence, the latter involving certain responsibilities which the former does not. It is hardly necessary to say that no such distinction is known here among architects, although our engineers have something of the sort. Among our engineers, however, special superintendence, in the German sense, commonly takes the form of stationing an assistant, who is paid by the day, or hour, as the case may be, to examine materials, particularly iron and cement, or to give continuous inspection to, perhaps, the compounding and laying of concrete. The general supervision of architects is also, in important work, usually supplemented by the services of a clerk-of-works, who is paid by the day by the owner of the building. The clerk-of-works, however, is often a total stranger to the architect, and neither his neglect of duty, nor that of the engineer's inspector, would ordinarily impose responsibility on any one but the owner, who employs him.

WE have received and looked over, with our usual pleasure, the Report of the Proceedings of the Eighth Annual Convention of the National Association of Builders, which was held in Boston last February. Before we comment upon it, we are disposed to call the attention of the members of the Association, perhaps not for the first time, to their good fortune in having so long enjoyed the services of their present Secretary. Among the scores of Reports which come to us every year, there is not one which, to our mind, shows more clear-headed mastery of its subject than those of the National Association of Builders; and, incidentally, the substance of the report often shows in a very favorable light the tact and discernment with which Mr. Sayward, as the most active officer of the Association, carries out his duties.

AS in other cases, the Association has suffered through the business depression of the past year. Six of the affiliated organizations have been dropped from membership, and only two new ones have been added. In most cases, the deserting members seem to have got tired of paying the dues, and the San Francisco Exchange very frankly reported, in giving notice of withdrawal, that it was so far away, and the customs of building on the Pacific coast so different from those prevailing in the East, that it did not think further connection of any use. In commenting on this, the Secretary observed that one of the San Francisco members, not long ago, became involved in a controversy resembling that of McNeil *vs.* Boston Chamber of Commerce, in which a builder, who had been assured that a certain contract would be awarded to the lowest bidder, secured heavy damages for its award to parties whose bid was higher than his own. The National Association kept a careful record of the case for the benefit of its members, and on the application of the San Francisco man, sent him a full account, which seems to have assisted him materially in winning his own case. Mr. Sayward observes that the sum involved, which the assistance of the National Association helped to win, would have more than paid the dues of the San Francisco Exchange to the National Association for twenty years, and yet the San Francisco Exchange withdrew because the National Association was "too far away to be of any service." As he well says: "This is a remarkably good illustration of the failure of individuals to realize the indirect value springing from associated effort, and which could not be gained to anything like the extent through individual effort. . . . It is only through that entity which we call organization, or, as I prefer to designate it, associated effort, that it becomes possible to make the experience of the individual largely available. . . ." This remark is well put, and should be taken to heart by the members of all professional organizations.

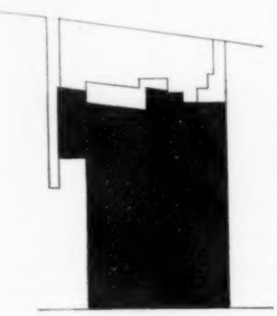
WE have received two documents describing a competition for a certain church, one from a member of the church committee, who thinks we might like to publish it, for the benefit of our readers, apparently because he supposes it is so good, and another from an architect, who also thinks it would be beneficial to have it published, because it is so bad. On studying the documents themselves, it appears to us that neither of our correspondents is right, and that the programme is neither very good, nor very bad. There is none of the shameful evidence of intended trickery which is so easily detected in many competition programmes; on the contrary, the paper indicates an intention on the part of the church committee to treat architects fairly, if somewhat austerely; and its failure, which is certain to interest respectable members of the profession, will be due less to any intention of treating them unfairly than to ignorance of the duties which architects are called upon to fulfil. For example, the programme, after saying, with a frankness which is rather attractive, that "The entire cost . . . must not exceed $45,000 . . . and if we can get what we want for less money we will be pleased," and giving a very reasonable description of the style and number of drawings required, goes on to say that "Complete building specifications must be attached, accompanied by an estimate of the cost. The correctness of this estimate must be guaranteed by the architect, his guaranty to be secured, first, by the amount of his own fees, and, secondly, by such other security as the Committee may require, it being the intention of the vestry not to commence the work until reasonably assured of the cost."

IT is a pity that, before making this extraordinary stipulation, which will cause every respectable architect, whose guaranty is worth anything, to throw the paper into the waste-basket, the Committee had not consulted some member of the profession, or, at least, some one who knew a little about an architect's work. He would have told them that to write "complete building specifications" for such a structure is well worth the six or seven hundred dollars that any architect whose specifications are of any value would charge for making them; that specifications which would be anything but misleading could not be written except in connection with a set of fifty or sixty completely finished working-drawings, for the preparation of many of which elaborate calculations of weights, supports, thrusts, ties, buttresses, wind-pressure and counter-bracing would be necessary; and that to do this work with even moderate care would require, at least, three months' time in any architect's office. As to the "estimate of cost," he would tell them that, while an architect can estimate, if necessary, the amount of work and material shown by his designs, and can say quite accurately how much such work and materials will be worth, at current prices, it is utterly impossible for him to know anything about the combination of builders, or the other circumstances which will affect the actual cost. The estimates of most builders are almost pure guess-work. We have heard a builder, with a large business, too, say that he never read a specification. He "counted the pages," as he said, and made his proposal accordingly. We knew another man, who was the lowest bidder for a large building, — a church, if we are not mistaken. The contract was awarded to him, and the building was well along before he discovered that the plans on which he had made his estimate were drawn at a scale of one-eighth of an inch to a foot, instead of the usual one-quarter; and, although the scale was plainly marked on the drawings, he had based his proposal on an estimate which made the cubic contents of the building only one-eighth of what they were required to be by the contract which he had signed. It may be imagined that architects who have either money or reputation to lose, never, under these circumstances, give any guaranty of the cost of executing their designs. They are willing to use their best judgment and experience, and most good architects can tell with tolerable accuracy how much, under average conditions, a given building should cost; but to warrant the caprices of local contractors would be a piece of folly which would stamp an architect, in the mind of the profession, as reckless and irresponsible. Of course, it is not unnatural for the Committee to wish to be sure of the cost of their building before beginning work, but the way to do this is not to drive away all the careful and skilful architects, and invite solely the reckless and dishonest ones, who have no money to lose, and know plenty of secret ways by which they can reimburse themselves for whatever part of their legitimate fees the Committee may confiscate; but to secure designs from men of skill and experience, by the offer of rational and decently remunerative terms; then, to have the designs judged by another skilful and experienced architect, who will throw out all that, in his judgment, cannot be executed for the sum proposed; and, finally, after the architect thus selected has reviewed and worked up in detail all the points of his design, to invite bona-fide tenders from responsible contractors for carrying it out. If the tenders are too high, the architect will modify his designs without charge, until a satisfactory result is reached; and, with a good contract, a good architect, good plans and good specifications, the building can be carried out without a dollar of extra expense; while, with an ignorant architect, unskilful plans, and specifications, and a careless contract, no guaranty on the architect's part, even if it could be enforced, which would very rarely be the case, can save such a committee from having to pay much more than it is worth for an ignorant, discreditable and unsatisfactory building.

ARCHITECTURE AND BUILDING makes some observations, which cannot be too often repeated, about the great advantages which are now offered for the erection of fireproof buildings. It says, what is undoubtedly true, that the movement toward the building of large structures for offices, which promises to give our builders and architects much employment next year, is due rather to the desire of capitalists to take advantage of the low prices now current for structural iron and brick, than to any extraordinary demand for offices; and suggests that fireproof construction might now be extended to dwelling-houses without a very serious increase in cost. We cordially sympathize with this idea, and will add another consideration, — that dwelling-houses of iron and terra-cotta are not only far cheaper in the end than those with floors and partitions of wood, but are much pleasanter to live in. A single visit to a city house fifty years old will convince even a layman that the shrinkage, bending and twisting of wooden beams and studding is the main agency in the deterioration of such buildings. No sooner is the roof on a house built with wooden beams than the staircase headers and trimmers begin to shrink and settle, the floors to descend, the partitions to distort themselves, the doors to bind, the plastering to crack, and the whole house to enter upon a process of decay which becomes every year more pronounced. With iron beams and terra-cotta partitions none of these phenomena are observed. The partitions, stairs, doors, floors and plastering stay just where they were originally placed, and are sure to remain there indefinitely. Walls and ceilings can be expensively decorated without the certainty that the painted plaster will be cracked, and, perhaps, thrown off, in twenty or thirty years, and the owner of such a building can await tranquilly its fiftieth birthday, with the assurance that it will then be in the prime of its beauty, while its wooden-timbered neighbors will be a mass of repairs, if they are habitable at all. Already, many such houses have been built in New York, and a great deal of iron is now used by architects to trim around stairs, and support partitions, in city dwellings; but the unshrinkable iron beams, unless skilfully used, are apt, when used in connection with shrinkable wooden ones, to cause ridges in the floors, and it is much better to adopt iron or steel exclusively.

THEATRES. — III.[1]

ROYAL ALHAMBRA THEATRE, LONDON.



ON the morning of December 7, 1882, I well remember visiting the ruins which the fire of the previous night had left of the old Alhambra Theatre. This fire was the last theatre fire we have had in London, and it occurred in the night after the audience had left the house. The original building was designed by Prof. Hayter Lewis, F. S. A., as the "Royal Panopticon of Science and Art," but after a varied career it was eventually converted into the Alhambra Theatre, the minarets and dome of which were familiar features of the west end of London for over a quarter of a century.

Naturally, a building designed for one purpose and adapted to another would not be as perfect as one designed for its special purpose; so it was with the old Alhambra Theatre; to adapt it to a theatre, many interior fittings and partitions of wood rendered it an easy prey to the flames, and a total wreck of fallen walls, twisted girders, broken columns and charred beams lay in a mass in the morning, where the night before had been crowds of spectators witnessing the performance.

It was not long after the fire before the architects of the present building, Messrs. Perry & Reed, completed the theatre of which I am enabled through their courtesy to illustrate the drawings in this number. On December 3, 1883, the new house was opened to the public.

This fire has not been without its attendant benefit to the London play-houses, for Messrs. Perry & Reed were among the first to set the example, now almost universally followed in London, of building theatres of iron, steel and concrete, with the iron-work protected and embedded in the concrete. In this case the concrete was

formed to a great extent of bricks of the old building, broken up by powerful steam crushers, and mixed with Portland cement; the new building thus, literally, springing up out of the ruins of the old. The whole of the floors, galleries, roofs, partitions, box-divisions and staircases, were constructed of this fire-proof material, no timber or wood-work, other than for the furniture, being used anywhere except for the stage, and where wood-work was thus used it was treated with asbestos paint.

Another feature in this theatre is that it was also among the first, if not the first, to be conceived with overhanging balconies unsupported by columns. I am able to give an illustration of the cantilever system by the kindness of the architects, who were assisted in the designing and testing of this part of the work by Prof. A. B. Kennedy, C. E. of University College, London. As one of the first theatres carried out with fireproof tiers on cantilever girders, this house calls for special attention.

Theatres, like other buildings, want periodically an army of painters and decorators to attack them, clean them down and put a fresh and new face upon them; this has to be done perhaps more frequently than in other buildings, because a theatre must never look dull or shabby. Now the Alhambra Theatre is unique in many respects: it has no special season, its doors are open all the year round, for the class of entertainment given is spectacular, and consists of sumptuous ballets, variety entertainments and comic sketches. The house, therefore, being always open and, I may also say, always full, whatever the time of year, there being no "off season," it would not do to give it over for a month or six weeks every year for the annual cleaning, and to have the auditorium filled with scaffolding. Now the architects were very far-seeing in this respect, and they have so constructed their building that the cleaning and decorating can go on without closing the house. The most difficult part to deal with was, of course, the ceiling, which as will be seen by the section is a dome. This dome is constructed of light iron framing and fibrous-plaster panels, being so arranged that whenever re-decoration may be required, it can be readily executed by lifting out the panels from the upper side and re-painting them, and then replacing them from the gallery which is placed between the ornamental dome and the constructional roof.

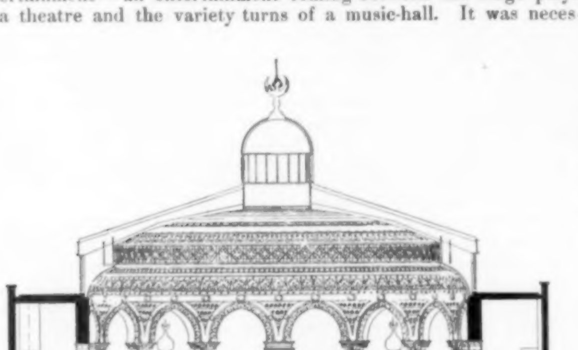
The upper dome, which can only be seen from the outside, is formed of iron ribs springing from the columns to a central ring which supports the cupola, and the under dome is of lighter iron affixed to the former.

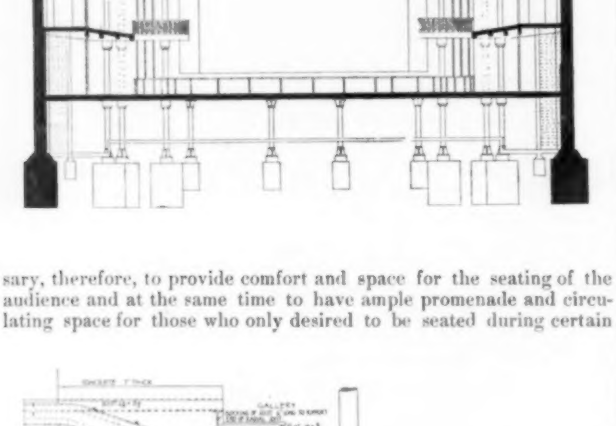
The lower part of the dome is a quarter circle, in section, surmounted by a lofty gilded railing, and open in the centre to the outer dome for purposes of ventilation, and concealing an iron gallery which gives access to the interior of the roof.

In examining the plans, the *raison d'être* of this theatre must be

[1] Continued from No. 959, page 60.

borne in mind. It was designed for a special and particular class of entertainment — an entertainment coming between the stage plays of a theatre and the variety turns of a music-hall. It was necessary, therefore, to provide comfort and space for the seating of the audience and at the same time to have ample promenade and circulating space for those who only desired to be seated during certain parts of the entertainment. Another point had also to be considered; as smoking is here allowed in the auditorium, special attention had to be given to the free circulation of air and ventilation, with the result that the "Alhambra" is never stuffy or clouded with tobacco smoke, however full a house there may be.





The proscenium, like the dome, is of fibrous plaster, and the hood is provided as a sounding-board; it also serves the purpose of concealing the massive iron girder that spans the opening; which girder is forty-four feet long and six feet six inches in depth. The width of the "sight" of the proscenium opening is 32 feet, and the height 41 feet.

The stage, which is sixty-two feet wide by an average depth of about forty-five feet, is provided with all the necessary appliances and machinery for spectacular representation, and there is a height from the basement floor to the gridiron of eighty-four feet, for the working of the scenery. The gridiron is supported upon a wrought-iron truss sixty-two feet in length.

The dressing-room accommodation is in accordance with the requirements of the house, and all the floors, roofs, staircases and passages are constructed of fireproof materials, in the same way as they are in the auditorium, so that the employés have the same care taken of them as the public.

To return to the auditorium: The ground-floor, which is on the level of the pavement, is occupied by stalls and pit, each with their separate approaches. The main dimensions of this part of the house are 96 feet between the side walls and 82 feet from the curtain line to the back wall.

The grand tier over the pit is fitted with "stall" seats in the centre, the sides being arranged as private boxes. The seats have been somewhat altered of late, the front rows being brought nearer the stage, and the standing space at the back increased. The plans here given are as the building was designed by the architects. On this tier is a foyer and on the tier above the grand saloon. The distance from the box front of the second tier to the curtain line is sixty-two feet.

There are two galleries over the second tier; each of these parts have their separate entrances.

The exterior was little altered after the fire, the architects merely adapting it to the requirements of the new plan. One provision was however made, which must be a welcome one to those awaiting admission on a wet night and for those alighting from carriages in evening dress. A glazed veranda stretches the full length of the front of the building and the full width of the pavement; from under this the entrance and exit doors are approached. This veranda rises from the theatre, the highest part being over the pavement and the lowest next the building, with a slope towards the building; the water is thrown backwards and there is no drip on the people as they enter their carriages. This arrangement also provides against columns on the edge of the pavement, which frequently cause the smashing of carriage doors.

E. A. E. WOODROW.

[To be continued.]

SUBTERRANEAN LONDON. — It gives an impressive idea what subterranean London is fast becoming, to learn that, on emerging from the river, the new City and Waterloo line will, in its passage up Queen Victoria Street, run for a part of the way underneath the low-level main sewer, which in its turn runs along beneath the District Underground Railway. So that at this point in the city we shall have, first, a busy main thoroughfare, below that a steam railway, then a huge metropolitan sewer, then an electric railway, reaching its terminus at a depth of about sixty-three feet below the streets, and here it will communicate with another line — the Central London — which will lie at a depth of eighty feet. — *London Daily News.*

WHAT COEFFICIENTS SHOULD BE ADOPTED FOR THE TRANSVERSE STRENGTH OF TIMBER.

ALTHOUGH the strength of timber is not as important a question, in these days of iron and steel construction, as the strength of the metals, still, owing to the increasing cost of timber, and the probability that wood will be, for a long time to come, the principal constructional material of at least three-fourths of the buildings erected in this country, it is of sufficient importance to demand careful consideration, and the use of such coefficients as shall ensure ample safety without unnecessary waste of material.

The recent building laws of the cities of New York, Boston and Chicago contain maximum values for the unit strains in timber, a feature not before included in these laws; but considering the fact that very thorough tests have recently been made on the transverse strength of our principal building woods, it would seem as though the requirements of these building laws, in this respect at least, should be practically the same. Such, however, is not the case, and neither do the standard works treating of the strength of materials agree much better. Believing that there should be great uniformity in the coefficients for the transverse strength of timber, the writer has undertaken to present a comparison of the experimental data bearing on the subject, and also of the practice of building engineers, hoping that it may result in a greater uniformity in the values published in our standard works, and in the building regulations.

The first person who endeavored to compute the strength of beams upon mathematical principles is supposed to have been Galileo. It appears that this philosopher was led to these investigations in consequence of a visit which he made to the Arsenal and dockyards of Venice, and that they were first published in his dialogues in 1633. He considered solid bodies as being made up of numerous small fibres applied parallel to one another, and concluded that their resistance to a pulling-force applied parallel to the length of the fibres was directly proportional to the area of the transverse section, and this is still the theory in use to-day.

He next considered in what manner the same fibres would oppose a force applied perpendicularly to their length, and ultimately came to the conclusion "that when a beam is fixed solidly in a horizontal position in a wall, or other immoveable mass, the resistance of the integrant fibres is proportional to their sum, multiplied into the distance of the centre-of-gravity of the area of fracture *from the lowest point.*" In his general theorem of the strength of beams, he asserts that the strength or breaking weight is also proportional "to the length of the beam, or the distance at which the weight acts from the point of support."

He also endeavored to show that whatever weight is sufficient to break a beam fixed at one end and loaded at the other, double that weight will be necessary to break a beam of equal breadth and depth, and of twice the length when supported at each end and loaded at the centre; and four times the same weight when each end of the beam is fixed solidly in a wall. In these conclusions, he was right as to the relative strength of beams in relation to their span and method of support, but he was in error in several of his hypotheses, viz.: first, in assuming the beam to be inflexible; second, that the fibres are inextensible and incompressible; and thirdly, that the beam turns about its *lowest* point when fixed at one end, or its upper when supported at both, and, therefore, that every fibre in the section is exerting its force *in resisting extension.*

As soon as it was attempted to compare Galileo's theory with experiments (which he himself had never done) it was found that the results did not agree. It is supposed that the first person to compare this theory with actual results, was Mariotte, "a member of the French Academy, who, having soon discovered its inaccuracy, proposed to substitute another theory in its place, which was published in 1680, in his '*Traité du Mouvement des Eaux,*' and here we find the first notice of extensible and compressible parts of the section of fracture, the neutral axis, etc."

This attracted the attention of Leibnitz, who, after examining the theory of Galileo and the experiments of Mariotte, published his own views on the subject in a memoir which appeared in the Leipsic Acts, in 1684. He adopted the principle first suggested by Dr. Hooke, that "the tension varies with the force," and concluded that every fibre exerted a power of resistance proportional to its distance from the line about which the beam was supposed to turn. This was one step nearer the correct solution of the problem, but he still considered the fibres to be incompressible, or that the beam turned about its lowest or highest point, according as it was fixed at one end or supported at both.

The subject was afterwards taken up by James Bernoulli, who made some experiments, and observed that the instant before a body is broken across with a transverse strain, a part of the fibres only are in a state of tension, and a part in a state of compression, and, consequently, that the line about which the beam turns is somewhere within the area of the section of fracture. But he unfortunately stopped at this point, merely contenting himself with stating a few general observations, and pointing out the difficulty of determining the neutral axis, or that line which suffers neither extension nor compression.

The next important step in this inquiry was made by Dr. Robinson, under the article "Strength" in the first editions of the "*Encyclopædia Britannica,*" in which the position of the neutral axis is introduced as a necessary datum.

The first person, however, to arrive at the correct solution of the problem and to deduce working formulas for the strength of rectangular beams was Mr. Peter Barlow, who first published his conclusions in an "*Essay on the Strength of Timber,*" in 1817.

Mr. Barlow deduced formulas for the strength and stiffness of rectangular beams, which correspond with those now generally adopted, and also verified their results by an extended series of experiments on small wooden beams. He also made a number of tests on small beams two inches square and from six to seven feet long, for the purpose of determining working-values for the coefficients for strength and stiffness. These afford the first practical data with which the writer is acquainted, although M. Buffon had previously made an extended series of experiments, under the auspices of the French Government, on timbers varying from four to eight inches square and from twenty to twenty-eight feet in length. It does not appear, however, that he made any practical use of his results.

Formulas. — The formula which Mr. Barlow deduced applied only to rectangular beams of wood; his formula for the breaking-weight of a beam supported at each end and loaded at the centre, being:

$$W = \frac{4\,b\,d^2\,S}{l} \qquad (1)$$

in which W denotes the breaking-weight in pounds, b and d the breadth and depth of the beam in inches, and l the length of the beam, also in inches. S represents a constant quantity determined by experiment.

For the deflection of a beam under the above conditions, his formula is:

$$\text{Deflection in inches} = \frac{W\,l^3}{32\,b\,d^3\,E} \qquad (2)$$

E denoting a constant determined by experiment.

The universal formula for the strength of beams derived from mathematical reasoning is:

$$M = \frac{R\,I}{y} \qquad (3)$$

in which M denotes the bending-moment, I the moment of inertia of the cross-section; y, the distance of the most compressed or most stretched fibre from the neutral axis; and R the modulus of rupture, or "the greatest tension or compression per square inch to which the most strained fibre of the beam is subjected, when the beam is just on the point of breaking," and sometimes called the fibre-strain.

For a beam supported at both ends and loaded at the centre, Formula (3) resolves itself into the following:

$$W = \frac{2\,b\,d^2\,R}{3\,l} \qquad (4)$$

or, if we use L to denote the length of the span in feet,

$$W = \frac{b\,d^2\,R}{L\ 18} \qquad (5)$$

For further simplification, we can let A represent $\frac{R}{18}$, when our formula becomes

$$W = \frac{b\,d^2\,A}{L} \qquad (6)$$

which is the simplest formula for the strength of rectangular wooden beams, and is the one used by the writer in the "*Architects' and Builders' Pocket Book,*" also by Hatfield, Haswell and others.

The S of Barlow, Formula (1), is one-sixth of R, or three times the value of A. Variations of Formula (6) for different conditions of loading and support can be found in the hand-books above mentioned. In nearly all of the experiments that have been made for determining the resistance of timber to a transverse strain, the results have been given in terms of the modulus of rupture, as this term has the same meaning in all technical works. The method of determining its value in pounds is by substituting the breaking-weight determined by actual test with the actual dimensions of b, d, and l in Formula (4), and equating for R.

The standard formula for the deflection of rectangular wooden beams supported at the ends and loaded at the centre is:

$$\text{Deflection in inches} = \frac{W\,l^3}{4\,b\,d^3\,E} \qquad (7)$$

in which E represents the modulus of elasticity, or the weight that would be required to stretch a rod, one square inch in section to double its length, if Hooke's law held good up to that point, and the rod did not break.

Its value in pounds for different woods is obtained by weighting a beam within the elastic limit, and carefully measuring the deflection; knowing the deflection, weight and dimensions of the beam, the value of E can be easily computed from Formula (7).

To make practical application of the "modulus of elasticity," it is necessary to assume a limit to the deflection of a beam, and then calculate the load which will just produce this deflection.

The greatest allowable deflection in a beam is generally limited to $\frac{1}{30}$th of an inch per foot of span, although it is sometimes limited to $\frac{1}{480}$th of the span. The iron companies in their hand-books use the $\frac{1}{360}$th limit for steel and wrought-iron beams, and such is the general practice of building engineers, for both wood and metal.

Substituting this value for the deflection, and transposing Formula (7), we have

$$W = \frac{b\,d^2\,e}{L} \qquad (8)$$

for the greatest allowable load on a rectangular beam supported at both ends and loaded at the centre: L denoting the span in feet, and $e = \frac{E}{12{,}960}$ when the deflection is limited to $\frac{1}{360}$th of the span, or $\frac{E}{17{,}280}$ when the deflection must not exceed $\frac{1}{480}$th of the span.

These formulas are accepted b[illegible] authorities on the strength of materials.

Experimental Values for R and E: — The values of R and E recommended by Barlow were for a long time the only ones given in books treating of the strength of timber, and even in standard engineering works published as late as 1873, his values are given.

In the years 1874–6, Mr. R. G. Hatfield, the well-known New York architect, made a series of tests on small beams of American woods which attracted considerable attention and which were adopted by him in his "*Transverse Strains*"; for other woods he adopted the values of Barlow.

Mr. John C. Trautwine, in his "*Engineers' Pocket Book*," published values for the breaking strength of the principal American woods, which he gives as derived from his own tests, although no description of them is given. Owing to the great extent to which this book has been used, these values were for a time probably more extensively used than any others, and his table for the strength of white pine and spruce beams has been widely copied.

In 1879 Prof. R. H. Thurston made a very careful series of tests on small beams of Georgia pine, the results of which were published in the *Journal of the Franklin Institute*, for October, 1879.

During the years 1879 and '80, the writer made similar tests on Georgia pine, white pine and spruce beams, from which he derived the values given in Table I.

These tests constituted about all the information available up to that time on the strength of American woods, and all these values were derived from tests on pieces about 1″ x 1½″, or 1″ x 2″ in cross-section, and from 3 to 5 feet span. They undoubtedly represented a better quality of wood than is generally used in actual construction, and this was recognized by using a factor-of-safety of from 5 to 8.

About the year 1874, Mr. Thomas Laslett made a number of tests in England, for the Admiralty, on three or four varieties of American woods in the shape of beams about 4″ x 8″ in cross-section, which did not vary much from the tests on small pieces above described.

During the year 1884, Professor Lanza commenced making tests on the strength of full-size timber beams, in the engineering laboratory of the Massachusetts Institute of Technology, which were continued until 1888, and the results are given in his work on "*Applied Mechanics*." These beams gave much lower values for the modulus of rupture than those previously obtained, but there was not as much difference in the values for the modulus of elasticity.

Mr. D. K. Clark describes some tests in his "Rules and Tables" which were made on large timbers and which gave results agreeing very closely with those obtained by Professor Lanza.

The Forestry Division of the United States Department of Agriculture have very recently conducted an elaborate series of tests on long-leaf yellow pine from Alabama, the size of the beams tested being 4″ x 8″, and 12 feet long. The values of R and E obtained in these tests are given in Table I; they are considerable above those obtained by Professor Lanza.

The average results obtained from the various tests above mentioned are given in Table I, which contains practically all the data that we have upon which to base our working coefficients for American woods.

TABLE I. — VALUES OF R AND E, DERIVED FROM EXPERIMENTS.

VALUES OF R.

	White Oak.	Georgia Pine.	Pitch Pine.[1]	White Pine.	Spruce.	Hemlock.
Barlow	10,596		9,792		6,612	
Laslett			12,254		9,045	
Trautwine	10,800		9,900	8,100	8,100	7,200
Hatfield	10,404	16,740		9,270	11,068	7,272
Thurston		16,740		5,280		
Kidder		13,048		8,297	11,000	
D. K. Clark			6,984			
Lanza	5,863	7,486		4,451 5,482[2]	5,046	3,825
U. S. Timber Tests.		10,960				

VALUES OF E.

	White Oak.	Georgia Pine.	Pitch Pine.[1]	White Pine.	Spruce.	Hemlock.
Barlow	2,148,800		1,225,600		2,191,200	
Hatfield	886,464	2,441,664		1,222,500	1,362,960	956,880
Thurston		3,534,727		883,636		
Kidder		1,821,630		1,388,497	1,650,000	
Lanza	1,131,100	1,666,000[3] 1,757,900		1,122,000 1,183,037[2]	1,367,500	922,250
U. S. Timber Tests.		1,982,000				

[1] Pitch pine (*pinus rigida*) is a different and inferior variety of pine from the Georgia pine or *pinus palustris*.
[2] Western pine.
[3] Average from time tests.

Professor Thurston made about 40 tests on California spruce and Oregon pine, during the year 1880, and obtained 12,280 pounds as the value of R for spruce and 11,071 for Oregon pine.

D. K. Clark gives as the average value of R, obtained by testing pieces of American red pine (commonly called Norway pine), 12″ × 12″ (15′ span), 4,960 pounds.

Bauschinger recently made an elaborate series of tests in Germany, on the strength of certain foreign woods in connection with their other properties, as specific-gravity, age, time of felling, percentage of moisture, etc. The moduli of rupture and of elasticity obtained by him for spruce and pine are somewhat higher than those obtained by Professor Lanza on woods of the same name. This was probably owing to the pieces being a little less in cross-section, and also drier, and, perhaps, of better quality.

As Professor Lanza's tests were carefully and scientifically conducted, and were made on beams such as are commonly found in the market, it is generally conceded that they give the most reliable values for the average breaking strength of the woods tested, some beams giving values 40 per cent less than the average, and others 20 and even 60 per cent more. The United States timber tests on long-leaf pine, however, deserve fully as much recognition as those of Lanza, as they are undoubtedly fully as reliable.

In deciding upon the working coefficients for beams, there are several other elements to be taken into account, such as the effect of continued strain on timber, the quality of the timber, the accuracy with which the load can be determined, and the nature and continuance of the load.

From long time-tests on small beams made by Professor Thurston, and also by the writer, it appears that a timber beam might support for an indefinite period a load equal to one-half of its breaking load, so that a factor-of-safety of 2 would allow for the effect of continued strain. To allow for defects in the timber, a factor of 2 should be more than ample, considering that our values are based on ordinary merchantable timber, and this would give a total factor-of-safety of 4, which is the nominal value generally recommended. In the case of floor-beams, however, the assumed load is generally estimated at from two to four times the actual load, so that in such cases we really have a factor-of-safety of from 8 to 16, and the practical engineer will often vary his coefficient to suit the load which is assumed.

Having thus considered the fundamental data from which we have to work, and the factor-of-safety to be assumed, let us glance at the working-values of A and E recommended by the leading books of reference, and required by the building laws of three of our principal cities. A comparison of these values is given in Table II. The values given by Trautwine represent a factor-of-safety of 6, Hatfield of 5, Berg of 10, and the others of 4.

Troutwine recommends that a further reduction of one-third be made for moving loads.

TABLE II. — WORKING VALUES OF A (FORMULA 6) AND E GIVEN IN REFERENCE-BOOKS AND BUILDING-LAWS.

VALUES OF A [$= R$ DIVIDED BY $18 \times$ FACTOR-OF-SAFETY.]

	White Oak.	Georgia Pine.	White Pine.	Spruce.	Hemlock.	
Trautwine	100	100 to 142	75	75	83	1
Haswell	80	100 to 120	62	65	60	2
Hatfield	162	212	125	137½	112½	3
Carnegie	55	69	41½	41½		4
Berg	61	66	50	55	41½	5
Lanza	81	152[1] 104	61 76	70	53	6
Kidder	75	100	60	70	66	7
World's Fair.	88	99	66			8
Boston	55½	70	42	42		9
New York	137½	137½	112½	112½		10
Chicago	60	80	50			11

VALUES OF E.

	White Oak.	Georgia Pine.	White Pine.	Spruce.	Hemlock.	
Trautwine	1,500,000		1,600,000	1,600,000		12
Haswell	1,710,000	2,430,000	1,830,000			13
Hatfield	1,339,200	2,548,800	1,252,800	1,512,000	1,209,600	14
Berg	900,000	1,200,000	850,000	850,000	800,000	15
Lanza	1,131,100	1,982,212[1] 1,700,000	1,122,000 1,183,000	1,367,500	922,250	16
Kidder	1,240,000	1,780,000	1,073,000	1,294,000	1,045,000	17
Boston	860,000	1,300,000	750,000	900,000		18

[1] From United States timber tests.
Not specified in Chicago and New York laws.

VALUES FOR A, E AND e SUGGESTED BY THE WRITER.

	White Oak.	Georgia Pine.	Pitch Pine or Texas Pine.	Oregon Pine.	Norway Pine.	White Pine.	Spruce.	Hemlock.
A	75	100	90	90	70	60	70	55
E	1,130,000	1,700,000	1,296,000	1,300,000	1,150,000	1,100,000	1,300,000	900,000
e	87	130	100	100	88	80	100	70

For permanent loads, reduce values for A 20 per cent, and of E and e one-third.

The values in line 8, are those used by the engineers having charge of the construction of the World's Fair buildings.

The numbers in the sixth line represent one-eighteenth of the average values of R derived from Professor Lanza's tests, although the values which he recommends in his text-book are practically the same as those given in the Boston Building Law.

The writer, however, believes that such a great reduction from the experimental values, for beams supporting ordinary floor-loads is entirely unnecessary and uselessly increases the cost of building. Among experienced engineers and architects, when unrestricted by building-regulations, the variations in the actual size of timbers used for different classes of buildings is probably not as great as what the variations in Table II would lead one to expect, as they use a value of A corresponding with the assumed load; thus with an assumed load of 70 or 75 pounds for dwellings and tenement-houses, a high value of A would be used, while, if the assumed load was about what the actual load would be, a lower value would be used.

When, however, both the load and maximum unit-strain are fixed, as in Boston, New York and Chicago laws, it is important that a proper and reasonable value for each should be specified, as it is unjust to the mass of the people to oblige them to spend money for unnecessary material in building their homes. By a study of the values of A in Table II, it will be seen that those in lines 1, 2, 6, 7 and 8, agree very well with each other, and with the exception of line 6, they represent the practice of experienced engineers, — particularly those in line 8.

The variations in the ninth, tenth and eleventh lines are particularly noticeable, those in the eleventh line being in the opinion of the writer nearest to what they should be, although with a limit of 70 pounds per square foot for loads on house floors, they are still lower than is necessary. In the values for E there is not so much variation, and as floor-beams are about the only class of beams computed by the deflection formulæ, and they are seldom, if ever, loaded for any length of time with their full load, it would seem that the values given in lines 16 and 17 are small enough for good practice.

In conclusion, the writer, after a careful consideration of all information bearing on the subject, and from a wide experience in actual building construction, would suggest the values given at the end of Table II, as suitable for general adoption by architects, and for the maximum limit in building-regulations, for ordinary floor and roof construction; and for permanent loads, such as masonry and merchandise, to be reduced as indicated.[1] F. E. KIDDER.

THE RESPONSIBILITY OF GERMAN ARCHITECTS.

THE following rules, defining the responsibility of German architects and engineers towards their employers according to civil law, have been issued by the Association of German Architects' and Engineers' Societies. 1886.

INTRODUCTORY REMARK.

The following rules define the responsibility of architects and engineers who assist their employers in executing an architectural or engineering work, without undertaking such execution themselves by contract.

This responsibility is determined in various ways according to the existing laws, but in each individual case it may be limited by agreement.

In order to enforce these rules it will be sufficient to refer to them in the agreement, either verbal or written, entered upon according to the special circumstances of each case.

GENERAL RULES.

1. Any architect (engineer) is responsible, that the technical performance, which he has undertaken, shall be carried out under the generally acknowledged rules of architectural science.

But he is not liable for the technical performance being in accordance with the rules of æsthetics.

2. An architect (engineer) is liable for damages arising by default of his employés in the fulfilment of any performance of their official duties to the same extent as if such default had been his own.

3. An architect (engineer) is only liable for damages caused by delay in the fulfilment of any performance undertaken by him, provided that a special agreement has been entered into to that effect.

4. An architect (engineer) is not liable for damages arising out of the neglect to comply with laws and statutes which are not in force at his place of domicile, unless such have been previously made known to him by his employer, or it can be shown that he had previous knowledge of the same from other sources.

Neither is he liable for any disadvantage which is claimed by his employer because of a purpose remaining unaccomplished which the employer had in view when engaging his services, unless the same had been notified to the architect (engineer) at the time of engaging his services.

5. The liability of an architect (engineer) for defects in buildings or other works executed, if existing, is limited to the making good of the defect in the building or other work itself.

6. An architect (engineer) is not liable for damages arising out of any neglect in the performance of his duties, which would not have arisen, if he had had the control of the execution of the work, unless he has been charged with at least the general superintendence of the work.

7. In the case of an employer who for the accomplishment of a project furnished by an architect (engineer) calls in the services of craftsmen or contractors, the choice of whom has not been approved of by the architect (engineer), the employer is not allowed to hold the architect (engineer) responsible for any defect in the building or work, unless he proves that the craftsmen or contractors, respectively, whose services he has employed, possess sufficient technical or artistic skill for the carrying-out of such work.

8. Liabilities for defects in a building or engineering work incurred by an architect (engineer) in consequence of neglect in superintendence or control cannot be enforced, unless the person who has executed the building or engineering work be insolvent.

In case of such insolvency, it is incumbent upon the employer to prove that he has used due diligence in selecting the person who has executed the building or engineering work, unless the architect (engineer) has approved of the said person being selected.

9. The duration of liability of an architect (engineer) for work done with respect to a building or engineering structure which he has designed, or the construction of which he has controlled, does in no case exceed the duration of liability of the person who has executed such building or engineering structure. In any case, his liability expires after the lapse of three years, after the building or engineering structure has been taken into use, or the owner has been summoned to take possession of it.

The liability of an architect (engineer) for all other performances is limited to the duration of one year from date of completion of the work. The liability of an architect (engineer) for defects discovered in buildings or other works does not hold good, unless notice of such defects has been given to him and, failing an amicable arrangement, he has been served with a writ of judicial summons before the expiration of the aforesaid limitations.

SPECIAL RULES.

10. *Designs, Building-contracts and Agreements.* — Sketches are preliminary designs intended to show the solution of a technical problem. An architect (engineer) is not liable for deficiences in sketches.

Projects, detailed plans, descriptions, building-contracts and agreements must be as clear and explicit and must be made upon as large a scale as is required by the purpose indicated. They must be made in such a manner as to render it possible to execute the work in accordance with them.

An architect (engineer) is not liable for the dimensions indicated by designs, unless they be given in writing or in natural size.

Architects (engineers) are liable for damages arising to their employers out of neglect or non-observance of legal rules in the making of designs, or in the drawing-up of the technical part of agreements and building-contracts to the extent only of the amount which would have been saved to the employer if such neglect or non-observance had not occurred.

Architects (engineers) are entitled to demand that damages caused by their neglect be made good by themselves.

11. *Estimates of Costs and Values.* — In the absence of any agreement to the contrary, architects and engineers are not liable for mistakes and errors in calculation committed in general estimates of costs and in valuations. They are liable for the correctness of detailed estimates of costs as to the measurements and the labor and material required for the due execution of the building — reference, however, being made to the customary margin permitted by experience. But such liability is limited to the surplus of expenditure which arises to the employer from his having to pay for things omitted more than he would have had to pay if they had not been omitted, or from his having suffered a loss by the sale of things superfluous. Architects (engineers) are not liable for the correctness of prices indicated and of their calculation.

12. *Opinions and Reports.* — In the absence of agreement to the contrary, architects (engineers) are not liable for damages arising out of errors in furnishing opinions and reports.

13. *Superintendence of the Constructions of Works.* — *a. In General.* — Architects (engineers) who are entrusted with the superintendence of construction of works are not allowed to order any alteration in the conditions of the construction laid down by plans or contracts, unless they be generally empowered to make such alterations, or that in working-out the project or the details it appears that the alterations are necessary from an artistic point-of-view.

No alterations are allowed which cause an increase of expenditure unless specially agreed to by the employer.

In case the employer encroaches upon the powers of the architect (engineer), the latter is freed from responsibility in regard to the points concerned by such encroachment.

b. Directing a Construction. — Architects (engineers) who are entrusted with the direction of a construction must give the explanations desired by those who execute the work, in order to make them understand the designs and the contents of the contract.

c. General Superintendence of a Construction. — Architects (engineers) who are entrusted with the general superintendence of a construction must from time to time, at intervals left to their discretion, either themselves or through their employés visit the building or other work. They must give the necessary instructions required for the furtherance of the work in progress, and order the removal of any deficiencies discovered by them on the occasion of such visits.

Their liability for defects of material or labor is limited to the defects of which they or their employés, respectively, have become aware during their visits and the remedying of which they have not ordered and tried to enforce by the means in their possession.

d. Special Superintendence of a Construction. — Architects (engineers) who are entrusted with a special superintendence of any construction must examine the materials and work as regards their being in accordance with the contract and as to their efficiency. They are liable for deficiencies which by a careful control could have been discovered — unless they have formally drawn the attention of the workmen, and in case of this having no result, of the employer also, to the deficiences — in so far, but in so far only, that they must replace the deficient work at their own expense.

It is understood that architects (engineers) who are entrusted with the superintendence of a construction undertake only the general superintendence, unless it has been expressly stipulated that they shall undertake the special superintendence.

[1] Since this article was written, the Colorado Chapter of the American Institute of Architects have drawn up a new Building Ordinance for the City of Denver, in which the values herein recommended have been adopted.

14. *Taking Delivery of a Structure.*—Architects (engineers) who are entrusted with taking delivery of a structure must by trial-tests on the apparent parts of the building, or other work, check the existence of deficiencies They are liable for deficiencies discovered and not made known to the employer, with this limitation, however, that they are only bound to refund to the employer the surplus of expenditure incurred by his having had to pay more in consequence of a rise in the prices of material or labor in order to make good the deficiences at the time of their actual discovery than he would have had to pay at the time when delivery was taken of the structure.

Special arrangements are required where the employer wants particular objects of technical work to be subjected to a special test and approval and the responsibility of the architect (engineer) for such examination and approval is consequently increased.

15. *Audit of Accounts.*—Architects (engineers) who are entrusted with the auditing of building-accounts must examine the correctness of such accounts with regard to the contract, or in case no contract has been made in writing, with regard to the fairness of the prices charged. Special agreements are required when the audit of accounts is to include the correctness, or the completeness and efficiency, respectively, of the objects charged in account.

Architects (engineers) are liable for mistakes in an account not corrected or brought to the notice of the employer by them, but only in case of the insolvency of the person who has issued the account.

16. *Final Rule.*—All rules contained under the head of Special Rules (10–16) are subject to the provisions of the General Rules (1–9).

THE POSITION OF THE CHOIR AND ORGANS IN CHURCHES.—II.[1]

THE DISCUSSION.

MR. H. H. STATHAM, who had been invited to take part in the discussion, wrote to say that he was prevented by another engagement from being present, but he sent the following remarks on the subject, which were read by Mr. Eales, one of the Honorary Secretaries:—In regard to cathedrals, I think the formerly usual position of the organ, on the screen between the nave and choir, was the best both for architectural effect and for the effect of the instrument, as long as the organ was of moderate size, and as long as the choir was practically the church, or when the choir and nave were not used simultaneously for worship. I do not think that position of the organ was at all detrimental to architectural effect,—rather the contrary. There is now, however, a growing feeling in favor of uniting the choir and nave, or having only a light open screen between, which necessitates the removal of the organ from that position; and the greatly-increased size of modern organs would render it impossible to plant the whole of the organ on the choir-screen in any case. Under these circumstances, I think a cathedral organ is best placed with the lighter portion bracketed out from one wall of the choir, and the heavier portion placed in the choir aisles, behind a screen; but the pipes must be concentrated, not scattered about as if they were playing at hide and seek in the choir aisles, as they are in one cathedral I could name; that takes away all the unity of effect of the instrument. The organ itself would sound better all built up in one case in the transept, but that is too far from the choir to blend with them or keep them properly in tune. The best of all arrangements for a cathedral, would be a small organ in the choir to accompany the choristers, and a large nave organ, either at one side or at the west end, to lead congregational singing: and with the present means of electric action the two could be brought under the control of the same player. For parish churches, I think there is no question that the best position for the choir in reference to the congregation, is the usual one, standing sideways and divided for antiphonal singing. The old west-end position of the choir placed them *behind* the congregation whom they were to lead, which was unsuitable; and to place them facing the congregation at the east end, though the best position musically, would be at variance with the idea of the simultaneous worship by choir and congregation, as well as placing them with their backs to the officiating priest. That being taken as settled, there is at present no place for the organ except in the chancel aisle or organ-chamber, which, as generally constructed, is simply fatal to the effect of the organ. The organ *must* be near the singers, however, and the bad effect of the organ-chamber may be lessened by making it much higher than is usually done, and by sinking the floor so as to get the bellows and the lower part of the pedal pipes below the floor, and the wind-chest on a level with the floor. The pipes will then have more space over them, and the sound will develop and get away better. In the usual low organ-chamber, we generally hear a great noise close to the organ, a large proportion of which does not get into the church at all. I consider, however, that all the difficulty arises from the faulty plan of our churches, and that reform should begin here. The adoption of the long chancel in which the choir are placed, is not only unpractical, as being the worst possible for the effect of the choir, but is, even from the point-of-view of orthodox precedent, without any reason for its existence. The long choir came into use in the latter days of the mediæval church, when the clerical body and their subordinate functionaries became very numerous, and required the lengthened choir to accommodate them all. They chanted the service, but they were shut off within a choir and behind a screen, *not* as choristers, but as *clergy*. In the present day there is no such large body of clergy connected with any church; the choir, whether paid or amateur, is a lay choir, and is properly part of the congregation, whose service of praise it is supposed to lead. But the choristers, who are no longer clergy, are packed into a long narrow chancel where they cannot be properly heard, necessitating also a most ineffective position for the organ, merely because such a position was once considered correct at a time when the clergy were themselves the choir. I cannot see that, even on the most orthodox High Church view of the matter, there is any reason for this arrangement. Let church builders return to the basilica plan, which was for centuries the accepted church plan, and which is exactly suited for our modern service,—the plan with the short chancel for the clergy and the altar, and the nave for the congregation; let them place the choir in the front portion of the nave (only seated sideways), forming, as they should, part of the congregation, and place the organ in a shallow transept adjoining them, and we should hear no more about the difficulties of placing the organ, etc. The whole difficulty arises from retaining, for a lay choir, on a mistaken idea of precedent, a form of plan intended originally to accommodate a numerous clerical body, which no longer exists.

The Chairman said the meeting had listened with very great interest to Mr. Brewer's interesting paper, and also to the supplementary remarks which Mr. Statham had been kind enough to send, and which appeared to throw some new light upon the subject. The whole question, it seemed to him (the Chairman) was to a large extent one of sentiment and ritual. Of course, looked at from an organist's point-of-view, the position for the instrument indicated by Mr. Brewer, in his drawing, was probably the best that could be chosen, although he had awarded very high praise to the position of the organ at Ratisbon, in the apse, at the rear of the altar. In the construction of an organ-chamber the object to be sought, he (the Chairman) took it, was to get as much height as possible, and to get the walls to act as sounding-boards, and probably curved surfaces would be the best. He understood Mr. Brewer to say that the plan of dividing an organ into two was objectionable, but in that they would probably not be all agreed. Did Mr. Brewer consider the arrangement of the organ at All Saints', Margaret Street, a bad one? However they might differ from him, however, they would all thank him for his paper, accompanied as it was by so many excellent and interesting drawings, for they were always glad to see his clever handiwork.

Mr. J. A. Gotch, in moving a vote of thanks to Mr. Brewer, observed that, fascinating as was Mr. Brewer's drawing showing his suggestion for the position of an organ, he should be very sorry to see all our cathedrals with the organ over the rood-screen or choir-screen. It seemed to him that one of the great effects of a grand cathedral, and one that stirred the beholder with so much awe, was the vista from west to east of the whole length of the interior. To cut the interior in half and so destroy the vista by placing the organ as suggested by Mr. Brewer would be a very great pity. But, of course, it was a matter of taste. No doubt the organist regarded the organ as one of the finest objects in creation, and would not have the least objection to its interference with the vista. But speaking for himself as an architect, he would rather see the whole length of the church than the finest organ that could be placed in it. It appeared to him that the west end of a church as the position for the organ had the sanction of antiquity, and was in all respects a very excellent place for the instrument, but the question was one for musical experts to decide. From an æsthetic point-of-view, he desired to raise his voice against obtruding the organ right into the middle of the church. He quite agreed with what had been said as to the improper positions often selected for organs. He knew a little church in Northamptonshire, the chancel of which had been rebuilt as the mausoleum of a neighboring ducal family, but quite recently there had been clapped right into the middle of it an organ, which had no merit whatever so far as the case was concerned.

Mr. W. A. Pite, in seconding the motion (in which he included the name of Mr. Statham), said he could bear testimony to what Mr. Brewer had said of the organ in the Cathedral of Ratisbon, where the music and singing were simply superb. With regard to the position for the organ suggested by Mr. Brewer in his drawing, it was to be doubted whether the clergy in the chancel would be able to make themselves heard in the nave, owing to the obstruction which would be afforded by the organ and screen to the passage of sound. There was an organ in Westminster Abbey in the tenth century, and there seemed to have been one at Winchester, erected by Bishop Elfeg, in 951, and which Wolstan, one of the the monks, thus describes:—

> Twelve pairs of bellows ranged in stately row
> Are join'd above, and fourteen more below;
> These the full force of seventy men require,
> Who ceaseless toil and plenteously perspire,
> Each aiding each, till all the wind be prest
> In the close confines of the incumbent chest,
> On which four hundred pipes in order rise
> To bellow forth that blast the chest supplies.

Mr. F. Farrow, in supporting the motion, said that with regard to the position of the organ, every one who was acquainted with the needs of the instrument would agree that it should not be placed where it could not make itself properly heard. One instance in which an organ was placed in a transept occurred in a

[1] A paper, by H. W. Brewer, read before the Architectural Association, London, February 2, 1883, and published in the *Builder*. Continued from No. 963, page 111.

modern church at Armley, near Leeds. There the organ was a very fine instrument, and the wind was supplied by a hydraulic blowing apparatus located in a building outside. In Glasgow Cathedral it was a condition of the authorities that the organ should not be a prominent feature, and hence it was necessary that some of the pipes should be laid horizontally in the triforium. The effect, musically, was very good. Although, no doubt, the western gallery of a church was a very good position for an organ, the clergy were not likely to adopt such a position, owing to the difficulty of maintaining discipline amongst the choristers, who must, of necessity, be located near the instrument. It had been suggested that a large organ might be placed at the west end of a church, and a small one in the choir, but it was not easy to get them both to act together, and even if that could always be done, the sounds of both instruments could not possibly reach the ears of all the worshippers at precisely the same time, and the effect of this would often be unsatisfactory. Probably the best position for a church organ was that suggested by Mr. Statham, viz., a shallow transept, so that the instrument would be in a comparatively open situation, and close to the choir, without obstructing the view of the altar. An organ so placed would render it possible for the organist to bring out its full effect.

Mr. Hampden W. Pratt said that, as architects, they were more concerned with the question as to the best position for an organ in a church, than with the question as to the best place for a cathedral organ. An arrangement which might be suitable for a cathedral would not necessarily be appropriate in a parish church. Assuming that Mr. Brewer's remarks applied rather to the needs of the Established Church than the Nonconformist churches (in which there was no difficulty in arranging the congregational singing with reference to the organ), it occurred to him (the speaker) that if the chancel were made rather wider than was usual, the organ might be placed on one side of it without projecting to such an extent as to obstruct the view of the altar. Of course, if that were done, it would be necessary to give the instrument a more ornamental and architecturally-effective case than was at present the rule,— a plan which would be productive of much better results than merely decorating the pipes, for most people were rather tired of seeing organs with gaudily-decorated pipes inclosed in cases of no architectural character. While he quite agreed, however, with Mr. Brewer's contention, that organs should be more prominently placed, he was sorry to hear from him that the tendency was for organs to become larger and larger. If they became much larger than they were at present, how were architects to properly dispose them? Their difficulties in that respect were already sufficiently great. For his own part, he was of opinion that a great deal more money was, as a rule, spent upon organs than was necessary or justifiable, having regard to the other requirements of buildings intended for religious use. Some objection had been made in the course of the discussion to the position for an organ suggested by Mr. Brewer's drawing, but he presumed that the suggestion was only applicable to cathedral organs?

Mr. Brewer.— No, it applies to parish churches. The drawing is meant to represent the interior of a parish church 130 ft. long.

Mr. Pratt said, that being the case, he should object most strongly to the placing of the organ in so prominent a position, for to place it as suggested would be to almost make a god of it, an object of worship. Some of the speakers had spoken in derogation of congregational singing, but so long as that continued to form a part of public worship, architects must give due consideration to it in arranging the position of the organ. He agreed with all that had been said in condemnation of what was called the "organ-chamber," which should be abolished, and the organ placed either, as Mr. Statham suggested, in a shallow transept, or, better still, in his (the speaker's) opinion, in the chancel, which might, perhaps, advantageously be made the same width as the nave.

The motion having been put to the meeting, and carried by acclamation,—

Mr. Brewer thanked the meeting for the attention which had been given to his paper, and proceeded to reply to some of the remarks made in the course of the discussion. He observed, with regard to the scheme which had been criticised by most of the speakers, that he had simply worked it out because it had been suggested to him whether it would not be possible to place a church-organ in such a central position. He had, he thought, shown how it might be so placed with the minimum of obstruction. He was not prepared to say that, architecturally, it was the best position, but undoubtedly, from a musical point of view, it would be a good position for the instrument. He quite agreed with the observations contained in Mr. Statham's communication, except with regard to a small transept being the best position for an organ. A large organ very often occupied a space measuring 20 ft. by 20 ft., and 40 ft. high, and those dimensions would necessitate a large and lofty transept. The organ should never touch the outer or side walls, but a space should be left all round it, because, if completely enclosed on three sides, the only pipes which had a chance of properly speaking out were those on the unenclosed side, the pipes at the back being half stifled and unable to make their voices properly heard. It had been suggested that the organ, if placed upon the choir-screen, would prevent the voices of the clergy in the chancel being heard by the congregation in the nave. Well, upon that point he would only say that, extraordinary as it might appear, he never knew what the music in Westminster Abbey was really like until he happened one day to be shut in the nave while the service was going on. He had often previously noticed when in the transepts or choir that the music seemed to have a sort of muddled effect, but in the nave on the occasion referred to, he could hear distinctly every word that the clergyman intoned. That seemed to prove that the placing of the organ upon the screen would not prevent the voices of the clergy in the chancel from being heard in the nave of a parish church. As to the interference with the vista, he admitted that there was something very fine in the vista along the whole length of a large church, but mediæval architects certainly did not make the vista the paramount consideration in their interiors, otherwise, why did we always find that they provided screens in their churches and cathedrals,—sometimes, as at Durham, extending right up to the roof? In most Continental churches which had not been modernized, it was impossible to see entirely from one end to the other of the interior; indeed, it seemed to have been rather the intention of the mediæval architects to divide their churches. With regard to the practice of dividing organs, he regarded it as objectionable and unwise. In the first place, it added enormously to the expense, and in the second place the two parts had to be connected by what were called "trackers" passing beneath the floor of the church,— an arrangement which was very inconvenient, for if what was known as "cyphering" took place, the floor would have to be taken up to get at the trackers. Another objection was that when an organ was divided, the two parts would in all probability be subject to different sets of draughts and atmospheric influences, and thus one part would get out of order a great deal sooner than the other. With such an arrangement, too, the action was a great deal heavier, except where the new pneumatic action was in use, but this appliance, although very ingenious, was likely to get seriously out of order when the atmosphere was damp, and the result would be that the organ would "cypher" like a Board school-boy. The "pneumatic action" did very well for important organs in public buildings, which could be perpetually attended to, but it was too liable to get out of order for the general run of church organs.

LONDON EXHIBITIONS.

WHEN, I wonder, was the last "good" exhibition of the Royal Academy? Never, in my memory. Each year we hear: "Is it a good exhibition? Is there anything striking?" Some answer, "No," bluntly; others, less positive, find that there are a fair amount of "interesting pictures." Probably never has an exhibition within the walls of the Academy been pronounced "good," since the days of Reynolds and Gainsborough; and were even those great artists appreciated to their full by the contemporary and captious critic?

This year's show is much as usual, as it appears to me; many excellent works which stand out from an amazing amount of rubbish. People say the same of the Paris Salon, and probably they are right; but where London shines superior to Paris is in the wondrous number of feebleosities, if I may coin a word. The French rubbish is better worked; just as a French preacher forms his empty words into well-composed sentences, so his artistic compatriot clothes his stupid subjects in well-drawn bodies. The feeble works in Paris are few; in London, they are many — let us pass them by in sympathetic silence, although wishing that some of the rejected were in their place.

The number of works sent in is said to have been 15,000. Think of the aching hearts! Think of the worry and boredom of looking through so many pictures! and yet, at a meeting held quite lately, the Academy refused to limit the number of works allowed to each exhibitor. Now, supposing the Council to sit eight hours a day for twelve days (which I think *exceeds* the number of days given up to selection), and supposing this number to be correct, we find that each picture has about twenty-two seconds spent upon it. Can a fair judgment be possible in that time? and mark, that all the works are supposed to go up twice. But if each artist were limited to one or two works, they might all have a minute, more or less, to themselves. And again, if the numbers were limited, there would be more space to allot to others than ourselves, our friends, and our pupils. However, reform is difficult in all institutions; and the Champ de Mars Society has become a clique, even as the "Atelier Julian," (as the Champs Elysées Salon is called), from whose unfair ways, the former set broke loose. Perhaps, the old system in vogue during the Empire was, upon the whole, the best — that of having half artists and half government officials upon the jury.

Mr. Watts takes us back to Paolo Veronese, in his fine figure clad in rich yellow and green draperies — "And he had great possessions" — the painting of the emerald ring alone is a splendid study. So is the portrait of Sir Andrew Clark. Mr. Herkomer is not at his best in his "Lord Salisbury," that peculiarly unintellectual looking statesman; but the doggedness of the man is forced up, as it were. It is curious how, sometimes, a physiognomy may belie a man.

Curiously, for the first time in its annals, the Academy is bursting with patriotism in the way of battles; but, although blood and mangling of human bodies are not spared, one is not a scrap affected by the would-be horrors. The artists have been inspired probably by the success of Zola's "*Debâcle*"; but it requires personal suffering and personal knowledge to be a battle-painter. Is not that the secret of the pathos depicted by those great soldier-painters, De Neuville and Morot?

Two works, widely differing from one another, stand out in one's memory — Mr. Tuke's "August," and Mr. Hitchcock's "Mary at the house of Elizabeth." The former represents some boys bathing from a boat in a blaze of sunlight — perhaps one of the sunniest pictures ever painted, with the exception of those by M.M. Claus and Montenard, with which it has a certain kinship. Mr. Tuke is a young man, who has been steadily advancing for some years. Mr. Hitchcock's "Mary" is charming in its simplicity and scheme of color. The Blessed Virgin is standing in a garden of lilies — "Mary's flowers," as the Germans call them — and in the foreground is a mass of marigolds. The simple young Dutch face, in the quaint head-dress, is admirably painted; and not only is there a pathetic forecast of sorrow in the expression of the eyes, but the whole figure and background is harmony itself as regards color and composition.

Sea pictures abound as usual. Equally, as usual, Mr. Henry Moore exhibits those stretches of breezy skies and dark-blue waves, which give one the impression of being painted on long strips of canvas and then cut into lengths and framed. It is a pity that success should call forth monotony; nothing can be finer than Mr. Moore's seas — one seems to smell the salt, and feel the spray; but have we not had enough of the same thing? Mr. Somerscale's "Fight off Ushant, 1 June, 1794," is also a brilliant piece of sea-painting. The picturesque old three deckers with their high poops, are sailing about in majesty such as the modern turret ships do not possess. Shall we ever come back into the possession of ships instead of floating fortresses? Many things are less possible, and many landscapes are far less beautiful than Mr. Ernest Parton's "Moonlight" and Mr. Alfred Parsons's "Sunset after rain." Probably the glorious weather of last summer is answerable for the numberless summer moons — that twilight time when the sky is bathed in the setting sun's reflected light and the afterglow surrounds the "pale cold moon," giving it a pinkish-yellow glow. Mr. Herkomer, so great in portraiture, is not very successful in his nude lady standing in a rose-bush. And what does Mrs. Grundy say to this departure on the part of the professor and instuctor of her dear daughters? Nor can one commend Mr. A. Goodwin's fantastic Doré-esque "First Christmas morn," for who can say whether the Heavenly Cathedral here depicted in the most aerial of architecture, and seen in a vision by the Shepherds, is true or false? A study in blue, it certainly is. The painting of the wet nets which fished up Mr. Draper's "Sea-maiden" is excellent; but the fisher folk want strength and vigor. An excellent portrait is Mr. Waterhouse's "Mrs. C. Newton Robinson," a delicious study in white, and an excellent likeness. Pathetic are Mr. La Thangue's "Poor People," and another fine portrait is Mr. Solomon's "I. Zangwill, Esq." — most vigorous; but "what an ugly man," said a young lady behind me. How could that be helped? Another, to whom the same epithet might be applied, is the old Dutch shrimper, who has placed his basket on the floor, while he recites the Angelus. Mr. Sherwood Hunter has been most successful, both in man and shrimps, not only as regards the harmonies of blues and violets, but in the feeling of the picture. That old shrimper has a soul, and he is pouring it out to his Maker with all the force of a hard worker and toiler of the sea.

Mr. Arthur Hacker's "Sir Persival" is fine in conception; but the knight wants dignity, and the maiden, beauty. Mr. Marcus Stone lately married his interesting young people after a very long and tedious engagement; but it seems as if the marriage were not likely to prove a happy one, for here is another young man "stealing a kiss" while the lady sleeps. Or is it the husband? It certainly resembles him, though it might be a brother or cousin, but surely a husband would not "steal" a kiss? Mr. Frith has put his servant maid of "Sherry, Sir?" into the modern garb of cap and streamers, which is so becoming that years do not seem to have told upon that immortal personage. Not so Mr. Mark's delightful old man reading an "odd volume" at a book stall — a charming piece of character-painting, excellently interpreted. Mr. Solomon's "Paula Tanqueray," otherwise Mrs. Patrick Campbell, scarcely does that grand actress justice; it is an excellent likeness and a charming harmony, but it seems to want the suppressed energy which is one of the characteristics of the actress. To say that Mr. Solomon is not at his best, does not prevent him from occupying a far higher pedestal than most of his "betters," as regards position and reputation. The most ambitious picture yet produced by a woman is probably Miss Rae's "Psyche before the throne of Venus." Although not quite satisfactory in certain details, it is an excellently composed work, and gracefully executed.

Water-colors do not shine at the Royal Academy this year; they are of the "finished" order. But then, have we not had the Dutchmen and Frenchmen with us lately — those masters of pure water-color. Here, in London, we have few native *aquarellistes* in the true sense of the word; but, of the few, let me cite as masters of the art Mr. Arthur Melville and Mr. W. H. Allan. PENGUIN.

FRENCH GOVERNMENT SUES THE WORLD'S FAIR. — Suit for $1,000,000 damages has been begun in the United States Circuit Court by the French Republic, against the World's Columbian Exposition. The litigation grows out of the French Government's claim for damages to exhibits of French subjects injured during the Manufactures Building fire. — *Exchange.*

OUR PUBLIC BUILDINGS: A SUGGESTION.

IN the discussion growing out of the correspondence of the President of the American Institute of Architects and Secretary Carlisle, in reference to the designing of the Government buildings, it has been suggested by a very few of the newspapers, that the architects were governed purely by selfish motives. Unfortunately, in this matter, as well as in other matters of public concern, only those are interested to bring about a reform whose business or profession brings them in close contact with the evil to be remedied, and the correction of the evil may sometimes bring to them a more or less direct or indirect advantage. Should the designing of the buildings for the Federal Government be thrown open to fair competition, it is probable that not one in ten of the competitors, and not one in a hundred of the practising architects of the country, would receive any direct advantage, but all would be benefited in the general elevation of the taste of the people, by providing for the erection of buildings in accordance with the canons of good taste and showing evidence of a cultivated and artistic education on the part of their designers.

As an evidence of the sincerity of the motives governing the officers of the American Institute of Architects,— the only really representative body which can speak with any authority for the architects of the whole country — its president at the last meeting of the executive committee of the Institute, in a discussion of the question of how to bring about the desired change and to secure the necessary legislation, made the proposition that the Bill now under consideration be so framed as to place in the hands of some of the great universities of the country the selection of a part of the jury whose duty it would be to formulate the programmes, select the most meritorious design, award the prizes for the best, and select the architects for the proposed buildings.

Suppose, for instance, that the selection should be left to Harvard College, Columbia College, and the Universities of Virginia, Chicago and California. These institutions have the elements of permanence and of wise and conservative management, and their officers are men who, from their position and eminence, possess a wide acquaintance, both among their own alumni and the leaders of men who are not college-bred, and their wide separation would ensure a selection which would be neither local nor provincial, nor political nor sectarian, but one which would command respect and would be readily acquiesced in by all who might take part in the competition.

An expression of opinion on this subject would be of value and would be a help to the committee just appointed to consider the whole subject, which is now attracting such widespread interest both in and out of the profession of architecture. F. A. I. A.

CHURCH FURNITURE.[1]

IT is remarkable that the modern builders of organs, with one or two notable exceptions, have failed so completely to recognize their responsibilities and opportunities in respect to the external appearance and fitness of their work. It is no exaggeration to say that, when let loose in a church, the organ-builder, speaking generically, is the veritable bull in the china shop. For no antiquity, for no beauty, has he any reverence or respect. They are reserved for his 16 or 32 foot pipes. If he adds a case to his instrument, he drags out a stock pattern, stop-chamfered Gothic, "*very Early,*" of the first quality. This, perhaps, he ornaments with some gilt-tipped ironwork, bedizened red and blue, which seems to have had its origin in Coventry; metaphorically, perhaps, its most appropriate destination. At stencilling in varied colored designs of the fleur-de-lis order, he has no rival. He contemplates his organ only as a huge square or oblong windbox, and this, although he has numerous modern mechanical inventions at his disposal which make it pliable and manageable in an extraordinary degree — methods unknown to our predecessors who turned out those grand combinations and designs, so instructive for our study. Here, indeed, is a field for the architect who enjoys openings for endless possibilities, a field which has been strangely neglected. There is none more seductive or more charming. True that it is full of technicalities and limitations which cross our path frequently; but the genial and accommodating organ-builder — when we are fortunate enough to find him — can help us to a remarkable degree. At its worst, the subject is one which common-sense, application, and tactful insistence can easily master. There is no attribute of the service demanding more earnest attention from all who have to deal with churches. The organs which have been permitted to disfigure some of the finest monuments in the country are, and will remain until remodelled, a disgrace, so far as their appearance is concerned, to the revival of church activity.

It is not only a question of the organ case to which I am referring. I know that funds often fail us to provide this. Sometimes it can never be added for this want. But the position, arrangement, and massing of the parts of the instrument itself are of first importance. If well done, the organ left only in skeleton can be made a fine object, and need never be an unsightly one while its grouped towers of pipes are waiting their clothing. In designing a new church, not only should the position and magnitude of the instrument be determined

[1] Extract from a paper on "Church Furniture" by W. D. Caröe, read before the Royal Institute of British Architects, April 23, 1894.

at the outset, but in all cases should its grouping and case appear upon the original drawings, being fully as important in effect as any other portion of the structure.

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.*]

SIDE ENTRANCE OF THE CABLE BUILDING, BROADWAY AND HOUSTON STREETS, NEW YORK, N. Y., MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

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

THE sculptor of the colossal figures above the door was Mr. J. Massey Rhind.

ACCEPTED DESIGN FOR FIRST PRESBYTERIAN CHURCH, ELM STREET, NEW HAVEN, CONN. MR. F. R. COMSTOCK, ARCHITECT, HARTFORD, CONN.

THIS building will be erected in front of the present Sunday-school building and adjoining same. The exterior of front will be of granite to first sill-course, and Indiana limestone above to roof of porch; the remaining parts will be of buff terra-cotta brick and cream-colored terra-cotta. The columns at entrance will be of polished pink granite. Work will commence in the fall of 1894.

A TRIO OF ITALIAN ORGANS.

THE CATHEDRAL AT AUCH, FRANCE.

HOUSE OF J. LEVERING JONES, ESQ., CHESTNUT HILL, PHILADELPHIA, PA. MR. GEORGE T. PEARSON, ARCHITECT, PHILADELPHIA, PA.

[Additional Illustrations in the International Edition.]

SOUTHERN CENTRAL PORCH OF THE MANUFACTURES BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. MR. GEORGE B. POST, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print.]

CHAPEL OF THE GERMAN GOVERNMENT BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. HERR JOHANNES RADKE, ARCHITECT, BERLIN, PRUSSIA.

[Gelatine Print.]

A HOUSE IN BEDFORD PARK, CHISWICK, ENG. MR. R. NORMAN SHAW, ARCHITECT.

THE GARDEN FRONT, "ASHCROFT," ENGLAND. MR. W. F. UNSWORTH, ARCHITECT.

COMMUNICATIONS

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

THE USE OF NEEDLES IN TUNNELLING.

PORTSMOUTH, May 22, 1894.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Through a friend of mine I had the pleasure a short time ago of reading an article in your paper upon the "Use of Needles in Tunnelling." As engineer for the contractor, Mr. Henry Lovatt of Darlington Street, Wolverhampton, and the one to whose care the work was entrusted, I have thought you may be interested to have a few details respecting the method employed in carrying out the plan that was adopted.

The writer of the article in your issue of the 20th January last has clearly shown the nature of the difficulties that had to be contended with, whether the work had been carried out by the ordinary way of tunnel driving, or by that of "cut and cover" (the plan generally adopted where the ground above a tunnel is shallow); and it was in consequence of these difficulties that Mr. Lovatt, who had just then learned of Mr. Jenning's invention, took the matter of the needles up and ultimately became the possessor of the patent. He, from the first, became convinced of the practicability of the invention and of its adaptability to the work in question, and the success that followed its uses has fully proved him to be correct.

The needles, as your correspondent describes, were ten feet long, six inches broad and two inches thick. They were rolled to a section that permits an interlocking or sort of open hinge along the sides, which holds them together in position. The sketch, Figure 1, showing a cross-section of these bars so interlocked, will make this clear. Along the centre of the bars and for their whole length

Fig. 1.

$1\frac{1}{4}''$ holes were drilled, $6''$ apart, and when the needles were required to be advanced, steel studs were inserted into these holes. Against these studs one end of a "ratchet-screw-jack" was placed, the other end of the "jack" abutting against the last turned length of brickwork, enabling a sufficient resistance to be obtained to advance one, two and sometimes even three needles at a time.

The excavation was, of course, worked from the crown to the sides, and then, though the whole of the needles were being moved forward during the time this excavation was in progress, those at the crown were always the most advanced until the operation was completed, which was when the needles had about a foot of bearing on the last length of brickwork. To support the needles while they were thus being advanced, temporary props were employed but, as soon as they had been got forward for the length required, timber "horse-heads," cut to the contour of the tunnel, were used; these "horse-heads" being supported first by raking props and afterwards, when the "top-sill" had been got into place, by props from this sill.

To prevent any sinking of the ground above where the needles were drawn forward on the previous length of brickwork, the outer ring of the tunnel arch beneath the needles was built by leaving out every alternate course of bricks, as in Figure 2, and when the needles had been drawn forward about 2′, fine Portland-cement concrete was rammed into the spaces thus formed and then, by means of a "screw-jack," was squeezed over the blocks of brickwork left between the openings, so that the roof of the tunnel became properly supported in its place. The needles were then advanced another 2′ and concrete again inserted, and so on, until the whole of the needles for that length were taken forward. These needles were only used for about 12′ on each side of the centre of the roof of the tunnel, the remainder of the excavation being supported by timber-bars and "poling-boards" in the usual way.

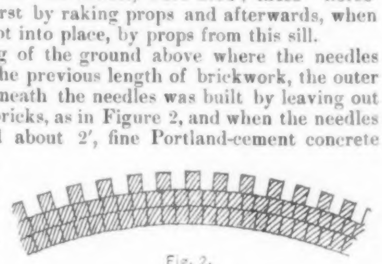


Fig. 2.

The King's Cross tunnel is very flat in its form, being 26′ across and 22′ in vertical height. Figure 3 gives a section of this and also shows from *a* to *b* the layer of needles forming the supporting roof over the excavation for the arch.

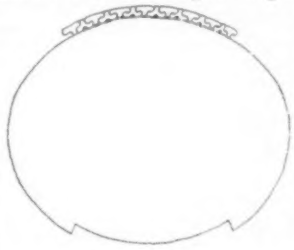


Fig. 3.

There is no doubt that if a tunnel is required to be driven through ground, where but little depth can be obtained above the tunnel arch, and especially where it is necessary to do away with all probability of the sinking of the ground, the use of these needles would be the best, both for safety and economy. The economy, especially, where the state of the ground requires timber, when used, to be built in, is clearly shown by the writer of the article in your January number already referred to.

In conclusion, I may say that Mr. Lovatt would, I am sure, be pleased to answer any question relating to the further employment of these needles, and also as to their supply for use in the United States of America. Yours very truly,

CHAS. PROUSE, A. M. Inst. C. E.

EXHIBITIONS

BOSTON, MASS. — *Several hundred Specimens of Textile Designs of all countries, from the second century to the present time, from the collection given by Denman W. Ross; also the Shirasu collection of Japanese Art:* at the Museum of Fine Arts.

CINCINNATI, O. — *Exhibition of the Cincinnati Art Club:* at the Art Museum, May 17 to June 30.

NEW YORK, N. Y. — *Twenty-sixth Annual Spring Exhibition:* at the Metropolitan Museum of Art, opened May 8.

Group Exhibition by American Painters — William M. Chase, J. Alden Weir, Childe Hassam and others: at the Galleries of the American Fine Arts Society, 215 West 57th Street.

NOTES AND CLIPPINGS

Private Houses at Damascus. — If you can only judge from the outside of the house, you would say there was not one tolerable one in Damascus, but that would be a very wrong conclusion. You go up a filthy lane, holding your nose by the way and carefully picking your steps over all kinds of garbage. You knock at an old tumble-down door in a mud wall. You pass through it into a dirty, narrow corridor, and emerge into a beautiful court-yard paved with white and black marble and shaded by lovely orange and lemon trees. This court is bordered by splendid apartments. I say splendid, not tasteful nor comfortable in any way. Imagine a grand drawing-room, wainscoted with exquisitely carved marble, the execution of which must have cost $20,000, paved with costly tiles, a graceful marble fountain in the centre, and mirrors in frames of carved cedarwood all around. Stained windows shed a soft light on the costly furniture of mother-of-pearl. On the carved tables are coarse worsted flowers, such as you might see in a cabin in the pine forests of Michigan. On the walls are cheap, 25-cent engravings, and the rusty pipe of a common sheet-iron stove goes out of one of the fine windows. Gilding, but no taste; expense, but no beauty. And in came the mistress of all this gorgeousness, a fat woman badly dressed, and walking on pattens inlaid with mother-of-pearl, which raised her up to the height of a giantess and made her look so funny that it was with the greatest difficulty we kept from laughing; and when you go beyond the one or two show-rooms, you find nothing but ugliness and dirt. The domestic arrangements are often unspeakable, the sleeping-rooms comfortless, the kitchen and dining-room common and far from clean. The servants never undress themselves at night, but roll up in a rug and drop down anywhere, and the masters are not much better. They wear European clothes, but underneath there is no European cleanliness. We went to a bath-house to try a Turkish bath, but a regard for our skins sent us home again. We could not risk it. — *Clinton Locke in the N. Y. Evening Post.*

A Silesian Replica of the Tuileries. — At Paris the sale is about to take place of the superb Champs Elysées mansion of the infamous Countess of Henckel-Donnersmarck. It may be remembered that she was the daughter of a Pole, of the name of Lachmann; that at 16 she married a poor tailor at Moscow whom she deserted to come to Paris, where for a time her name figured on the registers of the police. I have related how she was driven out of the Tuileries by order of the Empress Eugénie after she had stolen into the palace in the guise of the wife of the pianist Herz; how, subsequently, she inveigled the Marquis de Paiva into marrying her, the nobleman blowing his brains out a few months afterward in the very house which is now to be sold; how she became first of all the *belle amie* and then the wife of the fabulously wealthy German nobleman, Count Henckel Donnersmarck, and how, after the overthrow of the imperial regime in France, she revenged herself upon the Empress by purchasing all her Majesty's favorite jewels and by getting Eugénie's own architect to construct for her in Silesia, a counterpart of that very Tuileries palace from which she had been so ignominiously chased. She is dead now, and her husband is married again to a very pretty Russian woman. Anxious, no doubt, to obliterate all memories of his first wife, he has given orders for the sale of this mansion, the principal feature of which is a staircase made entirely of onyx. The Countess had asked Edmond About to write a short dedication for this magnificent staircase, with the object of having his lines engraved in the fashion of the ancient Romans, upon the first step. The brilliant author, however, felt very bitterly at the time against this most famous of modern Phrynes, in consequence of some fancied or real slight to which he had been subjected by her, and while he complied with her request, the verses were not of a character that she cared to engrave upon her onyx staircase; for they began as follows: — Tout comme la Vertu, le Vice a ses degrés. — *Marquise de Fontenoy in the Philadelphia Press.*

Eastern Metal-work. — It is one of the unexplained mysteries of Asia that the achievements of its best metal-workers, so long as their work is useless, should be so completely beyond rivalry. We can understand this as regards the setting of precious stones, for, as we once said before, many years ago, the instinct of a Southern Asiatic living in painful sunlight is to blend the bright colors he works in till they do not hurt the eye. Consequently, the enameller of Jeypore, though he uses flakes of ruby and emerald, produces a surface which looks, even in sunlight, absolutely cool. But what helps him or a Japanese, or even a Turk, if a sultana has given the order, to make a gold or silver ornament which the West can only gaze at in defeated admiration, is still a problem not completely solved. The Asiatic does not know anything particular about gold and silver; he has no tools except pincers and a hammer; and he has not the power of producing intense heat; yet he will do things with the metals which his European brother cannot do with all his appliances and skill. No doubt, if he is an hereditary workman, something has passed into his fingers which cannot be acquired by a new competitor, and he has the advantage of remembering patterns originally designed by the men of genius, who are apt, at intervals perhaps of centuries, to crop up in the artist families. But is that the whole matter? We doubt it greatly, and believe that there is an Asiatic "taste," or instinct, for the beautiful, which is as true in its way as the instinct of an Athenian sculptor or Florentine wielder of the brush. — *The Spectator.*

Cui Bono? — But when he [Hamdi Bey] came to the tomb of Tabnit, king of Sidon, to which he penetrated with great toil and expense, passing down through chamber after chamber till he found the great stone covering the actual vault, which he hewed in pieces because it was too heavy to move, what did he find? A very simple black granite sarcophagus having no ornament whatever except on the lid, and containing the body of the king with a single fillet of gold round the forehead. There were hieroglyphics (verses from the Egyptian Book of the Dead) on the lid, but across the foot the following inscription in Phœnician: — "I, Tabnit, priest of Astarte and king of the Sidonians, son of Eshmunazar, priest of Astarte, and king of the Sidonians, am laid in this vault. I adjure whatever person may discover this vault, open not my sepulchral chamber and trouble me not, for there is here no silver, there is no gold, there is no treasure. Here I alone am laid in this vault. Open not this sepulchral chamber, for it is abominable before the face of Astarte. If thou openest this chamber and comest in to disturb me, mayest thou have neither posterity in the life beneath the sun, nor a resting-place among the dead." In spite of this pathetic appeal, not only was the whole stone coffin dragged off to Constantinople, but the body of the king was packed up in a tin box to be transferred to a glass case, besides the sarcophagus, where not only the skeleton but the very entrails are exposed to the gaze of the tourist! And to what purpose? Had even the mere lid been removed and the rest described and covered up again, we should have lost nothing; nay, rather, the cost in time and money of removing the huge stone cover and then the sarcophagus itself, might have produced, if properly applied, some evidence bearing upon the great series of artistic reliefs which are still unexplained — a great problem in the history of Greek and Phœnician art. — *Professor Mahaffy in the Nineteenth Century.*

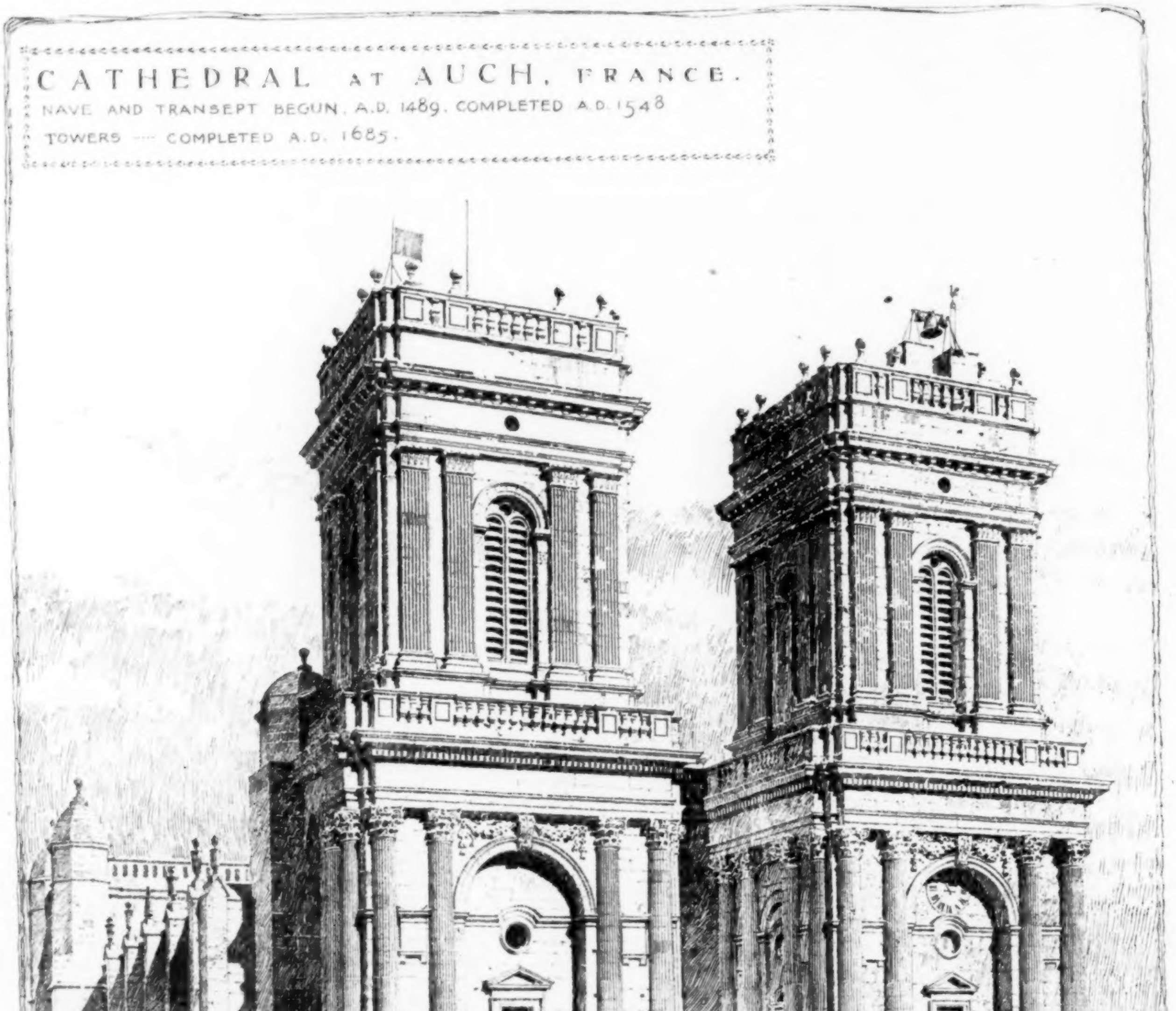
A Peculiar London Railway-station. — A very queer railway-station in London is that at Wapping, on the East London Line. Very few dwellers in other parts of London ever get out at Wapping, and thus they miss the singular beauties of the station. Its appearance is that of a huge caisson for some engineering works to which winding staircases have been added. Up the sides of the huge caisson the passengers crawl like flies on a window pane. The secret of its queer appearance is that it was originally the northern shaft of the famous Thames Tunnel, which Brunel built in 1843 at a cost of £468,000 ($2,277,522). It was very dangerous work, owing to the porous nature of the river bed, and the tunnel was long considered a masterpiece of engineering. It consists of two arched ways of 1,200 ft. long, 14 ft. wide, 16½ ft. high, and 16 ft. below the river. For a long time it was a popular excursion to go through the tunnel; but it never was a financial success, and in 1865 the East London Railway bought it for £200,000 ($973,300), or less than half its cost. The company now leases its lines to a syndicate of other companies, who use the tunnel as means of communication between the southern and northern railway systems. — *American Engineering and Railroad Journal.*

A House of Glass. — In a recently published book, W. Vander Heyden of Yokohama, Japan, describes what he calls a newly devised sanitary building, an example of which has been actually built and lived in. Drawing somewhat upon imaginative writings seasoned with a dash of scientific truth as a warrant for his conclusions, Mr. Vander Heyden has had built a house of glass which he thinks should make life bearable alike in the coldest and warmest parts of the world. From a reviewer's summary it appears that the walls of the house are constructed of glass boxes made of two thick sheets fitted in a cast-iron frame, and the space between filled with a solution of alum. This solution is intended to separate the heat rays of the sun from the quicker vibrating rays known as light. These glass boxes are fitted closely together with felt between, and form four solid walls without doors or windows. Window frames are inserted between the two glass plates and form air-spaces. The ceiling is made of double glass, covered with a thick layer of ashes, and the sloping wooden roof above this, is covered with cement. The floor is of double planks saturated with parrafine, with sawdust between. Access is through the floor by an underground room of brick or iron plates. All the air entering the house is filtered and artificially warmed. A test house on these conditions was built one year, and, during the winter, the interior temperature differed only three and one-half per cent between day and night.— *Providence Journal.*

The World's Fair Hotels filling up. — Such a moving as is taking place this week in Chicago! North and south and west, may be seen processions of furniture-vans loaded with the effects of thousands of families. Landlords who raised the rent of their buildings to the highest notch when the World's Fair was in view are now reaping the results of their avarice. The North Side is losing the most. The movement of the people is toward the West Side and the World's Fair district. The majority of the people who go to the World's Fair district have stored their furniture and are taking furnished flats in the big hotels and apartment-houses. After the Exposition many of the big houses shut down rather than pay coal bills during a long winter. Several of these buildings, however, were transformed into family hotels, and they are now receiving the benefit of an early start. Great inducements are made to get persons to move to this section, such as free storage for furniture, $25 per month for three or four furnished rooms, and all the conveniences of hotel-life thrown in. — *Chicago Tribune.*

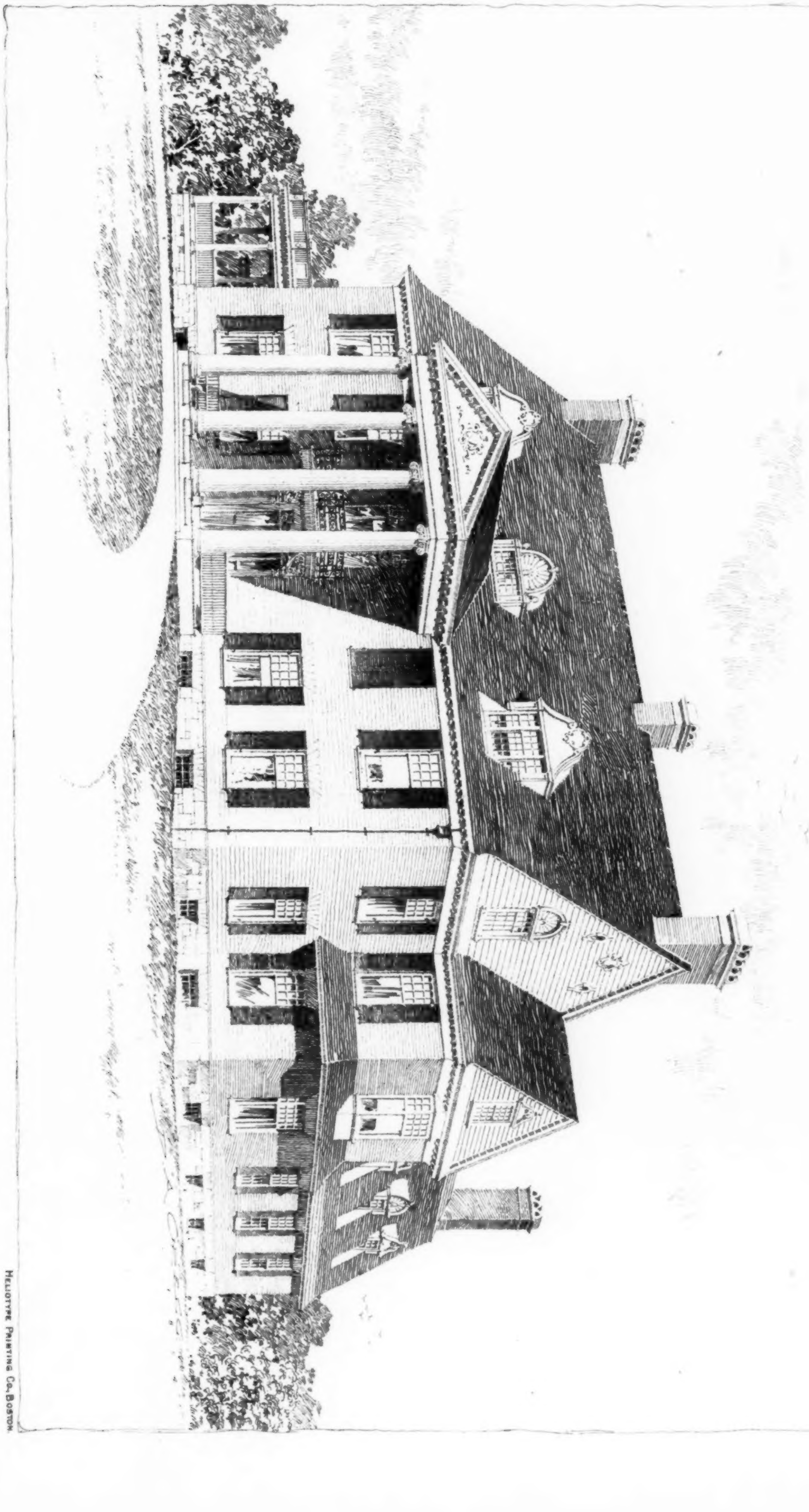
Leo protected by Flora.— In crossing a public square at Stockholm, says Professor Morse, in company with Dr. Hilderbrand, the royal antiquarian who had under his charge all the public monuments of the kingdom, he called my attention to some bronze lions at the base of a monument, stating that for some time he was perplexed as to the methods that should be employed to prevent the children from riding on the backs of the lions. This innocent enjoyment would not have been interfered with had it not resulted in adding an unnecessary lustre to the backs of these figures. It was absurd to place a policeman on guard, and it was a confession of weakness to fence in these works of art. Finally, taking advantage of the love of flowers possessed by the Swedes, he had laid out around the statue some flower beds, and not a child would mar these beds even for the delight of a ride on the lions' backs, and the patina which had been rubbed off began to form again.

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



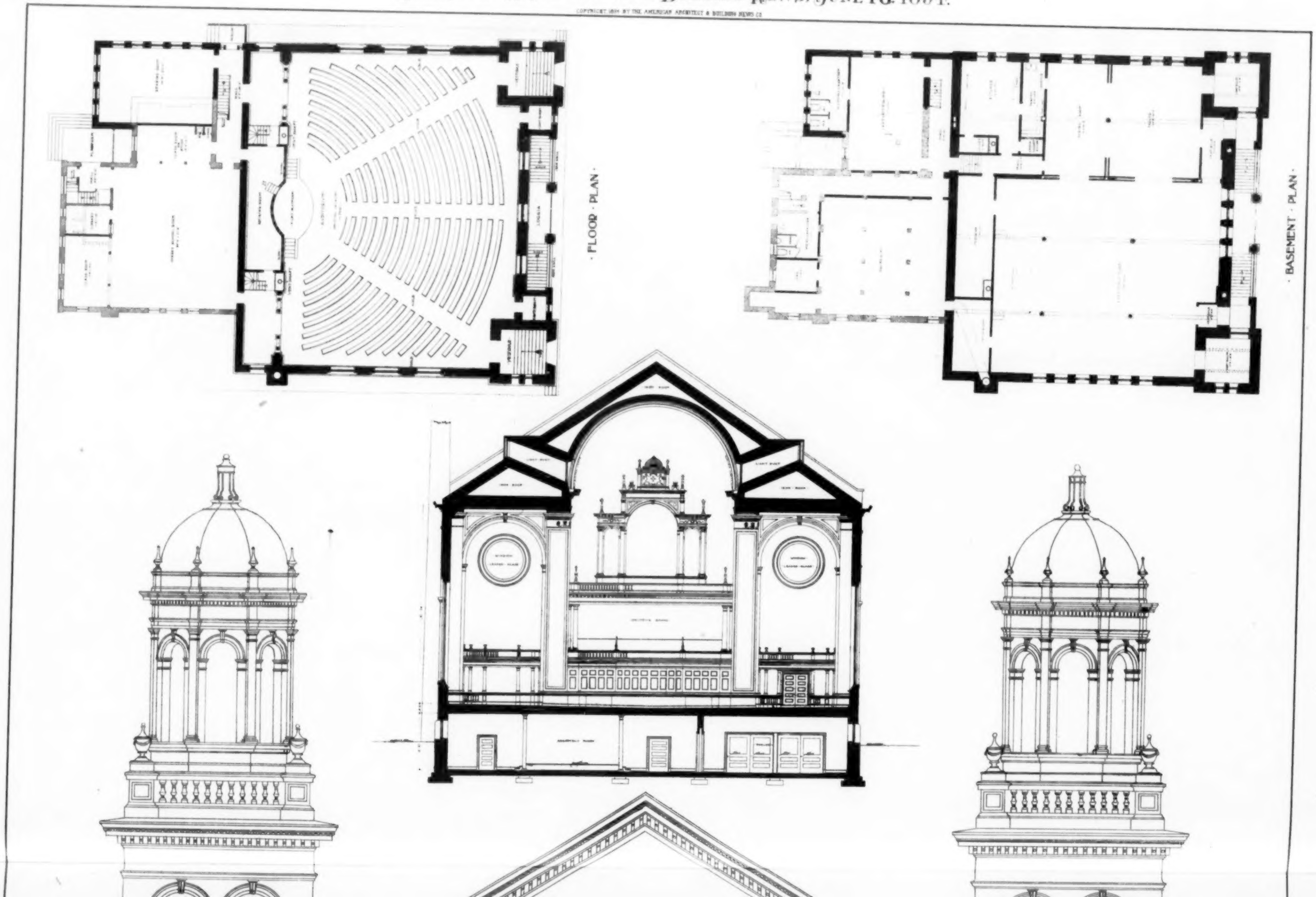
CATHEDRAL AT AUCH, FRANCE.
NAVE AND TRANSEPT BEGUN, A.D. 1489. COMPLETED A.D. 1548
TOWERS — COMPLETED A.D. 1685.

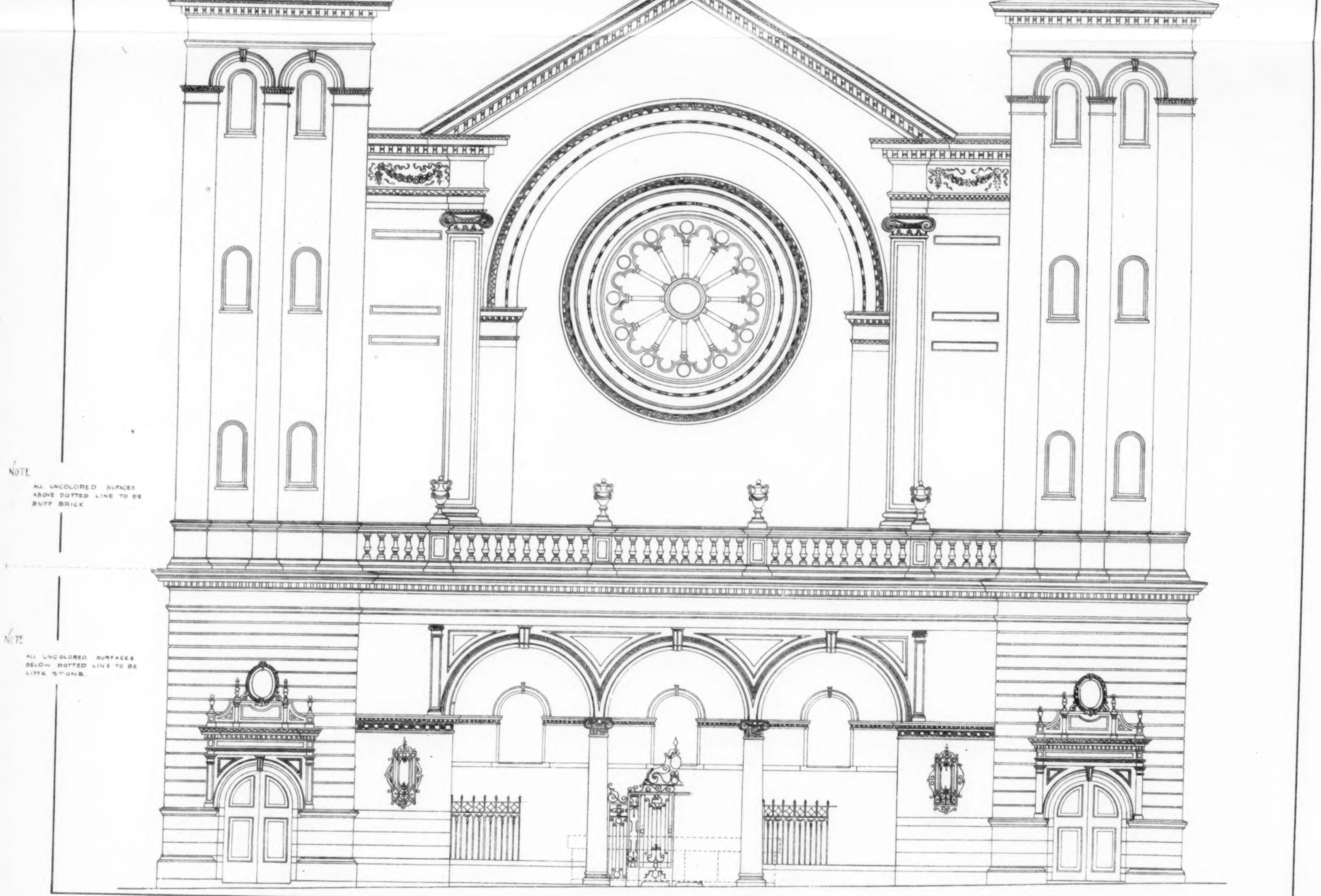
HELIOTYPE PRINTING CO. BOSTON.



View of Mr. J. Levering Jones' House, Chestnut Hill, Philadelphia.
Geo. T. Pearson, Architect, Philada.

Heliotype Printing Co. Boston.

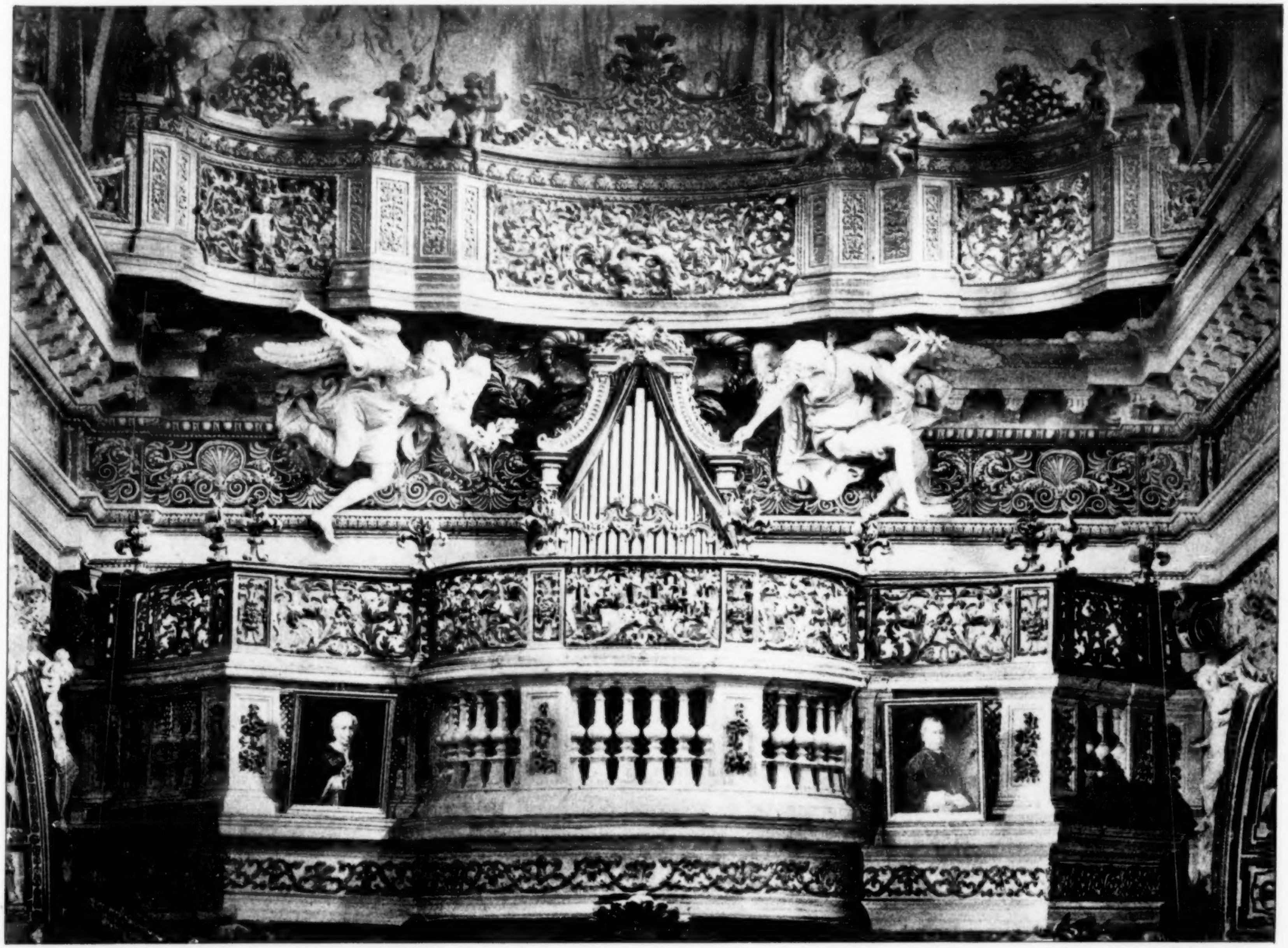

· FLOOR · PLAN ·
· BASEMENT · PLAN ·

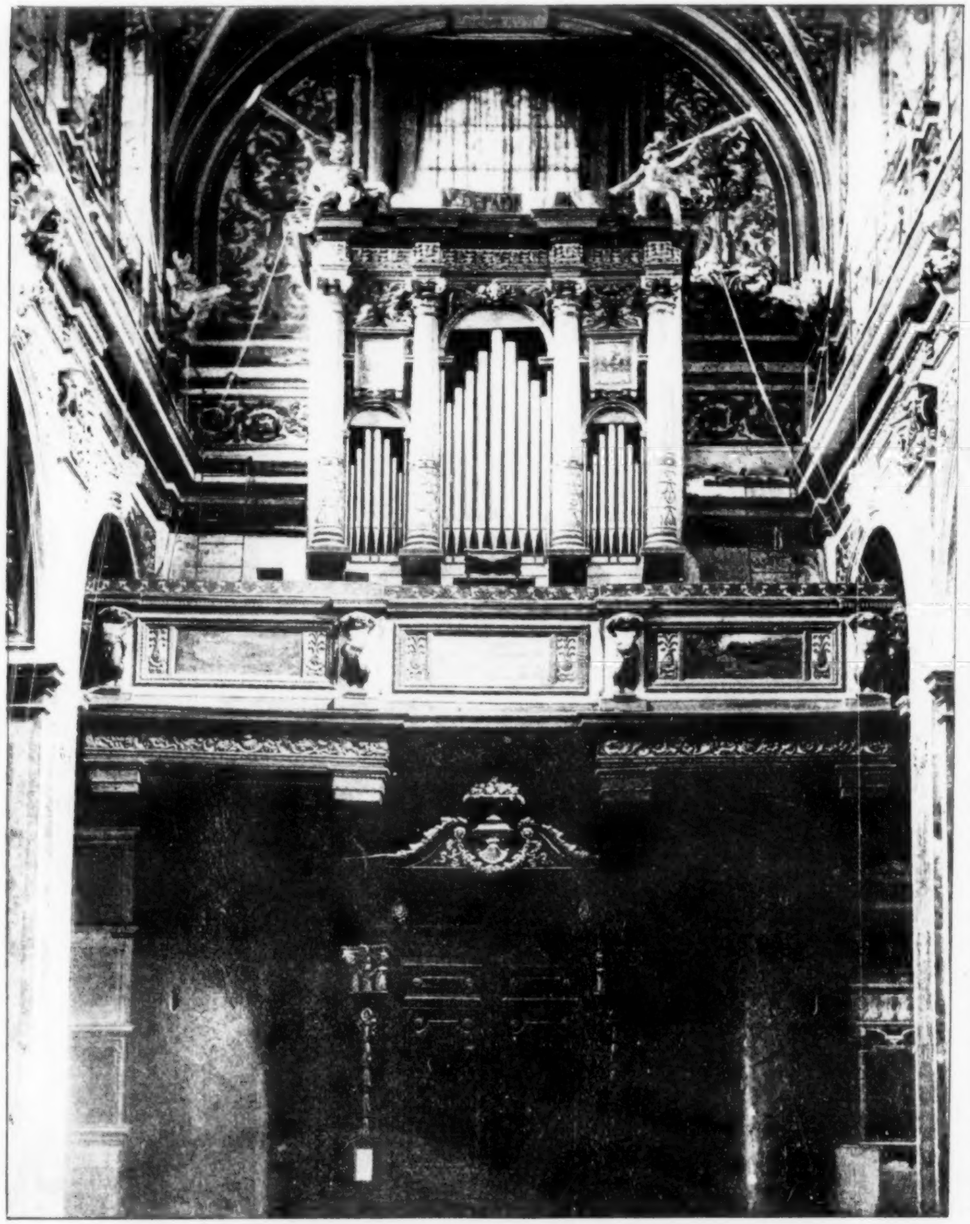


ACCEPTED DESIGN FOR FIRST PRESBYTERIAN CHURCH, ELM STREET, NEW HAVEN, CONN.

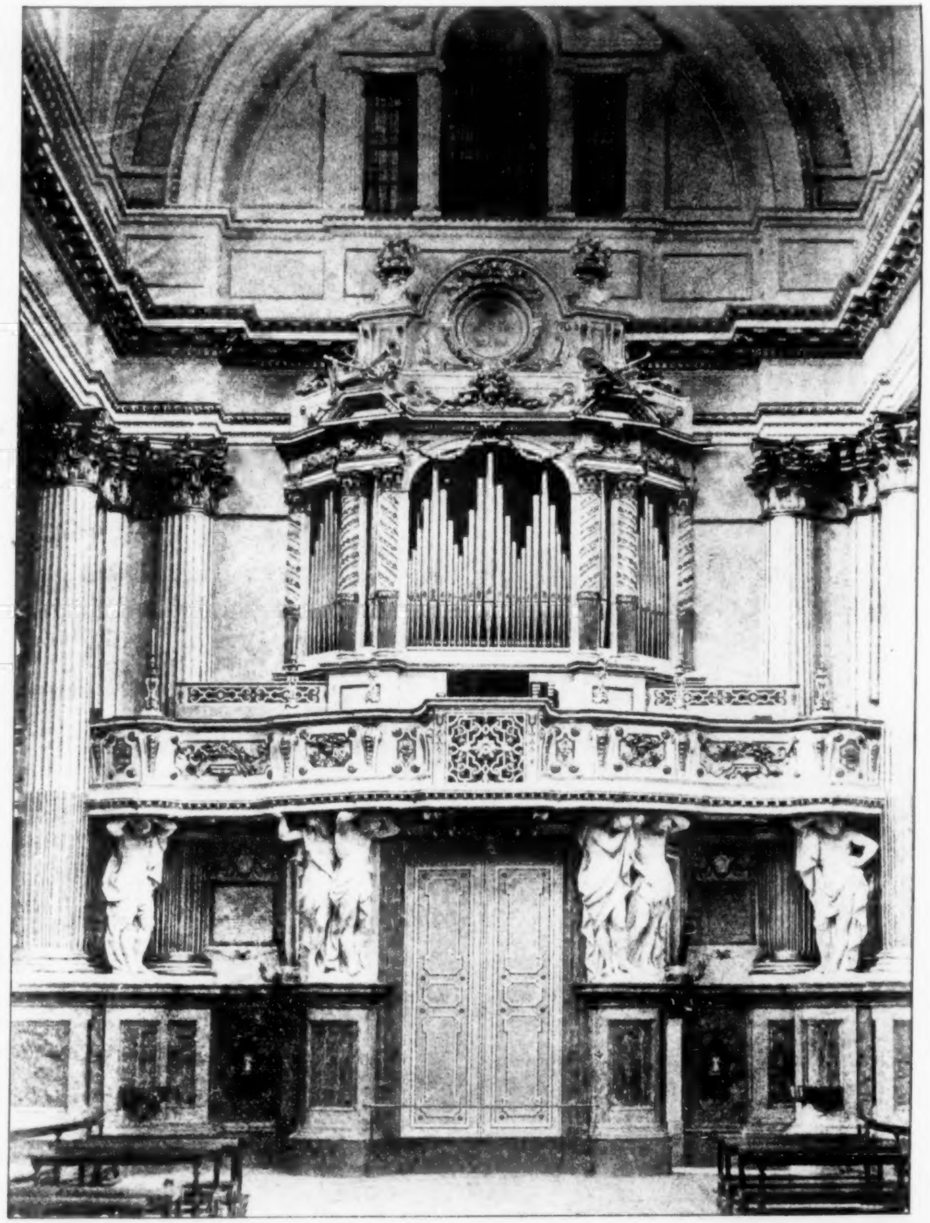
F. R. COMSTOCK, Architect.

HELIOTYPE PRINTING CO. BOSTON.





2.



3.

A TRIO OF ITALIAN ORGANS.

1. S. MARIA DELLA VITTORIA, ROME: 2. UNKNOWN: 3. CHURCH OF THE SERVITES, RIMINI.

Heliotype Printing Co. Boston.