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MAY 27, 1893.

CONTENTS

THE announcement of the World's Congress of Architects, to be held next August at Chicago, comes so long after the preliminary circular that, as we suppose, many members of the profession in this country thought it had been given up altogether, and there will be some difficulty, we fear, in arranging the necessary work in the few weeks that intervene before it assembles. So far as the foreign members of the Congress are concerned, particularly, it will be necessary to make some effort to get a full representation, as several lists of the World's Fair Congresses were published in the foreign architectural journals before the issue of the recent circular, and, of course, the Congress of Architects was not mentioned. It will, of course, be understood that we do not wish to find fault with the local committee having the affair in charge. It is not likely that they have either forgotten or neglected their duties, and we wish only to remind the rest of the profession that, as circumstances have rendered it necessary to make preparation for this most important meeting within a very limited time, every American architect should feel it his duty to give prompt and effective assistance to the local committee whenever and however he may be called upon.

NEW YORK is to have in the autumn what promises to be a very interesting exhibition of industrial art. According to the newspapers, Mr. Stanford White is entitled to the credit of having proposed the exhibition, and he will be active in its management, being, however, seconded by the owners of the Madison Square Garden, where the exhibition will be held, and by most of the great importers and manufacturers of porcelain, wall-papers, brass-work, carpets and other semi-artistic and decorative objects, as well as by various private lovers of such things. It is intended to keep the exhibition open for a month, and any manufacturer of suitable goods in the United States is eligible as an exhibitor. Whether the exhibition is to include foreign articles, or is restricted to those of native production, we are not informed, but it would be a pity to exclude the very objects, which, by reason of their novelty, would be best suited for the pleasure and instruction of visitors. In either case, however, the affair is sure to be of great interest. There is no question that, amid the mass of crudity and pretension which once did duty as American industrial art, has appeared an artistic growth as vigorous and original as any in the world. Hitherto, the men and women upon whom the new spirit has descended have worked rather apart from each other. In New York, blest with its great artistic societies, those who can draw and paint and design find each other out, but the rest of the country is not so fortunate, and if the proposed exhibition should bring together, as it ought to do, the best work of every State in the Union, as well as the persons who have produced that work, it will be of very great use in developing and encouraging those modest fine arts which, in our country, most need and best reward such encouragement.

THE French architects are just now agitated over an accusation which has been made, in that general way with which we are all familiar, that some of them take commissions from contractors. In England, this matter comes up every year or so. In this country, it is less frequently brought before the professional public; and in France it is still less often discussed, so that the views of the French architects on the subject are of interest. So far as this particular case is concerned, professional opinion seems to be all that could be desired. It seems that a certain contractor, a dealer in materials, wrote a letter to MM. Malézieux, members of the Society of Architects of the Department of Aisne, mentioning that many architects had accepted a special discount from him, and that the official architect of a city, the seat of a prefecture, had even written to him to demand an increase of this discount. MM. Malézieux, on the principle, as one of their friends said, which leads a farmer to nail an owl to his barn-door, immediately sent this letter to the *Bulletin* of the Provincial Association of Architects, of which their local Society forms a division, and it was published at length, with the omission of the names. At the same time, M. Journond, President of the Provincial Association, took up the matter, and wrote an admirable personal letter to the contractor. In regard to the first, and vague accusation, M. Journond said he did not care to trouble himself. "Any one," he said, "has now a right to call himself an architect, and, although you cannot be ignorant that the acceptance of your discount, which would be lawful for a contractor or an engineer-constructor, is robbery for an architect, I can understand that you may, like far too many other persons, confound architects with those individuals, devoid of either skill or honorable feeling, who usurp the name, and are the parasites of our profession." The second accusation, however, was too precise to be dismissed in that way, and M. Journond, while admitting that the appointment of a municipal architect was not guarded by all the guaranties that it should be, and still believing that the accusation contained in the letter was entirely without foundation, and was circulated thoughtlessly as a business trick, demanded as an act of justice toward the eighty-five municipal architects to whom the dealer's description would apply, that an answer should be sent to him by return mail, saying whether the accusation made in the original letter was maintained, or was withdrawn as having been made without cause. In case the dealer wrote that he maintained the charge, or if he returned no answer, M. Journond said that he would immediately call the attention of the eighty-five architects, to whom the description applied, to the accusation, in order that they might take steps to defend themselves. If, on the contrary, the charge was acknowledged to be without foundation, M. Journond said that he would have the withdrawal published in the *Bulletin*, without mentioning names.

THIS dignified and manly letter produced, practically, the effect desired. The dealer who thought to benefit himself by innuendoes against the character of the profession which he thought he could bribe wrote, in answer to M. Journond's demand, an ingenious letter, in which he said that, "on reading over again" the letter of the architect who wanted a larger discount, and which, for some mysterious reason, he seems to have carefully preserved, he discovered a word which had escaped his notice before, and which he felt it his duty to mention. The writer of the letter, instead of signing simply as architect of the City of X——, had written his name

as "formerly architect-in-chief of the City of X——," preceding it by other honorary titles, which the dealer "abstained from specifying." M. Gaspard André, who relates the latter part of the affair in *La Construction Moderne*, comments sharply on the singular habits of an architect who recited his honorary titles before his name, and at the end of his letter, instead of having them printed at the top of the sheet; but, as this explanation relieved the eighty-five actual city architects of the necessity of commencing libel suits to protect their good name, and transferred the charge to the large and indefinite body of "former city architects," it answered, no doubt, the purpose for which it was intended.

M. ANDRÉ, however, in recounting the happy issue of the provincial controversy, tells a story about his own experience, which indicates that some one of M. Journond's character might be useful to the profession in Paris. Having occasion, during a visit to Paris, to look for an address in the "*Directory*," he turned to the list of architects, and, almost at the very head, he found a name, accompanied, as is often the case in the Paris "*Directory*," with a card, as follows: "M. A ——, expert, informs the public that he hands over to his clients the large discounts allowed by dealers." Obviously the impression intended to be conveyed to the public by this information is that the other architects in the list keep the "large discounts" of material-men for themselves, and that it is, therefore, pecuniarily advantageous to employ the honest Mr. A ——; and M. André expresses somewhat vigorously his opinion of this piece of professional impudence, which is, we imagine, unique in its kind.

WE are informed that the managers of the New York *Herald* have invited competitive designs, to be accompanied with descriptions and estimates, for a building on the site of their present office. The structure is to be from fifteen to twenty stories high, something being left to the judgment of the designer in this respect, and is to be built of steel, according to the most approved system of modern fireproof construction. For the design, specification and estimate most approved, the owners of the *Herald* will pay the princely sum of five hundred dollars, the said plans, specifications and estimates to become the property of the company which, we believe, now owns the paper. Since receiving information of this tempting proposal, we have waited anxiously, thinking that some hoax, or other disappointment, might be intended, but, as no further developments have come to our notice, we feel encouraged to conclude that the offer is made in good faith. Our readers will easily figure out that, with Whatman paper at twenty-five cents a sheet, Indian-ink at two dollars a stick, and second-quality foolscap for the specifications, the sum offered will, for the person so fortunate as to win in the competition, cover the outlay for materials, with a little over for himself. We suppose, of course, that he will do all the work of making the drawings himself, and, to encourage those who have found that the cost of such drawings, when made by draughtsmen, is usually at least a thousand dollars, we will remind him that an active man can spread a great deal of Indian-ink over paper in a short time, provided he is not too particular where it goes. As to calculations of the steelwork, foundations, wind-pressure, etc., it will be remembered, also, that, instead of paying an expert four or five thousand dollars to make computations, it is much cheaper to guess at the details of beams, columns and braces, and the owner of the building rarely knows the difference between dimensions so obtained and those deduced from formulas and constants, until they are put into practice, and, as the designs are to be purchased outright, the transfer will, we presume, carry with it any responsibility for the sufficiency or skilful preparation of the drawings and specifications. Whether, under these circumstances, they will be worth to the *Herald* Company what they cost is another question, but, if they are good for nothing else, they will be curiosities, and we hope that the *Herald*, for the edification of the profession, will not forget to publish them.

THE table showing the results of the comparative tests of the holding power of cut and wire nails, made at the Watertown Arsenal during the winter, is very interesting reading. It is well known that wire nails have of late years enjoyed great favor in this country. Some of us can remember when the only wire nails seen here came from France, where they have been used for thirty or forty years for nailing packing-cases, but the French nails were soft, and it was not until the Bessemer and open-hearth processes had made steel cheap that the manufacture of steel wire nails was introduced here, and soon became a great industry, the new nails, even at a higher price, being almost universally preferred to those cut from a plate. The manufacturers of cut nails, in defence of their own industry, claimed that their nails possessed the essential virtue, for a nail, of holding more strongly in wood than the wire nails, but many carpenters maintained the contrary, being unwilling, apparently, to find any defects in the smooth and handsome wire nails. A sort of challenge was, therefore, issued and accepted by the rival manufacturers, and the Arsenal tests were made to decide between them.

IT must be acknowledged that the test was a conclusive one, the superior holding power of the cut nails being thoroughly demonstrated. Eleven hundred and sixty nails, ranging from one and one-eighth inches to six inches in length, and of various thicknesses, were driven into spruce and pine timber, and the force required to pull them out measured by the Emery testing-machine. Fifty-eight series of tests were made, and in every series the cut nails proved themselves superior. In most cases, the superiority of the cut nails was very great. With floor nails, ranging from two to four inches in length, the resistance of the cut nails was eighty per cent greater than that of the wire nails, both being driven into spruce; and, with finish nails, the resistance of the cut nails, in spruce, was seventy-two per cent greater than that of the wire nails; while, in pine, the cut nails, driven with the taper perpendicular to the grain of the wood, held with a strength one hundred and thirty-five per cent greater than that of the wire nails, and even with the taper parallel to the grain of the wood, the resistance was one hundred per cent greater. Taking all the tests, both in spruce and pine, together, the average superiority in holding power of the cut nail over the wire nail was about seventy-three per cent.

WHERE is, probably, no class of professional men who are so familiar with Mr. Ruskin's writings as architects. For some reason, painters know very little, and care still less, about what he has written on their art; but, although his deliverances on architecture have shown neither a profound understanding of the subject nor an ingenuous treatment of it, while his remarks upon architects have been persistently libellous and malicious, his occasional intensity and elevation of feeling have found nowhere such sympathy as in the profession upon which he has cast so much cheap ridicule, but which, nevertheless, followed patiently and faithfully the path which it supposed him to be pointing out as long as his directions were intelligible, and even now retains for him the affectionate respect which people feel toward those who have, even unconsciously, inspired them with new thoughts and aspirations.

WHAT claim, however, Mr. Ruskin's euphonious and measured prose gives him to the title of Poet Laureate of England those who know his writings best will be most puzzled to imagine. That he has written a certain amount of verse, in quantity, as in quality, suggestive of the school-boy, is well known, but neither this nor flights of prose rhetoric constitute a man a poet, any more than a few drawings of details, with such valuable criticisms as the well-known one about "carving-knife" tracery, or the comparison of York Cathedral with an elephant lying on its back, make him an architect; and, while we wish Mr. Ruskin every possible happiness in his declining years, we cannot imagine why Mr. Gladstone should have found propriety in offering the "place" to a prose writer, who, whatever his earlier powers may have been, is now commonly believed to be the victim of a malady that saps the mental vigor of its victim long before it overcomes his physical powers of resistance. But for this unfortunate condition of the noted writer the proffered honor might pass as a graceful and not wholly unmerited compliment to be worn for a moment and then resigned, as a member of the House accepts the Chiltern Hundreds. If the original report were true, then the current one also may be true which states that the honor has been declined and that Tennyson's cloak may fall on the shoulders of Mr. Lewis Morris, a writer who is said to be able to produce as good official rhyme as was turned out to order by his predecessor.

COMMEMORATIVE MONUMENTS.[1] — II.

THE Vendôme Column, at Paris, is copied from Trajan's column at Rome; correctly speaking, it is the Colonne d'Austerlitz. In its forms it is almost an exact imitation of the Roman monument, but in execution the two are quite unlike. In the Vendôme column the effect is obtained by means of bronze sheets fastened to a stone foundation. The figures of the spiral relief are dressed in the military uniform of the first French Empire; the arms and engines of war adorning the faces of the pedestal exhibit the different types in use from 1805 to 1814. It would, therefore, have been logical to crown the column with a statue of Napoleon clad in the fashion of his time; but it was thought that such a representation would lack due dignity and the hero was figured as a Roman emperor, holding in his right hand a globe with a little Winged Victory on it. Chaudet was the statuary. This statue was destroyed in 1814; in 1834, as the result of a competitive contest, another figure, by Seurre, the younger, took its place. But this time Napoleon appeared in his traditional frock-coat and small hat. This was retained until 1864, when a movement was started to restore the column according to its original design; the Napoleon in a frock-coat was banished to Courbevoie and replaced by the Roman effigy which is still to be seen there — the work of M. Dumont. The silhouette is certainly more artistic for the change, but truthfulness has been somewhat sacrificed thereby; at a first glance, it is difficult to realize that the monument was designed to celebrate the great achievements of a nineteenth-century army-leader. The shaft is 30m. 60 in height and 3m. 90 in diameter above the base. The bronze pedestal is 5m. 55 on each side, measured on the plain surface, and 5m. 64 in height. It stands on a granite socle. Including statue and platform, the whole is 45m. 50 in height.

The Column of Alexandria, erected at St. Petersburg in 1832, is the largest monolith known; it is 27m. 28 high and 4m. 55 in diameter at the base; it is of red Finland granite. It rests on a bronze pedestal which is itself set on a granite socle. The capital is surmounted by a hemisphere and crowned with the figure of an angel holding a cross. Total height, 50 metres.

The Column of Boulogne-sur-Mer is of the Doric order and was founded in 1804 in memory of the camp of Boulogne; at the Restoration it was surmounted by a globe covered with fleurs-de-lis with a royal crown above. It is of the gray stone known as Boulogne marble. M. Labarre, architect.

The Column of July, at Paris, is reproduced in Figure 8. The plan of raising a commemorative monument on the site of the Bastille dates from the first Revolution. Proposed by the architect Palloy, its erection was decided upon in 1792; it was to be executed with the building material of the fortress; the first stone was laid, but there the work stopped, and circumstances prevented its being carried any farther.

Napoleon conceived the idea of adorning the square with a monumental fountain, the principal motive of which was to be an elephant 13 metres in height, bearing a tower resting on a caparison. The foundations were permanently constructed but the colossal elephant was never executed. A wood and plaster model of it, of full size, stood here until 1832.

Fig. 8. The Column of July, Paris.

The present column, which was decreed in 1833, was to have been erected after the designs of M. Alavoine, but as he died shortly after, M. Duc was appointed architect of the monument. The entire structure rests on a slender pointed vault over the Canal St. Martin. The substructures built for the elephant have been preserved and form an enclosure around the vault which is indicated above the ground by a circular socle. The subterranean openings arranged as water-passages serve as doors to the vaults in which repose the remains of the victims of the three days of July, 1830.

The column and the pedestal are entirely of bronze from one centimetre to one-and-a-half in thickness. The pedestal is composed of plates mounted on a sort of bronze panel made of posts, cross-pieces and diagonal stays. The shaft comprises twenty-three superimposed drums each one metre high. The lowest is 3m. 60 in diameter and the upper one 3m. They have horizontal and vertical ribs on the inside; the first enabled the architect to fasten the drums together by bolted flange joints; the others furnish means for securing the bronze supports of the notch-board and the 204 bronze steps of the staircase; 36 stone steps lead from the square to the metal pedestal. The interior stairway is lighted through the lions' heads adorning the rings along the shaft.

The total height of the monument is 50m. 52. The Genius

[1] From the French of L. C. Boileau fils, in Planat's *Encyclopédie de l'Architecture et de la Construction*. Continued from No. 908, page 113.

of Liberty in gilt bronze, which crowns the lantern above the capital, is by the statuary Dumont; it bears some resemblance to the Mercury of John of Bologna. The lion in bas-relief on the socle is by Barye. On the shaft, between the rings, are inscribed in raised and gilded letters, the names of the citizens who gave their lives for freedom during those three days. The entire cost was 1,172,000 francs.

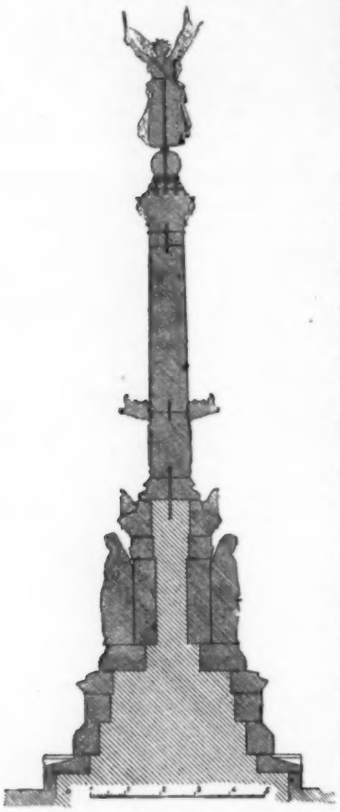


Fig. 9. Column of Lima, Peru.

This column is, in our opinion, the most noteworthy that has been thus far erected. The admirably conceived profiles, as well as the ornaments covering them, are of a style becoming the material. The beautiful capital has been treated as a corbelling, and reasonably so, since it supports a platform and balcony. The candelabra and the grille are of cast-iron, and in an original and excellent style. The whole forms a work of art which will remain a model of its kind. Remembering that it was designed in 1837, and considering that nothing either in the *ensemble* or details has become antiquated, we must admit that M. Duc is really the first and greatest of our modern masters.

The Column of Lima, Peru (Fig. 9), was designed by M. E. Guillaume, in honor of the victory won at Callao by the Peruvians over the Spanish fleet: aside from the fact that it is in a very good style, it offers an example that may well be followed for this sort of construction. The column itself is of veined white marble, the socles of dark blue, and all the statues of bronze. The four allegorical figures on the pedestal represent the allied republics of Peru, Bolivia, Chili and Ecuador. At the feet of Peru is the hero of the victory, Colonel Galvez, who was killed in the battle. He is in a half-recumbent position, raising himself on one arm in order to make a last appeal to his countrymen. The capital is surmounted by a sphere, three-quarters disengaged by a broad scotia, and this bears a Winged Victory with a sword in one hand and a palm and wreaths in the other. The well-executed crowning motive is admirably suited to a column. The sculptor was M. Cugnot.

The shaft is in two sections; the joint, a third of the way from the bottom, is concealed by a bronze band with four beaks of ships attached to it. A large, vertical iron bar fastened into the capital runs through the *piedouche* and the globe and up to the waist of the Victory, where it is secured by a belt. The visible faces of the pedestal and socles are walls about forty centimetres in thickness. Vertical dove-tail grooves on the inside of the various courses assure a juncture with the filling-core, which is entirely in concrete. The blocks are held together by bronze cramps; the sections of the column are made fast by large anchors. The total height is 7m. 40. The cost, not including transportation charges from France to Peru, was 260,000 francs.

The monument to Christopher Columbus at Barcelona (Fig. 10), is one of the largest of modern columns. It was erected in honor of the great navigator and discoverer. The architect was D. C. Buigas Monrabá, who won the first prize in the competition opened in 1882 by the municipality of Barcelona.

The circular socle above the platform is decorated with escutcheons of the Spanish provinces and with bas-reliefs in bronze portraying the main facts in the life of the hero; it is 17 metres in diameter, and is of stone from Montjuich, near Barcelona. The pedestal, which, if not the most successful part of the design, is at least the most original, is octagonal in form, and flanked by broad buttresses on four of the faces. These are intended to symbolize in their figures and enrichments the provinces of Aragon, Castile, Leon and Catalania. At their bases are seated allegorical statues of the four provinces, and they are crowned by a decorative motive representing the prow of a caravel disposed between two griffins and surmounted by a Winged Victory. About the globes bearing these Victories are sea-gulls with wings spread, in commemoration of the birds whose presence proclaimed to the sailors their approach to a new world. Between the buttresses, on the free sides of the octagon, figure the four celebrated persons who contributed to the success of Columbus's undertaking: Boly, the monk of Monserrat; Captain Pedro Margarit; Jaime Ferrer de Blanes and Luis Santángel.

The capital is adorned between the volutes with four figures standing on the astragal, representing Europe, Asia, Africa and America. Above is a sphere surrounded by a prince's crown and surmounted by a statue of the hero, with his hand extended in the direction of his discovery.

The pedestal is 8 metres broad and 10m. 30 high. The whole reaches a height of 57m. 20 above the pavement. The cost was about a million francs. The ascent can be made to the feet of the statue by an elevator. We commend this arrangement to the attention of architects. As large columns are always faced with casings, of varying degrees of thickness, it is entirely practical to run an iron *pylône* from the ground to support these, which can form the cage of the elevator and constitute the core of the construction.

The Column of Victory, at Berlin, is shown in Figure 11. The square socle above the platform is of red granite. The bas-reliefs are in bronze. The pedestal, circular in form, is surrounded by a colonnade and decorated with mosaics, representing historic events. The shaft, of sandstone, is five metres in diameter. The channellings of the different sections are filled at the base with cannon taken in the late wars with Denmark, Austria and France. The octagonal capital is formed of eight eagles, with garlands between, and the lantern over the stairway is crowned by a Victory 9m. 50 in height, sculptured by Drake. The total height is 65 metres. Architect, Strack.

The general disposition of the portico produces a novel effect. The great defect is that it constitutes a structure of such interest in itself that the shaft becomes a grand accessory,

Fig. 11. Column of Victory, Berlin.

something like the chimney of a factory. Nor is the form of the column calculated to correct this impression.

Figure 12 gives the plan proposed for a monument commemorative of the Constituent Assembly. A competitive contest of two grades had been opened in 1881 for a column in honor of the Constituent Assembly of 1789. At the last trial,

the execution of the work was awarded to M.M. Formigé, architect, and Coutan, statuary. Although the project has not yet been carried out, we have thought best to reproduce the plan which won the prize, because the column is of an excellent type and especially because the carefully designed enclosure is one of the most original that has been thus far conceived.

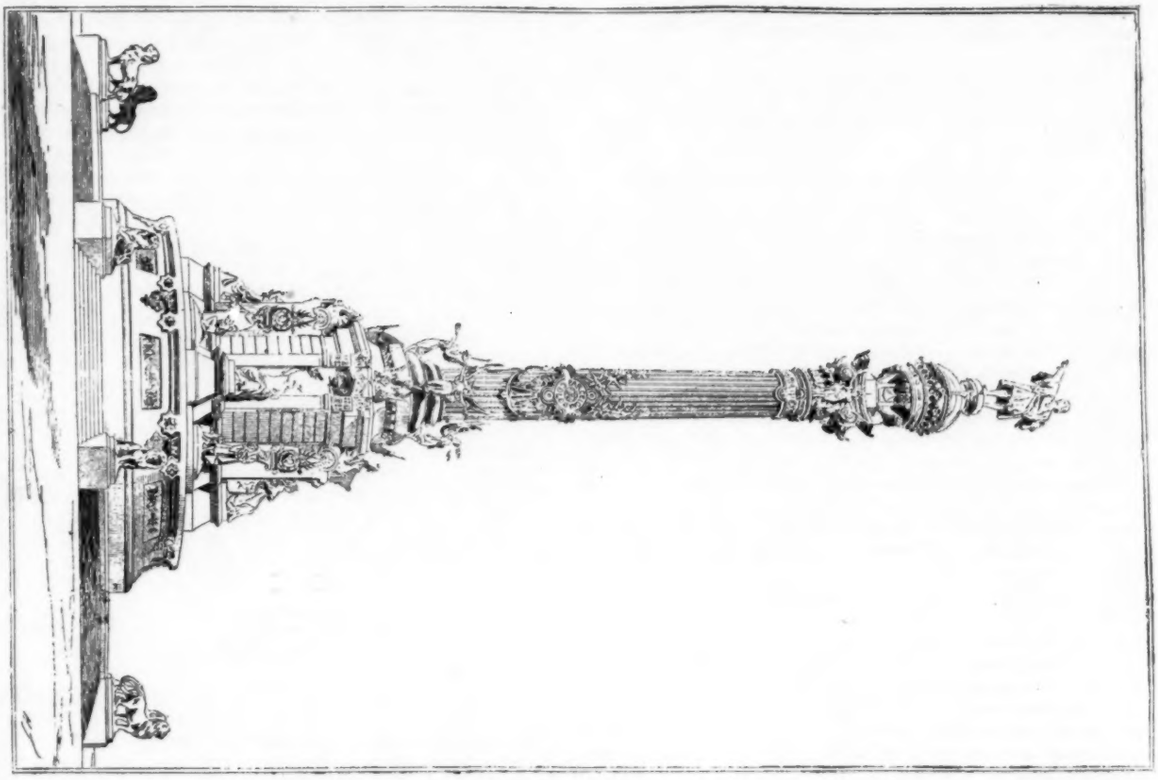


Fig. 10. The Columbus Column at Barcelona.

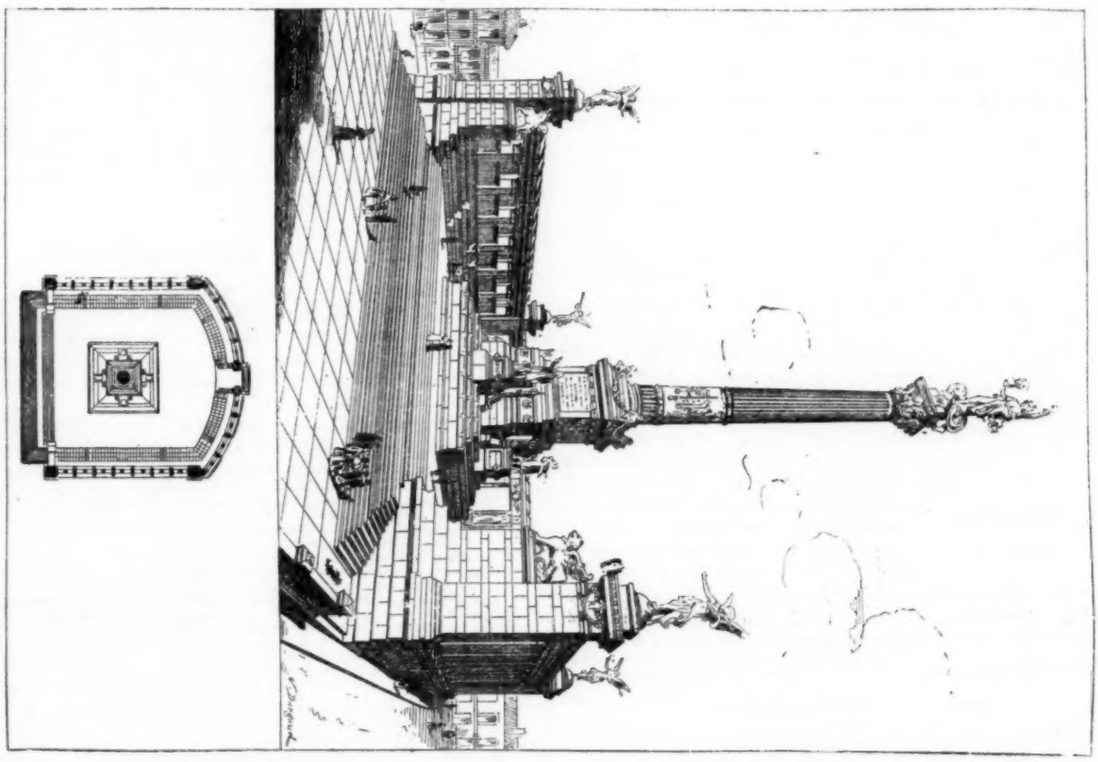


Fig. 12. Design for a Monument to commemorate the Constituent Assembly.

The slightly Byzantine capital has the solidity suitable for the architectural crowning of an edifice. The lion and statue surmounting it form an extremely happy decorative group and reflect the greatest honor upon M. Coutan. Also worthy of praise is the decoration of the lower part of the shaft, which contrasts very agreeably with the channellings of the upper part.

But the most important feature of the composition is evidently the enclosing wall, along which are represented the graded seats of an audience room. It is open above and is something like an imitation portico, an impression adroitly obtained by means of half columns and pilasters disposed on two

different planes and united by ledges, on which are to be inscribed the abolishment of the privileges. It is the glorification of a great assembly that is called for here, and the demand has been met, unquestionably, with entire success. The site of the monument was to be that of the Salle des Menus Plaisirs at Versailles, between the Avenue de Paris and the Rue des Chantiers, on the Rue de l' Assemblée Nationale, where the sittings of the Assembly were held from May 5 to October 15, 1789.

The enclosure is 46 metres by 45 metres; the top of the column is 44 metres above the ground of the Salle; total height, including the crowning figure, above the Avenue de Paris, 51 metres.

REMARKS ON THE PROPORTIONS OF COLUMNS.

Trajan's Column is only 7½ diameters in height, instead of 8, the usual proportion in the columns of a Doric portico. The Column of July is only a little over 7 diameters; the column of M. Formigé is planned on 8; M. Guillaume's is 7½, although manifestly Corinthian. Another of the same style, designed by M. Davioud for a monument to Dom Pedro, was only 6½ diameters. These examples show that the most successful architects reduce the height of columns that are to figure as monuments in themselves. At the same time, they enlarge the Classic dimensions of the pedestal, except in the height, which is generally diminished, so that the breadth may be equal to the total height, including plinth and cyma. The tapering of the shaft, which is a sixth for portico columns, should, it seems, be made a fifth for the columns under discussion, judging from the Column of July, which appears too nearly cylindrical, and which diminishes by a sixth of the diameter measured at the base.

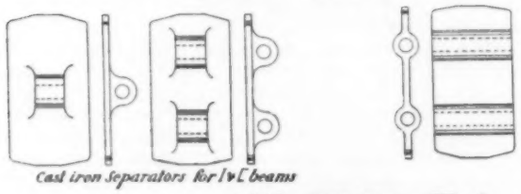
The steps and socles now commonly added beneath the pedestals proper constitute an excellent disposition. In transforming a portico element into a complete monument, it is necessary to give it the development, that is, the foundations and crownings, pertaining to the latter. And it is for the same reason also that it is well to convert the coping-plate of the capital into an abacus, or even to add a kind of rudimentary entablature, in order to form a firmer seat for the statue or group borne by the capital.

[To be continued.]

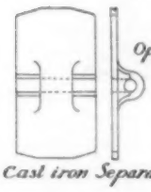
OFFICE-HELP FOR ARCHITECTS.[1]—XI.

Chapter III.—Lintels, Beams, Girders.

SECTION I.—LINTELS:



Cast iron Separators for I & [beams



Cast iron Separator

Fig. 42.

§ 196. Materials: — Wood, concrete, stone, cast-iron, wrought-iron and steel. Of these, wood is suitable for the rear part of the openings in the brick walls of non-fireproof buildings; concrete for all concrete work; stone for the face walls only unless fireproofed with fire-clay slabs or wire-lath and plaster; cast-iron for openings of small span; wrought-iron or steel for all other service, but fireproofed with fire-clay slabs, or wire-lath and plaster.

§ 197. Proportions: — For any material the lintel should be as broad as the wall it supports, except in the case of wrought-iron or steel shapes where each shape should carry 4″ width of wall.

The uniformly distributed load, L, is found for all cases where there is a plain wall to be supported by the formula:

$$L = 5\,l^2 \qquad (30)$$

For proportioning, the breadth remains constant at one inch, and the depth varies as the span, then use the formula:

$$d^2 = \frac{9\,Ll}{S_t} \qquad (31)$$

taking S_t from Table IV for the proper material.

For steel shapes it is more convenient to use the moment of resistance R and the formula for steel becomes:

$$R = \frac{Ll}{8{,}000} \qquad (32)$$

§ 198. Protection: — All back lintels and all lintels carrying parts of bearing walls should be fireproofed with either fire-clay slabs or wire-lath plastered with some rock plaster so as to be secure against fire.

§ 199. Notes: — For *wood*, the ends of the lintels may be chamfered off a little, and the bearing should be made 6″ long.

For *concrete*, the work should be monolithic, and the wall carried up over the lintel for a height of at least ⅛ l, before any of the work is set or the centres are removed.

For *stone*, the proportions are determined by the question of looks, and are therefore usually amply large. They should be tested for all lintels by the tables or formulas where l is more than 4′ 0″. The bedding of the stone for lintels is very important, as otherwise they will crack. All lintels should have a portion of the load applied to the centre first, to produce an initial deflection; then it should be worked out to the sides, the ends should be bedded in cement, and the load applied in part before it has a chance to set. The ends of the lintels should be only just long enough to give a proper bearing, and the masonry above them should be left with a full joint, so as to give room to accommodate any unequal settlement, should there be any.

For *cast-iron*, plates should be used up to the economical limit. They should be made solid, and should be limited to a thickness of 2″, as beyond this the castings are likely to be bad. For openings in interior walls, fish-bellied lintels might be used.

For *steel*, the most economical shapes are given in the table. Wherever L's are used they should be spaced the length of a brick apart, except where there is some reason for changing, as there is in fireplaces occasionally. Where it would seem desirable to use T's, as, for instance, over doors in fireproof partitions, two L's back to back give better results. Lintels in fireproof partitions should either be two L's back to back or a 4″ [on its back, wood shrinking and causing cracks.

SECTION II.—BEAMS:

§ 200. Materials: — Wood, wrought-iron and steel. In what follows, when wrought-iron or steel is referred to, either material may be used, the iron being subjected to a fibre-strain of 25% less than the steel. Since steel costs the same as wrought-iron, there are but two classes of materials to use for beams, wood and steel.

§ 201. Proportions: — For rectangular beams, Formula (31) gives correct results where the load is uniformly applied, and the equivalents for various other conditions of loading are

[1] By George Hill, Consulting Engineer. Continued from No. 905, page 65.

ABBREVIATIONS AND SYMBOLS.

= equal to.	∴ therefore.
∥ parallel to.	□′ square feet.
÷ divided by.	□″ square inches.
× multiplied by.	8# read 8 pounds per lineal foot.
+ added to.	[channel bar.
a^2 a multiplied by itself.	I I-beam.
$a > b$: — a greater than b.	T T-iron.
$a < b$: — a less than b.	L angle iron.
$\frac{a}{b}$: — a divided by b.	⊥ deck beam.
	● round section.

I ton = 2,000 pounds as this is the conventional ton, the legal ton is 2,240 pounds, but is rarely used.
l = the length between supports of any beam or girder or height of any column, always in feet.
b = breadth of any beam or girder, always in inches.
d = depth of any beam or girder, or the least transverse dimension of any column, always in inches.
L = total load uniformly distributed coming on any piece in pounds.
L^{pf} = " " " " per square foot in pounds.
W = concentrated load on any piece in pounds.
S = span of any arch or truss between centres of end pins in feet.
A = area of any section in square inches.
M = maximum bending-moment in inch pounds.
n = distance of centre of gravity of section from either top or bottom edge in inches.
I = moment of inertia, neutral axis through centre of gravity.
R = moment of resistance of section.
r = radius of gyration, in inches.
Sc = safe compressive strain in pounds per square inch.
St = " tensile " " " " " "
Ss = " shearing " " " " " "
S = strain per square inch in extreme fibre.
P_e = upward reaction of support at left-hand end of beam.
P_f = " " " " " right " " " "
e = distance of centre of gravity of load from left hand of beam.
f = " " " " " " " " right " " "

given in Formulas (18) to (26), § 171, affording a means of reducing any load to an equivalent uniform load. Formula (31) is based on a breadth of beams of 1″, which should be allowed for in making up the loads or sizes.

Formula (26) is correct for the equivalent value of L when the girder is divided into three equal parts by the beams, and the portions of the loads carried by the beams at the points of support are assumed as parts of the load. This assumption slightly increases the loads on the girder, and is, therefore, on the safe side. Other methods, applicable to shapes only, are as follows:

(*a*) Find the maximum bending-moment in *inch*-pounds, divide by the maximum fibre-strain allowed, and then select the lightest section whose R in Table VII equals the quotient. This method is particularly applicable to shapes, and is the most flexible and the easiest to use for all conditions of loading except uniform loads.

(*b*) Multiply the uniform load by the length of the beam in feet (l). The product is the C or C' of Table VII. Having computed C for a beam, compare it with the C given in the table, selecting some beam whose C is slightly smaller than the C found, and then increasing the weight of the beam in the proportion given in the table, so as to equal the C computed; that is, subtract the C taken from the Table from the C computed, and divide the remainder by the correction given in the table as the amount C is increased for each pound increase in weight of beam, the quotient gives the number of pounds the beam must be increased in weight to be strong enough.

Always be sure that there is not a deeper beam of less weight and of greater strength than the one just found. This often happens, and should, therefore, be guarded against. On the other hand, it is folly to add several inches to the height of a building just to save a few hundred pounds in the weight of the iron of one or two girders.

(*c*) By taking the size of the beams from tables of safe loads uniformly distributed, and spacing the beams at haphazard from them.

Economic sizes of floor-beams and girders are given in Chapter IX "Floors."

§ **202. Points:** *Wood Beams:* — The section should always be rectangular, and should be practically uniform from end to end. The breadth should be determined from the conditions of use; first, the depth should equal in inches $l \times 0.6$ (that is, a 20′ 0″ span calls for a 12″ beam), and the width should be such as to give the required strength with a spacing of about 16″ *c* to *c*. If the beam is without side supports, then its depth must be still the same, and the distance between the extreme fibres horizontally at right angles to the length must equal three-fourths of the depth. This width can be obtained by separating the outside beams if necessary. The end bearing of wooden beams should be determined so as to limit the strain per square inch of bearing to 350 pounds, increasing to 400 when the live load is 50% or more of the total.

The New York building-law requires a minimum thickness of 3″.

Steel Beams: — Sections may vary through a very wide range, but the best results generally come from the use of the I-section. In fireproof buildings, there are sometimes spans where it is not economical to use the same depth of beam as is used throughout the balance of the work, and at the same time

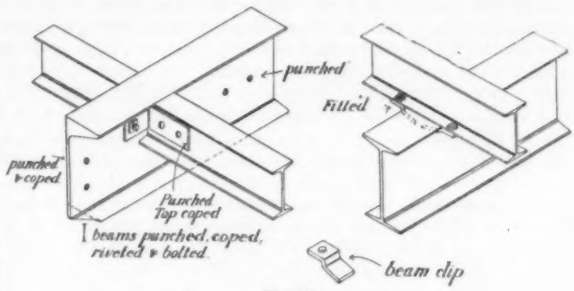


Fig. 43.

it is not economy to use a thinner floor-arch and furr the ceiling or fill over a thin arch with concrete; then we can use a section made of two L's with a plate interposed, giving deck-beam for less money than the beam would cost, and doing away with the head.

The depth of all beams in inches should be made $l \times 0.6$. That is a 20′ 0″ span would call for a 12″ beam.) After the lay-out of the beams is made, the heaviest loaded beams should be tried for deflection by multiplying their length squared by the deflection co-efficient given. The result must not exceed $l \times 0.03$ else the ceiling will crack. Whenever the beams are not supported against deflection sideways they must have a distance between extreme fibres equal to $l \times 0.5$ in inches to secure the top flanges against buckling. Whenever it is necessary to double beams, the beams should be secured together by means of cast-iron separators, made to fit snugly between the flanges of the beams and bolted to them with $\frac{5}{8}$″ bolts spaced vertically 6″, *c* to *c*, the separators should be spaced about 4′ 0″, *c* to *c*, or not to exceed five times the depth of the beam (Fig. 42). When a wall is to be supported by a beam the load should be assumed in such a way as to give the maximum possible under any condition of load, say when a window is cut through so as to throw all of the wall onto the beam, the cutting destroying the arch action of the bricks. The wall should be carried on a double-beam with $\frac{1}{4}$″ plate placed on top to bed the masonry solidly on. The load should be applied first in the middle so as to obtain an initial deflection and then there would be no further trouble from the loads subsequently applied. Bearings should be $2\frac{1}{2}$″ on all brackets or column connections and 8″ on all walls. Wall-bearings should have bluestone templates four times as long as the width of the beam flange, depth equal to $\frac{2}{3}$ flange width and going into the wall 12″. If cast-iron be used for the templates it should be made of the same area and 1″ in depth for each 4″ in depth of the stone.

Carnegies Standard Connection Angles for I beams. (*all holes for $\frac{3}{4}$″ bolts or rivets*)

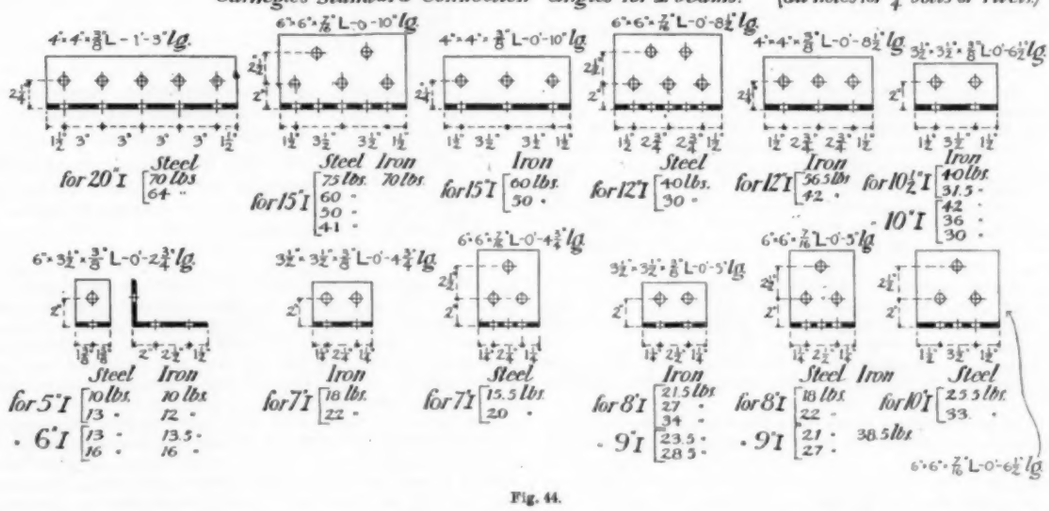


Fig. 44.

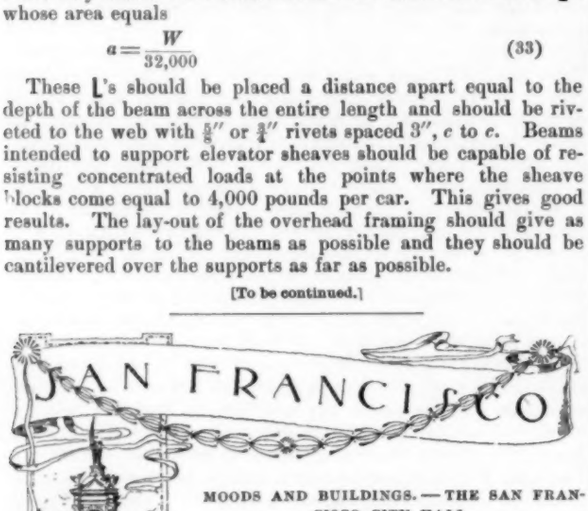
Connections are known as plain, coped, coped and punched, etc., as shown on Figure 43 where they are all labelled. They should be connected with ⌊'s shown on Figure 44, which are Carnegie's Standard and are the best. The strength of these connections is given in the table of minimum safe spans, Table X. If the question is as to whether the connection rivets are sufficiently strong, take their safe-bearing value in single shear from Table XI, the data, thickness of plates, etc., coming from the details of the connections and beams. Wherever it is necessary to proportion the plates especially for the connection, they should be made of the same thickness as the webs and the size of the rivets made to give maximum results. That is, the size of the rivets should be taken from the above heavy line in the table.

All connections should be made with rivets heated and headed in place on the works, bolting being permitted only when riveting is impossible. All holes for connections should be punched and reamed when the metal is $\frac{5}{8}''$ or less in thickness, and drilled for thickness over $\frac{5}{8}''$. Webs of deep beams (20″ and 24″) should have $3'' \times 3'' \times \frac{1}{4}''$ ⌊'s riveted to them 24″, *c* to *c*, whenever a weight of beam of over 10% above the minimum weight is used. When beams carry concentrated loads they should have stiffeners at each abutment made of ⌊'s whose area equals

$$a = \frac{W}{32{,}000} \qquad (33)$$

These ⌊'s should be placed a distance apart equal to the depth of the beam across the entire length and should be riveted to the web with $\frac{5}{8}''$ or $\frac{3}{4}''$ rivets spaced 3″, *c* to *c*. Beams intended to support elevator sheaves should be capable of resisting concentrated loads at the points where the sheave blocks come equal to 4,000 pounds per car. This gives good results. The lay-out of the overhead framing should give as many supports to the beams as possible and they should be cantilevered over the supports as far as possible.

[To be continued.]



MOODS AND BUILDINGS. — THE SAN FRANCISCO CITY-HALL.

ONE of the surest tests of a thing's worth is to be found in the fact that we may come to it again and again without becoming weary, and as to the well those who are athirst come to draw water, so may we daily return, and daily find in it a source of never-ending joy.

Thus with good architecture; here or there a building may impress us for a moment, a week or a year, because of some novelty, eccentricity or what not, but the crucial test of true worth is that beneath its shadow, morning or evening, sunlight or moonlight, in our gay moments or in our moments of sadness, we may come and find comfort: in sorrow, sadness, in joy, gladness and in every humor, sympathy; for with buildings as with men, the frivolous may amuse us in one mood, the gloomy entertain us in another, but the great building, as likewise the great man, will hold its dominion over us in all moods and at all times, for it has within it the impress and image of a regal mind.

Ruskin says, in speaking about Giotto's famous tower at Florence: "I remember how, when a boy, I thought it meanly smooth and finished; but I have since lived beside it many a day, and looked out on it by sunlight and moonlight, and I shall not soon forget how strange seemed the savageness of the Northern Gothic" compared with this which he calls the mirror and measure of perfect architecture.

Such is the experience of every one; the more mature man, like the more mature age, selects the more perfect model, that which is a synthesis of many virtues, in preference to that which is eccentric or one-sided in its goodness. Consequently, many of the things which in our youth we despised in our more mature years we learn to appreciate.

Such has been my own experience in regard to San Francisco's most important public building, for I remember well how contemptuous was my first impression of it, seeing in it only the defect that it is built of poor material (stucco) and is mud-colored, and forgetting the fact that, had the design gone no farther than the drawing of the architect, it would have contained all the merit that is attachable to architecture, for building is not architecture, the one being mental, the other mechanical. In the mind of Michael Angelo rose the dome of St. Peter's, as complete, yet more so than, human hands could fashion it. So with all architecture; the mental conception is that for which the architect is responsible, the building belongs to the mechanic. Still it is a misfortune that reflects upon the architect in this case that the material used and the workmanship generally is so bad. At the same time, we feel sure the fault was not his, for in the mind of the architect, no doubt, the material and execution were to be as becoming as that part of the work whose matter is pencil and paper.

As I have said, my first impression of this building was that of contempt consequent upon allowing the poorness of the material to overbalance the goodness of the design. But, like Ruskin, "I have lived beside it many a day, and looked out at it by sunlight and moonlight, at noonday, when the light and shade are fierce, and when at eventide the mass is blended together in one soft harmony of gray, casting against the darkening sky and light clouds that gather round a *silhouette* of strength and peace that is as full of meaning as when, in summer seas, a great rock from out the ocean lifts itself against the gathering night, and silently and in strength resists the lapping of its waters."

In architecture, as in all else, nothing is perfect, for the ideal is that which goes before us and cannot be reached; but for every aspect and attitude of the human mind there is that which stands for and is the symbol of perfection; and such we do not criticise, saying, of a building, the dome is too high or the tower too low, for it is right that we should love at least one of the buildings of any place in which we may reside; and as from afar the pilgrim to the Holy City, who sees rising above Campagna's plain the great dome of St. Peter's, lifts his eyes heavenward in silent adoration, so would we consecrate one such building as the shrine at which to worship the beautiful — a shrine at which criticism is silenced and comparison ceases, and at which we sit in peaceful contemplation and repose, reaping in some measure the reward of effort, that rest which comes when the toiler has passed above the stepping-stones of comparison and condemnation to that vantage-ground from which the student of architecture may look down in true and just appreciation of that which the giants in building have brought forth.

The City-hall of San Francisco was designed by Augustus Laver. It was begun about fifteen years ago, and has cost, so far, about five millions. The building is now all but finished, with the exception of the dome over the rotunda at the main entrance. To this nothing so far has been done, except the doubtful suggestion made by some of the city fathers to replace it by a tower mounting heavenward 350 feet. Towers are good things, and height is magnificent, but I think the architect who fits such a tower to the base now existing, and makes it harmonize with the balance of the building, will have to exercise a good deal of ingenuity. Let us hope the difficulty of the situation may evolve something marvellous, or, still more, that the present administration will see fit to content themselves with the original design.

THE MICROSCOPE AS AN IMPORTANT FACTOR IN DETERMINING THE QUALITY OF BUILDING-STONES. — TERRA-COTTA AS A BUILDING-MATERIAL. — DEATH OF MR. R. HERBERT CARPENTER, ARCHITECT, AND MR. VICAT COLE, R. A. — SOCIETY FOR THE SUPPRESSION OF OBJECTIONABLE ADVERTISING. — PROGRESS IN THE EXAMINATION SCHEME.

SOME very interesting discussions have recently been initiated at the Royal Institute of British Architects upon stone and terra-cotta. The subject of the examination of building-stones was taken in hand by Mr. Henry W. Burrows, a gentleman of equal experience in both the architectural and geological worlds, while Messrs. Ingress Bell and Leonard Stokes compared the two materials from varying points-of-view.

The most novel portions of Mr. Burrows's interesting paper were those advocating the adoption of microscopical analysis as a chief factor in the examination of building-stones. This subject was dealt with in connection with testing by chemical analysis. Reference was made to the statements constantly put forward by quarry-owners giving the chemical composition of some particular kind of stone. The point to which most attention was generally directed was the presence of silica, as that mineral was practically indestructible and the inference was that the weathering properties of stone varied in proportion to the amount of silica. Mr. Burrows, however, proved the indefensible character of such a proposition by showing that it would logically lead to the conclusion that sandstones were, as a rule, better than limestones or even granites. Comparing analyses of

sandstones with those of limestones, the silica reached a higher percentage in the former: Chilmark, for example, had 10.4 per cent, while in many of the best known and most valued limestones, such as Portland, the proportion of the silica did not exceed 1¼ per cent, the bulk of the residue being carbonate of lime. Even comparing analyses of limestones with one another, the proportion of silica afforded no guide whatever to the weathering qualities of a stone. The gray chalk of Folkestone had an insoluble residue of 3.61 per cent and the bulk of that was silica; but excellent weathering stone, as Barnach, Ancaster and Kelton, had no silica. The inferences drawn from the presence of silica were therefore quite erroneous unless supplemented by something beyond the facts supplied by chemical analysis. To arrive at a satisfactory conclusion as to the weathering qualities of a stone, it became necessary to study its state of aggregation, and this he considered to be done best by microscopical examinations. To ascertain the capacity for weathering, it was far more important to understand the manner in which the component grains were bound together, than to discover the composition either of the grains in detail or of the rock as a whole. The nature of the cementing material and its disposition around the particles of which the rock was formed should be the chief objects of inquiry, for, as a rule, it was on this that the weathering qualities of the rock depended. This information could be ascertained by microscopical examination. A transparent section of the stone under discussion, when examined through the microscope, showed by means of ordinary transmitted light the structure of the material and the disposition of the component particles and matrix. Even in materials like quartz and calcedony, which were chemically identical, a means of detecting the differences in structure was attained by the use of polarized rays and the alteration produced upon the component minerals by weathering or decay could be detected. Mr. Burrows concluded his remarks by throwing on the lantern-screen highly magnified images of photographic sections of various stones and pointed out the differences of structure.

The paper received a considerable amount of attention, because it indicated a field of investigation that has not received much attention in England, and some of the speakers did not hesitate to express the preference for examination by chemical analysis. Mr. Burrows was ably defended by Mr. G. F. Harris, F. G. S. The old story of the proportion of silica in stone was, he felt, practically disposed of six or seven years ago. If we studied very carefully the work which had been done with the microscope, especially in America, for ascertaining the durability of building-stone; if we examined such remarkable works as those of Professor Winchell of Minneapolis, and of Mr. George Merrill of the United States National Museum of Washington; if we examined, too, the work that had been done in Germany and in the experimenting-rooms and laboratory at Paris, no one who had given much attention to the subject would for a moment come forward to say that chemical analysis was anything like as important as microscopical examination. Chemical analysis was useful to determine the chemical composition of the material and the latter could then be identified under the microscope. This was of little value at this stage, but when one examined into the stages of decomposition of the various minerals and considered practically the way in which the stones weathered, the great value of the microscope became at once apparent. In specimens he had examined, he found why certain stones had given way or had been preserved as the case might be. He had divided stones into various stages of decomposition. Taking one mineral, calcite, which was carbonate of lime in crystalline form as it was found in oölitic building-stones, it would be found that under varying circumstances it weathered in totally different manners. It was really on the state of decomposition of the minerals, as seen under the microscope, and on the manner of their association with one another that the durability of stone depended, and only by the aid of the microscope could the conditions referred to be observed and noted. I have given the remarks rather fully because the use of stone in large towns is becoming more and more attacked, because it is urged that it is next to impossible to obtain a really reliable test of its weathering qualities.

The subject of the comparative advantage and disadvantage of terra-cotta and stone were dealt with in three papers, one by Mr. Ingress Bell advocating the use of terra-cotta, one by Mr. Leonard Stokes denying both its artistic and constructive merits, and a third by Mr. Leech giving some details of its manufacture. Mr. Bell has worked very considerably in terra-cotta in conjunction with Mr. Aston Webb and is well able to speak from experience. Mr. Bell's chief preference for terra-cotta was that it was a new material and would lead to new developments of architectural design; he considered that neither its being a cast material nor its irregularity of line and surface was any real disadvantage. As to the charge that terra-cotta did not weather, *i. e.*, did not encourage the lichenous growth found upon brick and stone, he attacked the manner in which stone buildings weathered in London and asked the somewhat unfair question, "Shall the façades of our buildings be daubed over fantastically with soot and water, under pretence of 'weathering' or shall they be composed of a material which every shower will cleanse?" Terra-cotta was cheaply won, easy and pleasant to manipulate, the surplus could be re-used so there was no waste, and made little difference in point of cost whether the designer confined himself to the simple, unsophisticated chamfer, or indulged in series upon series of the most elaborate mouldings. There was no limit to the delicacy or complexity of detail obtainable, in theory at least, and practice is fast overtaking theory: it was hardened by fire to imperishability. Mr. Bell's paper was written in a persuasive and courteous mood but it was not very convincing. He kept reminding us of the facility with which terra-cotta responded to the artist's lightest touch, he talked about developing the Gothic architecture of Henry VII, revelled in fan-tracery and shrine work, which he would fain have reproduced in clay, and spoke of the utmost possible attenuation of the point of support as being a ruling condition of modern town buildings. Mr. Bell was speaking to a London audience who derive their ideas of terra-cotta from the buildings they see being erected around them, and it must be confessed that these leave room for reflection as to whether terra-cotta is really an artistic material.

Mr. Stokes attacked terra-cotta very vigorously and made out a strong case. Constructionally, he felt terra-cotta to be a weak material. The usual terra-cotta block had practically no weight-carrying power whatever, being simply a hollow cube with one side open, filled-in with concrete. As these materials settled unevenly, strain was set up and the building cracked or spalled. He related an amusing anecdote of a terra-cotta church which he visited and where he found nave and aisles, arcades and clerestories, all of the regulation stone patterns. He inquired whether these terra-cotta piers and arches really carried the walls and roof above. "Oh dear, no sir," replied his guide, "there's a sturdy iron stanchion inside each pier, with an iron girder over the tops of the arches: they take all the weight." Artistically he felt that terra-cotta had little to recommend it and he endeavored to show that it was as costly as Portland stone. The vigor of Mr. Stokes's attack brought upon him several retorts from architects whose names are intimately connected with terra-cotta and the meeting became very lively. The discussion was afterwards continued in the building-papers.

An unfortunate accident in the northwest of London has served to direct public attention to the unsatisfactory way in which cornices are frequently designed and constructed. In this particular instance the whole of a cornice over a corner public-house suddenly gave way and fell without warning, taking with it the cornices of some adjoining houses, killing three persons and severely injuring many others. It is so easy to properly secure a cornice that accidents of this nature are not very far removed from criminality.

I regret to have to chronicle the death of Mr. R. Herbert Carpenter, who in conjunction with Mr. Benjamin Ingelow has carried out a number of buildings of considerable importance in the ecclesiastical and scholastic world. His work frequently showed a great deal of feeling although at times the effect aimed at was not always obtained. The art world has also to deplore the loss of Mr. Vicat Cole, R. A., whose memorable picture depicting the "Pool of London," was very popular in the Academy some years ago, and was purchased for the nation by the Chantrey bequest. Vicat Cole was born at Portsmouth, in 1833, and was elected an Associate of the R. A. in 1870, and a full Academician in 1880. He was noted for his pictures of river scenery and was particularly happy in his studies of the Thames, of whose beauties, in common with J. D. Leslie and others, he was an ardent lover.

Talking about the Thames, I must note the sale of the Duke of Westminster's charmingly situated river-seat near Maidenhead, to Mr. Astor, the American millionnaire; the present building was from Barry's design, but it is not of a character to call forth any exuberant enthusiasm.

A very useful society has been formed for checking the abuses of public advertisements in this country, and if it carries out its object at all vigorously it has a wide field before it. Public advertisement in England has been carried to a really unbearable extent, and so far little serious effort has been made to check it. The Sky-signs Act whereby the London County Council has been empowered to veto the erection of those hideous inventions which threatened to ruin all that was left of the picturesque element in London was a step in the right direction and has performed useful service, but the flaring poster, depicting in the crudest colors various sensational episodes being performed at the theatres, still reigns triumphant in our streets, and many of our finest pieces of natural scenery have been disfigured by placards or tablets inviting visitors to purchase somebody's soap or somebody's pills. The programme of the new society, which numbers among its active members the Chairman of the London County Council, Mr. Waterhouse, R. A., Alfred Austin, William Black and Professor Lecky, includes the promotion of a bill to confer power on local authorities to exercise permissive control over advertisements, the insertion in all bills for acquisition of land or construction of works of a clause subjecting to appropriate regulations the use of the fabrics for advertising purposes and the use of personal influence in abstaining from the use of commodities advertised in an offensive way. The new society has been well received and has attracted a good deal of public sympathy. Whether it will have any practical results, depends on the energy with which it is administered, for there is no doubt that advertisers are a powerful body, may be strong enough to ignore such a society as this, unless it is very influential and widely supported.

The growth and development of the triple scheme of examination promoted by the Royal Institute of British Architects has led to an important proposal from the Institute which is likely to lead to a considerable improvement in the organization of English architectural education. So far as London is concerned, the architectural student

has not very much to grumble at. The new scheme of the Architectural Association seems to be fairly on its legs and in the course of a few years it will probably have become more consolidated and widely known, and the progressive examinations of the Institute serve as a goal toward which the student may work. The discussion indicated by Mr. T. G. Jackson seems now to have worked itself out, and, although the result is not perhaps very visible on the surface, yet it has served to show the governing bodies of both the Institute and the Association that an undue leaning towards a purely academical education may arouse a considerable feeling of resentment; thus it may be taken that the metropolitan student has his course fairly well mapped out. With the country students, however, it is different. They do not possess the advantages at the disposal of their more fortunate London brethren and it is not always easy to spare the money and time for a London course, therefore the Institute is proposing to map out England into architectural provinces, each with a local society at its head and represented in the Institute Council by the president for the time being of the local society. With this object, a conference of provincial architects has been held in Liverpool to discuss the Institute's proposals. These were received very warmly and it was felt that they would serve to bring into harmony and united action the scattered and unorganized members of the profession and tend to create a better-educated class of architects and so improve the prevalent type of provincial architecture. Definite steps were taken to settle the delimitation of the various boundaries and the scheme was practically set on foot.

MUNICH.

Chateau de Mouchy. From *La Semaine des Constructeurs.*

It will commonly be found that visitors to Munich, especially English visitors, display more or less uncertainty when they are criticising the city. They treat it as a sort of puzzle. Most of the greater towns of Germany are sure to surprise the stranger, for where he expected antiquity he is likely to find an imitation of something that was to be found in Paris not earlier than the eighteenth century. The princes who went to pay their respects to Louis XIV, if they did not bring back French gold or a promise of it, carried home a belief that to become every inch a king it was necessary to dwell in a building that was an imitation of Versailles. Reverential subjects imitated their highnesses on a becoming scale. Now in Munich one sees evidence enough of the influence of France on the buildings; but that is not all. You have exotics of many other sorts. If you are disposed to dream as you perambulate streets at home or abroad, you may in Munich be suddenly transported to Florence, and you will scarcely have discovered you are the victim of an illusion, and that you are standing in the Bavarian capital, than you are likely to imagine, after taking a few steps, that you must be in Rome or Milan, in Athens or Ravenna. You have spent, say, an hour in the Basilica of St. Boniface, and may be endeavoring to determine for yourself, after seeing an artisan's marriage in it or a christening, whether a costly copy of St. Paul-without-the-Walls is an ideal modern church, when you find yourself in front of the neighboring national Palace of Glass. Here, at least, Munich designers should be free; but if you are unable to recall the exhibition building which served as the prototype, you are convinced that you have seen engravings of it years ago. Then the notion, in spite of its absurdity, may arise within you that Munich is only a scattered Sydenham, or that Sydenham is a compressed Munich.

While one is in so hesitating a mood it is astonishing how interesting will become the comparatively few buildings that have survived the mutations of kingly and electoral taste in Munich. The Frauen-Kirche dates only from 1468, and is therefore not of the purest type of Gothic. An English critic in the early part of the century condemned the exterior as "frightful in the extreme," and in the interior the air and dust of four centuries appear to have been preserved. But after a general survey of the streets of Munich the student of architecture will find that he prefers to go round and round the church to while away time rather than to renew acquaintance with what is outside. He may have admired the cast of the monument of Louis IV in London, but in the Frauen-Kirche it assumes a new interest because it is genuine. In any other city the church of St. Cajetan would be condemned as an example of the ultra Rococo; in Munich there is relief in the extravagances, because they appear more human in their fallibility than the chilling correctness which is visible in so many of this century's buildings.

A judge of the Matthew Arnold type would, however, find much to gratify him in Munich, for if the function of criticism be to rule all things, to hold sway especially over all men who claim to be artists, there is no doubt it has had a better opportunity to show its strength in the Bavarian capital than in any other city, ancient or modern. There is scarcely a street which does not present something to testify how inferior is the individual artist if valued beside some formulation of a principle. The critical spirit had demonstrated about sixty years ago what was proper to be done in the way of building, and ever since the architects have been trying to realize the discoveries which the æstheticians had drawn out of their studies as amateurs.

Fate was undoubtedly favorable to all those in Munich who had faith in "the bookish theoric." In 1825 Louis, who was the second king of Bavaria, reached the throne. He was an enthusiast for whatever was Greek, even in name, and for a long time he was a yearly visitor to Athens. In 1829 he published a volume of verses, but he had not much belief in the inspiration of his contemporaries. He considered his subjects would be better employed in imitation of ancient works than in setting up freaks of their own, and in order to convince them he decided that Munich should exemplify what His Majesty considered was the best work that had been produced by Greek, Roman, Mediæval and Renaissance hands. If Louis were as strong as Napoleon, who was the creator of the kingdom of Bavaria, he would have carried off every stone of the buildings he admired, and have set them up again triumphantly in his capital. The King's limitations, however, became a source of new pleasure. Louis was able not only to erect imitations of the buildings he admired, and as they appeared when most perfect, but he could also have them adorned with paintings and sculpture that would gratify his own inclinations, and correspond with the theories of the Court philosophers. In that way Munich would present an appearance still more unlike what was to be seen in Nuremberg or Innspruck, and more becoming the capital of so important a kingdom. The king's family are still visionaries, and Louis may have imagined that he was doing much to make his country a connecting-link with Italy, Rome and Greece in the chain of civilization. One of his unhappy successors, it is well-known, wished to renew the connection with the France of the Willkürregiment that had passed away with the Pompadours and Du Barrys, as well as with the far more remote mythic period of the Wagnerian "Gottdammerung"; but, failing, he sought relief under the waters which he loved to traverse as the Knight of the Swan. Apparently it was not believed at Court that Bavaria could stand alone or work out an independent destiny.

King Louis could not have discovered a more suitable architect than Leo von Klenze. He had mastered Classic and Renaissance styles, and he was willing to evince his reverence for them by combining them in a manner that would be considered illegal if ordered by an inferior architect. He began with the Königsbau, which would recall the Pitti of Florence if it were not for the Doric entablature of the lower story and the Corinthian and Roman pilasters in the upper stories. The palace seems absurdly strong for a city in which the inhabitants are loyal. In the interior the architect meekly sacrificed a reputation for planning in order that ample room and verge enough should be provided for the series of paintings by Schnorr, Kaulbach, Zimmermann, friezes by Schwanthaler, and other decorations. The pictorial work is undoubtedly remarkable. No artist could work on so large a scale and so correctly who had not mastered all the knowledge that was attainable in a German academy. But as often happens with learned artists, the draughtsmanship is superior to the coloring. In spite of what Goethe had written in his "Farbenlehre" (and the English scientists who profess to have demolished his conclusions would do well to remember that during forty years Professor Helmholtz championed them) it was not possible sixty years ago to convince German artists of the importance of the relation between color and form. They were taught so much about figure, how "der Künstler gibt Bilder" and "Bilder nehmen die Sinne auf," and so on, they concluded that mental images were comparable to cartoons in black chalk, which might vary in definiteness and beauty, but were colorless, because color was unnecessary to their significance and appreciation. To people who were brought up on German metaphysics, the paintings of subjects derived from the "*Iliad*," the Greek tragedies, the histories of Charlemagne, Barbarossa and Rodolph of Hapsburg, which are seen on the walls of the Königsbau, would not be made more impressive if a second Titian had executed the coloring. They were accepted as examples of the ideal as far as it could be depicted; the compositions were considered, as it were, by the mind's eye of every onlooker, and in that way they were deemed to be satisfactory. Critics whose eyes had grown dim by poring over books, and to whom most things seemed of the color of printed paper, realized the intentions of the artists, and were indifferent to

shortcomings of execution which to a color-grinder in a Renaissance workshop would appear ridiculous.

It would be unjust for any one to judge of the experiments in painting by the appearance which the pictures present to-day. Time has not dealt more tenderly with the Munich frescoes than with those which are to be seen at Westminster. The external work has suffered, and the writer must admit that he prefers Smirke's post-office or even Williams's at St. Martin's-le-Grand to the Post-gebäude in Munich, which forms part of a group with the palace and opera-house. Although its polychrome decorations must have been ambitious, they have now as used-up an appearance as if they belonged to the "halls of dazzling light" in some broken-down Cremorne. Elsewhere in the city the color-work is not more persuasive — at least to English eyes — than the crude plates which are produced for the benefit of students in treatises on polychromy. There is, or rather was, in the Munich paintings a comprehension of the law of contrasts, and the colors are rightly chosen for the positions in which they are laid; law, in fact, is supreme everywhere, and probably nothing was done without a precedent whose existence is duly recorded in an official report, but the difficulty is to find anything which denotes that the painters possessed feelings and were not afraid of experiments which would give them pleasure. Is it disappointment with so much of the colored architecture in the streets which makes so many of the paintings in the Pinakothek appear almost fascinating? A visitor who sees many galleries may grow sceptical about Rubens's power as a colorist, but in Munich he becomes almost refreshing, and one is indifferent whether the numerous dozens of pictures which bear his name contain any of his handiwork. They have at least his characteristic effects, and one's gratitude is excited. Another example may be allowed. Piloty is prone to exaggeration in his color experiments, but go straight to his picture, after a contemplation of the frescoes outside the galleries, and you are likely to say the artist must be a man of genius. May it not be said that the important sculptures in the Glyptothek hardly seem to convince every visitor that they once adorned temples and public places in Greece? It is difficult for a moment to resist the misgiving that they also were reproduced, restored or in some way manipulated according to the canons of the local professors.

If those canons were attempts to get at the essence of things they might be excused, as well as any artists who accepted them because they helped to impart consistency to work. But in Munich the initiative for all the speculations about art and the buildings which were raised were derived from the fads of King Louis. He believed he had discovered the noblest works, and too many able men were ready to aid in demonstrating the infallibility of the royal perception. It would be absurd for anybody to suppose that it was not possible to excel the work done by machines at any time, and yet it is taken for granted that the human machine declines in power after it has attained some efficiency. Munich presents so much evidence of the latter assumption as to become depressing to every one who believes that art is not outside the influence of the law of progress. The disappointment which is felt at seeing how valueless are the efforts which once were made to resist that law is, however, a good sign, for it is an expression of a belief that political power should never be allowed to control an art. — *Correspondence of the Architect.*

THE PARIS FIRE BRIGADE.

At the close of the year 1890, there were 203 telephone fire-alarms in Paris, with 409,566 metres of wires. The *état-major* of the regiment composing the fire-department, situated at 9 Boulevard du Palais, the centre of the general system, is connected with twelve barracks, and through these with 124 relief-posts or stations. It is, besides, connected with seven steam fire-engine stations. The United States Consul-General at Paris says that there is under construction, at the present time, a new net-work, or system, of public fire-alarms. These new lines are already partly completed within the limits of four barracks; they connect 112 public fire-signals by means of 95,033 metres of wire. There are, besides, 182 private alarms, with 171,984 metres of wire. In each post or barracks there is a fireman telegraph-operator on permanent duty, whose special mission is to receive and transmit the alarms of fire. The Paris fire-department consists of a regiment called the *Regiment des Sapeurs Pompiers.* This regiment, maintained at the expense of the City of Paris, belongs to, and is under, the War Department, so far as concerns organization, recruiting, military command, discipline, promotion, rewards and interior administration. The services, however, of the regiment, as pertaining to fires, are under the direction and orders of the prefect of police. The regiment is commanded by a colonel, and comprises two battalions of six companies each. There are 51 officers, and 1,693 men, making a total of 1,744. The 12 companies are lodged in 12 barracks, situated in different parts of the city, and each has a certain portion or section of the city under its more direct protection. In each of the barracks the service is assured for each period of 24 hours by a picket of men under the orders of an officer, and conveyed to the scene of the fire by vehicles carrying the necessary apparatus. These vehicles are the apparatus wagon, long ladder, steam-engine and cart. The picket, with the apparatus wagon and the long ladder, form the first equipment sent to the fire. The apparatus wagon carries a reel with 320 metres of heavy hose, 120 metres of light hose, apparatus for extinguishing cellar fires with air-compressors, and a life-saving apparatus. As soon as the equipment has started, a second one is immediately formed, ready to respond to a new call. The second equipment comprises two hose cases, containing 200 metres of hose, one hand-engine, and one *caisson*, with life-saving apparatus. Each barrack is furnished with (1) a steam fire-engine, which always accompanies the first contingent sent to a fire at night, and which in the day-time serves for fires of some magnitude, and also to increase the water-pressure in those parts of Paris where such pressure is insufficient; (2) a ventilator, which is used to air localities, containing injurious or explosive gases; (3) an apparatus for life-saving in wells, pits, etc.; and (4) safety lamps. At the end of 1891, which is the latest year for which statistics are available, there were 12 steam fire-engine stations, of which five were at the barracks, and seven at isolated stations. At each of these stations there is a steam-engine and a *caisson*, with 720 metres of hose and the life-saving apparatus. Every twenty-four hours each of the barracks sends a detachment of its men to a certain number of posts or stations situated in that section of Paris over which the respective barrack has special guard, these detachments of firemen being installed in localities hired for the purpose from private property-owners, or in public buildings. These posts are required to respond to every requisition of the police, or of the public, for service in extinguishing fires or saving life. The number of men stationed at these posts varies from one to eight. The apparatus consists of one or more hand hose-carts carrying each 160 metres of hose, which the firemen attach to the fire-plugs by means of special couplings. In the districts of Paris where the water-pressure is insufficient these posts are furnished besides with hand-engines, for increasing the water-pressure. There are, at the present time, 124 city posts. In the public buildings there is generally provided a special canalization of water under pressure, with safety fire-plugs placed at points exposed to danger, and furnished with fixed pipe and nozzles. For the theatrical performances, the barracks send a contingent of firemen in proportion to the importance of the establishment, from one to thirty men, and they are on duty especially in the part of the building occupied by the stage and scenery. To combat any outbreak of fire there are permanent fixtures with water under pressure installed under the direction of the officers of the corps. The system of water-supply for fire purposes is the following. In the public streets, the firemen immediately find water by opening special fire-plugs. This system, established in 1872, now comprises 4,500 fire-plugs, the number provided for being 7,200. When they shall all have been put in, they will be about 100 metres apart. They are branched-on to the distributing-mains of water under pressure, from the rivers Seine, Marne and Oise. In most of these fire-plugs the water-pressure is sufficient, so that the aid of the engines is not necessary. All causes of fire are investigated by the *commissaires de police.* — *Journal of the Society of Arts.*

THE INTERNATIONAL ENGINEERING CONGRESS.

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

The manner in which the engineers have prepared for their Congress at Chicago during the World's Fair, as shown by the following account in *Engineering*, is in refreshing contrast with the lack of preparation that seems likely to signalize the Architectural Congress to be held about the same time.

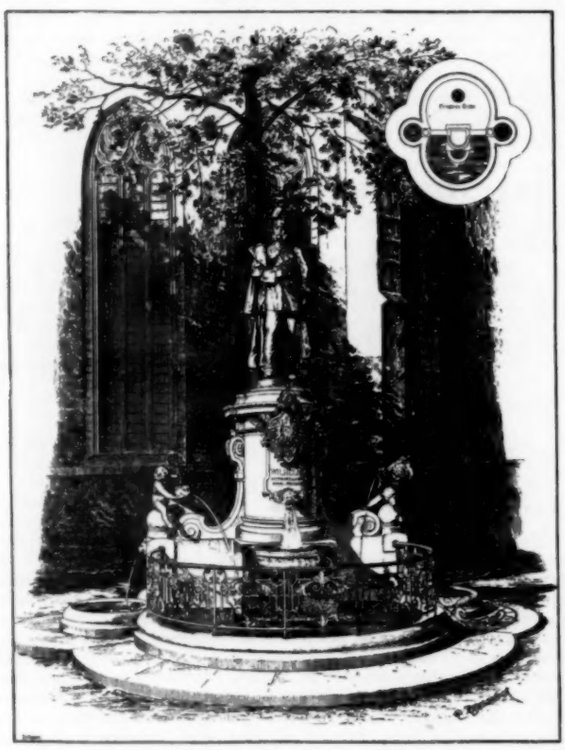
"The Engineering Congress to be held at Chicago during the first week of August next is, as our readers are aware, one of the many international assemblies which, under the auspices of the World's Congress Auxiliary, are to occupy nearly the whole of the six months during which the Exposition will remain open. We shall hereafter have much to say about these congresses, though, of course, that relating to engineering must occupy most of our attention. It is most gratifying to be able to announce that this Congress is already completely organized, the necessary funds subscribed, and a large number of papers guaranteed; to a considerable extent arrangements have been made for publishing the papers, at first for distribution in pamphlet-form prior to the date of the Congress, and subsequently in volumes as a permanent record of the great work carried out by American engineers.

"Ample experience has already shown that the actual business of such congresses in session is of comparatively small importance, though the assembling of representatives of the profession from all parts of the world lends the highest possible moral influence to such meetings. Nor are the discussions on the papers read of very great value. Where so much business has to be transacted in a few days, where so many papers have to be considered that many of them can be read only by title, where the members assembled are from many lands, speaking many tongues, it is evident that the real value of an International Congress must lie in the subsequent publications. It may be safely asserted that, so far as the Engineering Congress is

concerned, a brilliant success is assured. During two years the various societies have been working together to secure this result — the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. For the work in hand these societies have been amalgamated, or rather members of their councils have been appointed to form a joint committee for the Congress, with head-quarters at Chicago; Mr. O. Chanute and Mr. E. L. Corthell, both prominent engineers residing in Chicago, are placed at the head of this commitee.

"But while neither as regards organization nor means are these societies at all deficient, it is otherwise with two most important branches of the profession — those relating to marine and naval engineering and to military engineering. Both these subjects form separate sections at the Congress, and at each a large number of papers are to be submitted. But it happens that neither branch is represented by any technical society and, therefore, funds are lacking, though under the able and energetic management of Commodore Melville, Engineer-in-Chief of the United States Navy, the section of Marine and Naval Engineering and Naval Architecture will be able to present a very large number of papers for reading and discussion. But as there are no funds available for the publication of these proceedings, the deficiency has been made good by private enterprise. Messrs. John Wiley & Sons, of New York, have arranged for the publication of the papers in this section, both separately for previous distribution, and collectively in a volume shortly after the Congress has been closed. These transactions will occupy 700 octavo pages, and about 150 plates; the numerous contributions in French, German, Italian, etc., will be translated into English. There will be about fifty-five papers in all, of which about thirty have been contributed by foreign engineers. Sixteen of these papers are written by English engineers, so that we may be well content with the part we have taken in the Congress, as the number of English papers is as great as that of all other foreign nations put together. This is the position England ought to take at an International Exhibition, and it is gratifying that, if we have sadly failed with our exhibits, our engineers, at least, have done their part to retrieve the position, and the good moral effect of this, and of other personal efforts, may yet go far to make up for the deficiencies of the British section."

VENTILATION.



Monument to William I, Lippstadt, Westphalia. From *Architektonische Rundschau.*

NOTORIOUS examples of the failure of mechanical ventilation by impulsion, or artificially forcing air into a building, are the new London Law Courts and Houses of Parliament, where mechanical arrangements are employed, and all that money and the highest scientific and engineering skill could do to make the ventilation satisfactory has been tried, but without success. Mechanical ventilation by impulsion forces air into a building under pressure, and at a high velocity, destructive of diffusion, causing disagreeable and dangerous draughts in the vicinity in the line of the inlets and outlets, the other parts of the building being left wholly unventilated, as the incoming columns of air usually travel, or are propelled, in a direct line to the nearest outlet, and there make their escape. Engine-driving columns of air through a building is not ventilating it.

It will, therefore, be evident, as is recognized by the authorities, that it is wholly misleading and incorrect to take the registered volumes of air forced into or out of a building at certain points as in any way indicating how often in a given time the whole of the air is changed. Analyses of the air taken — as is but too commonly done — from the immediate vicinity of the points of admission are also equally misleading, and do not demonstrate — as the uninitiated might suppose — the general purity of the air, as other parts may be quite stagnant and vitiated, though it is usual to tabulate the average, which is, obviously, again misleading. This is the chief cause of the complaints which are so constantly made with respect to the unhealthiness and discomfort of buildings mechanically ventilated by impulsion, which, owing to the compression of the columns of air forced in, and also of the atmosphere of the building, causes headache and a feeling of oppression, and is an actual source of danger to health and life; and it is a well-known fact that those employed in public buildings mechanically ventilated by impulsion constantly complain of feeling ill, and are frequently incapacitated from fulfilling their duties. The evils described are accentuated when it is attempted to deliver air into a building at the higher levels — that is, to create a continuous down-draught — and to expel it at the floor-line. But this method is seldom or never employed, though from time to time it is advocated in some form or other, and it is universally condemned by scientific authorities as most pernicious, contrary to the laws of nature, and, from causes which are well known, fatal to health, insidiously sowing the seeds of disease, which sooner or later develop into rheumatism, chronic neuralgia and various forms of pulmonary complaints.

A report was published a few years ago by the late Professor Carnelly, which caused considerable controversy at the time.

Professor Carnelly's report on the heating and ventilation of schools is all the more remarkable when it is considered that mechanical ventilation was the professor's pet hobby, and, though compiled with a very different intention, there never was formulated a stronger indictment against the advantages of mechanical ventilation and heating as compared with the cost of that method. The exposition contains a valuable lesson to those capable of understanding it.

It is stated that an installation of a mechanical system of ventilation and heating in a school for 1,000 cost 24*s.* per head, as against 2*s.* 5*d.* for a natural system, the average for a number of schools of the same size in different towns being 20*s.* and 4*s.*, respectively, though in schools for less than 1,000 the cost of the mechanical system would be greater in proportion. "In naturally-ventilated schools," the report states, "the cost of the ventilation is but a fraction. With mechanically-ventilated schools this comparison cannot be made. To fit up a school for 1,000 children with mechanical ventilation would cost from £400 to £700 more than if one of the ordinary methods were employed." The report bristles with elaborate calculations and tables which so impress the non-statistical mind, but, when analyzed, are found to prove very little either one way or the other, the results obtained in certain schools mechanically ventilated, when tested on different occasions, being most erratic and contradictory; and, when one school was compared with another, these conditions were found to be even more pronounced, whilst the difference in the purity of the atmosphere in the schools mechanically ventilated and tested, as compared with the schools having a so-called natural system of ventilation, which consisted in the cases described of simply the windows and doors, was absurdly disproportionate to the cost of the one as compared with that of the other.

It is a curious fact, and one that should be carefully noted, that in the whole of the report not one single instance is given of the mechanical system having been tested against or even compared with any automatic system, the schools mechanically ventilated being tested against schools having only the windows and doors to rely upon for ventilation — that is to say, schools in which no system of ventilation existed at all.

It would have been interesting to have known what the results would have been had a good automatic system been in use, applied under equally skilled advice as the mechanical, which is, of course, as necessary to insure the success of an automatic system of ventilation as of any other engineering undertaking.

One is struck, upon a perusal of the report, with the extreme one-sidedness as well as by the futility of the deductions arrived at, as, beyond showing that the advantages gained with a mechanical system are, in the cases cited, ridiculously out of proportion to the expenditure incurred, they are, for all scientific or practical purposes, valueless, as they prove no more than that an elaborate and costly system of mechanical ventilation has been found in a few special instances to be slightly more effective than where there was *no system of ventilation in use at all.* At least, the same results might have been achieved with an automatic system properly applied at a fraction of the initial cost, and no after-expense for maintenance (which, with a mechanical system, is considerable). Indeed, it is admitted by Professor Carnelly that in the reports received by him from schools ventilated with automatic systems consisting of roof extraction-ventilators and fresh-air inlets, the ventilation is described as "highly satisfactory"; also that, amongst others,

the report *re* mechanical ventilation received from the clerk to the Birmingham School Board stated: "Mechanical ventilation has not worked satisfactorily, and it is still a question whether we have gained by its adoption anything equivalent to the expense."

Architects and school-boards contemplating the adoption of mechanical ventilation would do well to first procure a copy of Professor Carnelly's report, and carefully read and digest the same before expending their clients' or the public's money, and satisfy themselves if the outlay would be justified by the results as therein tabulated, and whether the same or better might not be secured by simpler and less costly methods. The results attained in other quarters certainly point in this direction, but, whatever system may be selected, it should always be borne in mind that any plan which creates a down-draught is essentially dangerous to health.

Who, indeed, does not know the terrible and too often fatal consequences of sitting in a continuous down-draught, however insidious or of whatever temperature, and which is quite unavoidable with any system which delivers the air-supply at the upper part of a building and expels it at the lower? The air may possibly be changed by such a method, but at what a price. The Spaniards, even with their genial clime, fully recognize the seriousness of this danger in one of their most time-honored proverbs: "The two greatest evils in life are a through-draught and a scolding wife."

With all down-draught systems diluted foul air only is breathed, never fresh, pure air, as the respired and exhausted air first, owing to its greater levity, ascends, and is returned by the downward current to the breathing-level mixed with the products of combustion, and is there re inhaled. Only a very strong and what would be an unendurable down-draught could prevent the highly-rarefied respired air from rising to at least the height of the crown of the head, which is sufficient to insure its re-breathal. Analyses of air taken from any part of a building, when occupied and ventilated with a down-draught system other than close to the person, and immediately above and also below the breathing-level, would be most misleading, as the air one foot away from the breathing-zone, with which, owing to the downward vertical current, it does not mix, would be comparatively pure.

An analysis of air taken from a building when it is unoccupied would, of course, prove nothing beyond the purity of the atmosphere when there was *nothing to vitiate it.* It is well known that, with mechanical ventilation, and especially so with a down-draught method, the natural law of diffusion, to which it is the antithesis, is rendered practically inoperative. — *Building News.*

SOCIETIES

ENGINEERS' CLUB OF PHILADELPHIA.

AT the meeting on May 6, the Secretary read a paper on the Preparation of Portland Cement — the Various Systems of Grinding the Cement, by Mr. Pierre Giron, in which the author called attention to the qualities of the burnt product of the Portland cement kiln, and the desirability of reducing the clinker to a fine powder. While the quality of the cement was determined by the neat test only, the matter of fine grinding did not receive much attention, but the sand test now generally adopted shows conclusively that the value of Portland cement is increased by fine grinding to an extent that warrants the slightly greater expense to the consumer.

A table showing the results of tests of cement mixed with three parts of sand by weight, made into briquettes pressed in the moulds according to the European method, and of others made to the consistency of mortar used in practical work according to the American method, showed conclusively the value of fine grinding.

Results of sieving the cement and of obtaining a fine residue by the water method were mentioned, and the various machines used to reduce the clinker to the requisite fineness were described in detail and illustrated by drawings thrown on the screen from the projecting lantern.

The speed of operation and the necessary horse-power were given in most cases and the Morel Ball Pulverizer was recommended for the quantity of material produced per hour and the advantage that it can be run continuously day and night.

The paper closed with a description of two new methods of screening and called attention to the fact that "remarkable progress has been made during the past few years toward the solution of this, one of the most difficult problems of the cement industry. It may well be said now that the grinding of Portland cement has about reached its limit of perfection, since it is possible to get at low cost a ground product of extreme fineness."

In the following discussion, Mr. Robert W. Lesley said: There are a number of us here, who came to the meeting to-night, with the hope of learning something new on the subject stated in Mr. Giron's paper, and for myself, I regret extremely that the facts stated are, for the most part, ancient history, and that much of the machinery claimed to be in operation in cement works, is hardly to be found in mills built of late years. If any one uninformed in the business, had come here to get information of value in the construction of cement works, from the paper read, I would certainly advise him to look more deeply into the later history of the subject.

It would seem to me that it is due to a society of this character, that the papers presented here should contain new and original matters, and state facts that are scientifically correct, and in both of these elements, I think, the paper read falls far short of the requirements of a society such as ours.

In answer to a reply made by Mr. Giron to my discussion on his last paper and published in the "*Proceedings*" of the Society's last meeting, I would say that I am ready to substantiate both of the facts stated by me:

First. — So far as the cost of oil and coke — the figures as to quantities that I presented, were taken from Mr. Giron's own paper. The price of coke was figured at the cost of coke in the cement kiln, allowing a very large margin for handling it, and the price of oil was figured from prices given by the Standard Oil Company, allowing also a margin for handling it from the cars to the tanks, and thence to the rotaries.

Second. — As to the disintegration of briquettes, I would state that I have here briquettes made, both neat and sand mixtures, of a cement manufactured in rotary kilns, and representing the product of four separate years of a mill manufacturing under the rotary process. All of these briquettes show disintegration at periods of a year and over, while briquettes of three other American cements and two foreign Portland cements, made in pairs or at about the same time and kept under the same conditions as those first mentioned, show no signs of disintegration. One of the rotary-kiln briquettes actually showed disintegration in sand mortar at a period of three months.

In view of the fall of the St. Nazairre Bridge in France (*London Engineering*, April 22, 1887, page 310) after seven years' use, and the breaking-down of the Aberdeen Docks in Scotland (Bamber and Carey's paper, *Institute Civil Engineers*, London, 1892), after an almost equal period of use, both built with Portland cement regularly burned, though of improper materials — the fact that cement burned, in rotary kilns has been in use in this country for three years as stated by Mr. Giron, is no "contradiction" of the facts I have stated above, and in point-of-fact, in the completing of the Reading Terminal, mentioned by Mr. Giron, a cement other than a rotary-kiln cement, was principally used.

Now as to the reasons for the opinion I have advanced, that cement made by the rotary method does disintegrate, the facts are these: At the works whence the cement came, of which the disintegrated briquettes were made, the raw mixture is composed of a limestone and a cement rock, the former being much higher in specific gravity and density than the latter.

The limestone contains a small percentage of silica and alumina, while the cement rock contains a large percentage of silica and alumina. Inasmuch, therefore, as these two widely different materials are fed in the form of a slightly moistened powder into a rotary cylinder, it is easy to see that a mechanically-combined homogeneous material is not presented to the flame for the chemical operation of calcining. For this reason it can be seen that the flames act differently upon the two materials, each of which has a very considerable variation in the clinkering point, the cement rock clinkering at a much lower temperature than the limestone. That this is the case, can be seen by screening in a 10,000-mesh sieve the cement so manufactured and comparing its residue with the residue of other well-known English, German, or American cements. This I have done, and the powder I have here shows grayish-green pepper-and-salt residue from the rotary kiln cement, and a greenish-black residue from the cement made in ordinary kilns; the white particles in the former residue indicating the presence of small particles of lime not driven to clinkering point in combination with silica and alumina, as should be the case in well-burned cements. The dusting and checking of the briquettes at the long periods show the final results of these portions of uncombined lime.

Prof. Silas G. Comfort said: I think that the gentleman's criticism as to the kind of papers to be presented before the Club is a little too sweeping. If followed it would throw out all historical or descriptive data of work not entirely new, but upon which the facts might be widely scattered or unavailable until brought together to be presented in a concise manner. A paper which shows the painstaking preparation of material collected from various sources and arranged in the most accessible manner is oftentimes quite as valuable to those needing information as one giving the results of the author's own work or new investigation.

I mention this as a protest against a criticism which I think was a little too sweeping.

Mr. Thomas D. Whittaker said: We are burning cement in a rotary kiln and do not find that it disintegrates. We do not, however, add lime in the burning, which may account for this to some extent.

Mr. Lesley said: My criticism upon the paper was not directed so much to the fact that the material in it was not new, as to the fact, that many of the statements in it were misleading. For instance, after stating that unless some new mills are introduced for economical grinding, the manufacture of Portland cement in this country will become impossible, the writer recommends the Morel Ball mill, as possessing the "remarkable advantage that it can be run day and

night." Such a statement to a cement manufacturer, who is running day and night not less than fifty run of stone and eight or ten Griffin mills, is certainly information of a most startling character, and it is to just such statements as this, that I make my objection. An historical statement is always of interest, but this paper does not pretend to be historical, but is given as a description of machinery and conditions now existing in the cement industry, and as such, it is certainly misleading.

This is the fourth time that I have been here to meet Mr. Giron, who was announced to read papers before this Society. If he had been able to attend this or any of the meetings, he might perhaps have given us in reply to inquiries, further information in this discussion.

The discussion was also participated in by Messrs. George S. Webster, Edward K. Landis and others.

L. F. Rondinella, *Secretary.*

Illustrations

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

FOURTH BAPTIST CHURCH, ASHLAND BOULEVARD, CHICAGO, ILL.
MR. C. F. WHITTLESEY, ARCHITECT, CHICAGO, ILL.

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

RETABLE BY LIGIER RICHIER IN THE CHURCH AT HATTONCHÂTEL, FRANCE.

SITUATED on the top of a mountain, which rises between the valley of the Meuse and the plain of the Vœvre, eighteen kilometres distant from St. Mihiel, the Church of Hattonchâtel possesses the earliest work of Ligier Richier. The date, 1523, engraved in relief on the base of the monument which we are going to describe, indicates that Richier was only about twenty-eight years old when he executed it. The retable, or, as it is called, the Calvary of Hattonchâtel, is placed at the end of the apse behind the high-altar. It is composed of three bas-reliefs, approaching to high relief in character, placed in niches 0m. 33 in depth, and separated from one another by pilasters, architecturally elegant, to which we shall refer later. The figures are about 0m. 45 in height, and are painted, and, in spite of the restorations made during the last century, still preserve their harmonious tones.

In the left-hand compartment, Christ is giving way beneath the weight of the cross. His head, gored by a large crown of thorns, bears the imprint of profound sadness. His half-opened mouth seems to exhale an agonizing sigh. Behind him, Simon, the Syrian, lifts the cross. His Jewish profile, his long pointed cap, whose flaps are folded upwards, indicate his origin. Near him a female saint, with clasped hands, expresses through the contraction of her features the sorrowing compassion which she experiences. Her head is covered with a sort of turban, kept in place by a band of cloth passing under the chin, a detail of costume which is often repeated by Richier, and which we refer to here once for all. The executioner at the right of the Saviour is clothed in a tight-fitting doublet decorated with a multitude of slashings. He is bare-headed. Like a man familiar with this sort of work, he phlegmatically supports the cross, so as to keep it clear of the ground. The action of his assistant is more vivacious. With the left hand he lifts the cross, while with the right he threateningly flourishes a bunch of goads above the Saviour's head. In the foreground, St. Veronica, whose features witness the pious astonishment which she feels, offers to the eyes of the faithful the handkerchief which has received the imprint of the sacred face. Behind St. Veronica a woman is bending down to see the miracle. Her hair, scattered over her shoulders, causes her to be recognized as Mary Magdalene. This group of seven figures is skilfully composed, each person vividly expressing by his or her gesture and expression the different impressions which affect them. In his first work, Ligier Richier announces the grand qualities which later distinguish him. He opens a new way, which he will never abandon.

The central niche, as commonly happens, is much higher than the two others, because of the cross, which occupies the upper portion. It is 1.25 metres in height, while the others are 0.70 metres high. Dominating the passions, which express themselves below him, the Saviour of mankind resigns himself to his fate and pardons his enemies. In the foreground, at the left, the Virgin, kneeling, allows her languid head to droop upon her left shoulder. She seems about to give way to the weight of her grief. Probably by reason of a slip of the chisel, the right eye turns to the left and causes a defect in the general harmony of the features. On the other hand, her draperies are well arranged, and we already find here the girdle, which unrolls itself in elegant arabesque over the robe, and by its development happily models the form, a device that is very obviously copied from Mansuy Gauvain, who, in his Virgin for the Church of Bon Secours, carved for Henri II in 1505, very ingeniously arranged the girdle lengthwise. This picturesque detail still provokes the admiration of all those who visit the church at Nancy, which has replaced the Chapel of the Burgundians. St. John respectfully supports the Virgin. The knot formed by the ends of his mantle on his right shoulder shows the same method of fastening Richier always used later in his figures of this apostle. Thus at Hattonchâtel Ligier Richier indicates his preferences not only for the impassioned expression of the figures which he introduced, but even for the very arrangement of their clothes and the accessories which particularize them. Arrived at the apogee of his talent, he will not abandon the powerful support which observation of nature furnishes him. His heads, like his costumes, are peculiar to Lorraine. Often he has reproduced the head-dress of peasant-women, and, if sometimes he omitted it, he substituted an imaginary turban, desiring, like contemporary painters and sculptors, to indicate that the scenes of Christ's life were enacted in the Orient. As for the Virgin, he always used the vestments which were given to her in the Middle Ages, and which are still used by certain religious orders. As for Christ, St. John and the apostles, he did not disregard tradition, which attributed to them the long robe and mantle — a costume which has a close analogy to that of the Benedictine monks, whom he saw every day at St. Mihiel.

In the scene on Calvary, which occupies the central niche, three cavaliers first attract attention. On the right, the centurion lifts towards the dying Christ a large banner, attesting that the divine victim is truly the Son of God: "*Vere hic hom Filus Dei errat.*" This personage, clad in a rich doublet and voluminous turban, armed with a large cimeter suspended by a chain, riding a heavy horse solidly caparisoned, recalls the appearance which those knights of the sixteenth century must have presented when they fought in the Italian wars at the side of the youthful Antoine of Lorraine. Behind this energetic, warlike figure is the grinning head of a second horse, who is impatiently neighing. It is seen that Richier, at the beginning, sought to excite emotion by every means, and all methods of producing it were good in his sight. Not being able to place the two thieves at the side of the Saviour because of the lack of space, he has given to the two horsemen the sentiments which the thieves experienced on Calvary. The horseman on the right hand insults Christ, while the one at the left lifts his hands imploringly towards him. The contrast of the action is striking. A soldier bearing a sponge soaked with vinegar and spice on the end of a stick fills up the vacant space at the foot of the cross, which Mary Magdalene, overcome with grief, clasps in her transports.

Of all the religious subjects which Ligier Richier treated, that which seems to have occupied the highest point in his religious thought is the arrangement of the body of Jesus after the torture of the cross. His *chef-d'œuvre*, or, rather, his most considerable work, the "Entombment" at St. Mihiel, is really only the last episode of this grievous scene.

At Hattonchâtel the third bas-relief is, after a manner, the first idea of those groups which are seen at Etain, Clermont-en-Argonne and at St. Mihiel. Christ's body, stretched on the ground, is tenderly supported by his mother. For her it is a moment of the most poignant grief, that in which human force abandons her feeble body all ready to swoon away. This group is well composed, and Christ's head, fine and drawn with pain, offers a type of beauty superior to that in the two other bas-reliefs. St. John, standing at the left, is a figure of mediocre value. The holy woman who bends over the body of Christ in a most natural manner has a commonplace and almost trivial aspect. Here realism has been exaggerated. On the other hand, on the left rises a splendid female figure, coiffed in good taste and clothed with a narrow waist, which discloses her shape, allowing to be seen at the breast a finely-plaited chemise. A long girdle encircles her waist and an ample mantle completes her elegant costume. Doubtless this is St. Mary Magdalene, formerly a courtesan of Magdala, on whom Richier has lavished finely-cut jewels and sumptuous garments, forgetting that he ought to represent a humble penitent, who had renounced the joys of this world. In the background can be distinguished a bishop or a mitred abbot clothed in his pontifical garments. Below him a priest in surplice with joined hands kneels in prayer. These two figures are evidently portraits. M. Léon Germain reasonably supposes that the bishop is St. Claude, and that the priest must be the donor himself, whose name even now remains undiscovered.

These three bas-reliefs are separated by pilasters covered with light arabesque work, where are figured on the one hand the sculptor's tools, a mallet and chisel, and on the other a rule and compass, the attributes of the architect. The entablature is decorated with arabesque work, designed with much taste. The arms of Duke Antoine surmount the central niche. The entire decoration, where all the parts in relief are gold upon a background of blue, forms a splendid frame for the bas-reliefs which are ungilded. On the base can be read the following description in Roman letters:

"*XPS: Passus est nobis relinquens exemplum Vt sequamini vestigia*": "Christ has suffered for us, leaving you his example, in order that you may follow his footsteps." Upon the base of each of the balustrades there appears the date of the erection of the monument arranged thus:

L'an 1000 500 23.

An armorial shield is carved in the midst of a crown of fruits, whose bearings have not yet been deciphered. In all probability it represents the arms of the donor. Upon each side of the crown of fruits are seen the two letters "G. R.," which have greatly exercised the sagacity of all those who have taken an interest in the retable of the Hattonchatel.[1]

[1] From "*Les Artistes Celebres: — Ligier Richier,*" by M. Cournault.

THE CASA ALAMEDA, NEW YORK, N. Y. MR. J. G. GLOVER & H. C. CARREL, ARCHITECTS, BROOKLYN, N. Y.

PORTE COCHÈRE OF THE SAME.

"BUSHY HILL," HOUSE OF WALTER PHELPS DODGE, ESQ., SIMBURY, CONN. MESSRS. CRAM, WENTWORTH & GOODHUE, ARCHITECTS, BOSTON, MASS.

THE CITY-HALL AND THE HALL OF RECORDS, SAN FRANCISCO, CAL. MR. AUGUSTUS LAVER, ARCHITECT, SAN FRANCISCO, CAL.

SEE letter from San Francisco, elsewhere in this issue.

[Additional Illustrations in the International Edition.]

ST. BARNABAS PARISH CHURCH, DULWICH, ENGLAND. MESSRS. OLIVER & LEESON, ARCHITECTS.

THIS plate is copied from *Building News*.

DECORATIONS BY M. FRANCOIS EHRMANN IN THE HÔTEL DE VILLE, PARIS, FRANCE.

THESE illustrations are copied from *L'Art*.

DETAILS FROM THE CHURCH OF SAN FRANCESCO, RIMINI, ITALY.

THESE illustrations are copied from *Zeitschrift für Bauwesen*.

BUILDINGS AT STUTTGART, GERMANY. FRIEDRICH VON LEINS, ARCHITECT.

THESE designs are published by the *Deutsche Bauzeitung* as a memorial to their late designer.

DESIGN FOR ROYAL HOSPITAL FOR SICK CHILDREN, EDINBURGH, SCOTLAND. MR. G. WASHINGTON BROWNE, A. R. S. A., ARCHITECT.

THE design for this building, copied from the *British Architect*, is from a drawing hung at the Royal Scottish Academy Exhibition. The original design was prepared for the site at Meadowside, where the work of the hospital had been carried on for many years in old buildings imperfectly adapted for hospital purposes. This design was completed in all its details when the ground was acquired by the managers of the Royal Infirmary, which adjoins it, for their projected extension. The new site acquired at Rillbank being different both in shape and extent from that at Meadowside, an entirely new design became necessary, and the plans of this design which is now in course of erection are given along with the perspective view.

As seen from the plans the building forms three sides of a quadrangle. The administrative block forms the north side, the ward wings connected with the administrative block by cross ventilated corridors, the east and west sides with their length running north and south, while the south side is left open for sunshine and air.

The hospital consists of four wards of 24 beds each, a spare ward for 16 beds, an observation-ward for 4 beds, and two isolation-wards for 1 bed each, 118 beds in all, with the necessary administrative accommodation. The plan is so arranged that the principal work of the hospital shall be carried-on on the ground and first floors, these being easiest of access. On these two floors are placed the four principal wards, two in the east and two in the west wing. The wards on each floor are approached by corridors ten feet wide which run through the centre of the administrative block in touch with the two staircases, the principal stair and the service stair. Within the administrative block, north of the corridors in each of these floors, is a lecture theatre for teaching purposes and a visiting physicians' room for each ward. South of the corridors on the ground floor are the suites of rooms for the matron and the resident doctors, right and left of the principal entrance; while occupying a similar position on the first floor are the board-room, a small museum, ophthalmic-room and dispensary, and in proximity to the service stair the staff dining-room. The upper floors of the ward wings are occupied with the spare ward, observation and isolation wards, while in the upper floors of the administrative block are placed the common rooms for the nursing staff, bedrooms for the sisters and dormitories for the nurses. The kitchen suite is placed upon the north side of the third floor of the administrative block and in the attics overhead the dormitories for domestics, etc.

The whole of the hewn-work and face-work of the external walls is to be of red stone from Corsehill quarry, and the roofs covered with green slates. The floors throughout the entire building are of fireproof construction, composed of steel joints embedded in cement concrete, finished on top with wood, which in the wards will be teak. The roof principals are also of steel.

The building has just been started, and is expected to occupy two years in erection.

NORTHAMPTON INSTITUTE, CLERKENWELL, ENG. MR. E. W. MOUNTFORD, ARCHITECT.

THE site was a difficult one to treat, owing to its shape, being nearly that of a right-angled triangle; though apart from this it is a fine site, with good frontage in each direction. The difficulty of planning was further increased by the fact that only a portion of the site is at present available, and upon this the great hall, swimming-bath and gymnasium had to be placed. The principal entrance is under the central tower. The great hall to the left is to seat 1,500 people, in addition to an orchestra of 200 performers, with all necessary retiring-rooms, etc. There are three entrances to the ground-floor of the hall, and three separate staircases leading to the gallery, besides the entrances for choir and artists. The swimming-bath has a separate entrance, and measures some 120 feet by 60 feet, the gymnasium being about the same size. Social-rooms, refreshment-rooms, cloak-rooms, and lavatories, are provided for each sex, while there is a large reading-room, library and museum, etc., common to both. Workshops, laboratories and class-rooms are also provided. The administrative-rooms are arranged on the ground-floor adjoining the principal entrance. The committee have limited the cost to 50,000*l*., with a margin of ten per cent. The site has been given by the Marquis of Northampton, and the buildings are intended to serve as the Central or City Polytechnic, the site not being very far north of the City boundary. This plate is copied from the *Builder*.

BATSFORD PARK, MORETON-IN-THE-MARSH, ENG: GARDEN FRONT. MESSRS. ERNEST GEORGE & PETO, ARCHITECTS.

NEW PREMISES FOR THE IMPERIAL LIVE-STOCK INSURANCE ASSOCIATION, LIMITED, 17 PALL MALL EAST, LONDON, ENG. MESSRS. ESSEX, NICOL & GOODMAN, ARCHITECTS.

THIS drawing represents a portion of Waterloo House, which is now being reconstructed. The ground-floor and basement, with premises in the rear, will be occupied by the above Association, and the upper floors as offices and residential chambers. The front is executed in Portland and Dumfries stone, with Norwegian granite columns. The building throughout will be lit by electric-light.

KIRKBRAE HOUSE, EDINBURGH, SCOTLAND. MR. JAS. G. FAIRLEY, F. R. I. B. A., ARCHITECT, EDINBURGH, SCOTLAND.

THE illustration shows additions that have been made to an old and prominent house at the south end of Dean Bridge, Edinburgh, the property of Mr. Stewart. The site of this house is unique. It commands views towards Princes' Street, Firth of Forth, with Inchkeith in the distance, and Corstorphine Hill. None of these views can ever be built up. In his "*Old and New Edinburgh*" the late James Grant said that Mrs. Grant, of Laggan, lived in old Kirkbrae House. At that time her house was the resort of select literary parties, of whom Professor Wilson ("Christopher North") was always a member.

NOTES AND CLIPPINGS

THE SHELTERING OF THE ROMAN PEOPLE. — According to the calculations of De la Malle and others the area of ancient Rome was five square miles and sixty-three acres. It seems hardly possible to estimate, on a comparison of the mode of life and social demands of the ancient Romans with those of populations nearer our own era, the numbers which might have been accommodated, according to the fashion of the time, within that area. We must make an allowance, no doubt, for the ordinary habits of outdoor life among the Romans, vast numbers of whom may be said to have dwelt in the circus, the theatre and the baths, and only to have slept in the miserable dark cabins they called their homes. It may be believed that during part at least of the year multitudes of the lowest class even slept in the open air, or under the shelter of colonnades, as in Naples. We are sometimes told indeed to look to this modern city for an example of the conditions of life in ancient Rome. But though at the present day the temperature of Rome is said to suffer less violent extremes than other places in Italy, the well-known passages in Horace, Livy and Dionysius do not allow us to question the great severity of the winter there in ancient times. Great allowance, however, is unquestionably to be made for the treatment of domestic slaves, who were huddled, we may believe, without reference to their comfort, or even their health, in the holes and corners of their masters' houses, often confined at night in the basements or vaults of the mansion, and particularly of the temples and public buildings. The vaults of a public building might hold a vast number of public slaves, but it may be questioned whether the service of the temples and basilicas of Rome required the attendance of so great a multitude. Indeed, the question of this density of inhabitation turns very much upon the numbers of the slave population — a problem of which no reliable solution has yet been found, and which the most careful of modern inquirers, M. Wallon, has prudently abstained from attempting. Some inquirers divide the population equally between the servile and the free, though all inclining apparently to a still higher ratio of slaves. Other writers, however, would reduce the proportion very much lower, and it would be difficult certainly to point to any known example of domestic slavery at all approaching to this extent. Generally, the Roman citizen, being himself fed almost gratuitously by the government, must have felt more sensibly than the modern the burden of servile mouths to be supplied at his own private expense. — *The Architect.*

The Unprofitableness of State-owned Railroads. — Austrian State railways pay at the most 2 1-4 per cent; and Hungarian roads pay about 3 per cent. Italian State railroads are in a still worse plight, for they paid only 1.63 per cent in 1892, on an investment of about $000,000,000; and the tendency is toward still lower dividends under State management. In 1860, says the *Nuova Antalogia*, with a capital account of $109,200,000 the profits were about 3.6 per cent; but with a steady and rapid increase in the total amount invested the profits have as steadily diminished to the figures first given for 1892. A particularly bad omen for the future is the fact that in the same period, 1860–1892, the operating expenses have increased from 53 to 70.4 per cent of the gross earnings. Prussia alone seems to have made her State-owned railways profitable. But Prussia built up her present railway system for strategic purposes mainly, and according to all accounts the administrative organization is defective and far from popular. The primary object of location, equipment and control is to meet the emergencies of war rather than to serve the conveniences of the people in time of peace; and that the system does pay such handsome returns as are credited to it can only be explained by the needs of a dense population, accustomed to military rules and regulations and more prone to travel from place to place than are the people of France or Italy. In Italy particularly the cost of construction has been enormous, and the line along the coast of the Mediterranean, from the French frontier to the coast opposite Pisa and Florence, is almost one continuous line of tunnels. While the Prussian railways are excellently built and equipped, after European standards, they have probably cost less per mile than those of Italy, Austria or Hungary, owing to advantages of natural conformation. France subsidizes her railways purely for military purposes; and apparently is content to pay well for the possible advantages this control may some time return in an emergency. She takes no part in the operation and administration of the lines except in that which pertains to the maintenance of lines useful in war, and in the general control of the accounts and records. — *Engineering News.*

Production of Mica in the United States. — The name mica is not that of a single mineral, but is a family cognomen which embraces a number of varieties, all of which shine and split into more or less transparent sheets, highly elastic, and having certain ingredients in common. In addition to the importance of micas as rock constituents, their transparency, elasticity, lustre, comparative infusibility and electrical non-conducting power give them a number of applications in the arts and make them the object of industrial mining. The mica of the market is in nearly all cases the common white mica or muscovite. Although mica is so widely distributed in nature, it is only in a few localities, and when fissures in the rock have been filled with very coarsely crystallized granite, that mica can be mined with profit. According to a recent United States mining report, such fissure veins occur in a number of localities, notably in Siberia and Norway, and in the United States principally in New Hampshire, North Carolina, Wyoming, New Mexico, the Black Hills of Dakota, and, probably, in paying quantities in Alaska. All these mines are more or less alike so far as their natural features are concerned. The chief differences are artifical, and consist in the methods of mining and handling the mica. The mines of Western North Carolina have been worked largely and may well serve as a type. In travelling across the State to the westward, three distinct belts of country are met with: the lowlands, covered by recent alluvial deposits; the middle or Piedmont section, a low plateau, underlaid by older sandstones and shales; and last of all, the western or mountain section, in which the Appalachian system reaches its development. Many of the veins of mica occur in a fined-grained black gneiss, which passes with the mountain miners under the name of slate. The veins vary in thickness from less than an inch to ten or twelve feet, occasionally to as much as 30 or 40 feet; but these instances are rare. The mica is seldom prepared for market at the mine itself, but is taken to a neighboring factory, and here the mica is put into shape for shipment. The blocks vary greatly in size; one from the Wiseman mine is reported to have been six feet long by three feet wide. Pieces a yard in diameter have been obtained at the Ray mine, in Yancey County, and similarly large plates have been found in Siberia; but these are exceptional. The average block is little larger than the page of a magazine, and is generally less than six inches in thickness. It separates very readily into sheets parallel to the base of the prism. It is estimated that it would take 300,000 of the mica plates to make an inch. The mica is generally split into plates varying from about 1-8th to 1-64th of an inch in thickness. In preparing these plates for market the first step is to cut them into suitable sizes. Women are frequently employed in this work, and do it as well, if not better, than the men. The cutter sits on a special bench, which is provided with a huge pair of shears, one leg of which is firmly fixed to the bench itself, while the movable leg is within convenient grasp. The patterns, according to which the mica is cut, are arranged in a case near at hand. They are made of tin, wood, or pasteboard, according to the preference of the establishment. Generally, they are simple rectangles, varying in size from about four to eighty square inches. The cutter selects the pattern which will cut to the best advantage, lays it on the sheet of mica, and then, holding the two firmly together, trims off the edges of the mica to make it correspond with the pattern. The cleaning process comes next. The cleaner sits directly in front of a window, and must examine each sheet of cut mica by holding it up between her eyes and the light. If there be any imperfections, and such nearly always exist, they must be removed by stripping off the offending layers of mica until a clear sheet remains. Finally, the cut and cleaned mica is put up in pound packages, and is ready for the market. There is an enormous waste in the processes of preparation. One hundred pounds of block mica will scarcely yield more than about fifteen pounds of cut mica, and sometimes it is even less. The chief use of the cut mica is in stoves. In Siberia the sheets of mica are still sometimes used in windows. The sheets are also used in the peep-holes of smelting furnaces, in lanterns, in shades, and in the port-holes on board vessels, where the vibrations would soon demolish less elastic glass. Mica is an excellent non-conductor, and of recent years has been cut to some extent into narrow strips for use in the construction of dynamos. The scrap mica was formerly thrown away, with the exception of a small quantity used as a lubricating material, but it has recently found a market in several new directions. Old waste heaps in the United States are now being bought up for a few dollars a ton, and their contents cleaned by being passed through a rough mill. This is simply a roasting cylinder of coarse wire screen with its axis slightly inclined to the horizontal. The scrap is fed into the upper end of the cylinder and slowly discharges itself from the lower end. As it makes its way from end to end, the sand and dirt are supposed to fall through the meshes of the screen. The clean scrap is then ground into a coarse powder and distributed to the various industries requiring it. Large quantities are used in the manufacture of wall-paper. Considerable amounts are used to produce the snow effects on Christmas cards, and in stage scenery and other tinsel, while smaller packages under the name of diamond dust are sold as powder for the hair. — *Journal of the Society of Arts.*

TRADE SURVEYS

In all the mass of matter in daily journals concerning the probable future of trade and finances there are only two or three things harped upon, as though their disposal would open the way to prosperity. Nothing that mere legislation can do or that treaties or combinations can effect will bring about those results and conditions that are thought to be desirable. We are growing out of one thing into another, and that is the trouble. The recognition of this fact must precede the application of the effective remedy. Errors and evils have a way of curing themselves that is surprising. During the past year, for instance, the value of listed and unlisted stocks at New York decreased five hundred million dollars in value, much of which was in inflated industrial securities. Railroad securities have held their own, but careful observers notice that this holding has been largely due to wiser management, the reorganization of finances, the introduction of economies, and the confidence growing out of increasing traffic. The railroad system, as a whole, has made one very decided step forward this year, though it is not a step that stock-jobbers take notice of. That step lies in the fact that a point is now reached where harmony in fixing rates can be preserved. Until lately the conditions were otherwise. Rates were made to be broken, but now they can be preserved. It does not follow there will be a general rise in traffic charges, but it is true that better rates will be made and kept. Several Southern roads have already advanced rates on pig-iron and lumber. Several Western roads have equalized upward rates on heavy freights, raw material, etc. The managers of large systems between Chicago and New York expect to announce and enforce rates on certain low-classed freights where canal competition permits. Just how this ability to live without endlessly cutting rates has gradually come about it would be no easy task to set forth, but it is the result of growth rather than of volition or agreement of the great interests concerned. One fact might be mentioned, viz, the percentage of the local freight in which there is no competition has greatly increased in five or ten years to the through-freight, for which there has been such a struggle. This is due to a number of causes, most of which are understood. The financial world is still feverish over gold exports, uncertain crops, slim deposits, continuing foreign failures, and so on, but these things have very little to do with the unobserved undercurrent which, among other things, is drawing with it or in it broader methods of doing business in many respects, chiefly in the banking world. In the industrial domain there is slight improvement. The country is economical, as its people understand economy. Production is expanding slightly week by week in the aggregate, though in some isolated cases declining for the present, as in the textile trades. Architects in several cities have lately reported a great increase in house-building, and the statements of building-material men fully corroborate it. Within two weeks an enormous demand has set-in for lumber and planing-mill products. The activity extends, so far as can be learned, to small towns. The wage-workers are putting their money into homes, and, as soon as trolley-lines will enable them to ride five miles for five cents in twenty-five minutes, the stimulus to house-building will, perhaps, be increased. Some interesting tables have been published going to show a steady increase per capita of textile goods, foot and head gear, household furnishments, etc., all of which goes to show bettering conditions. Discontent over wages is at a low ebb, but the wage-worker cannot be relied upon to keep quiet in the event of a general improvement. While the actual number of trade-unionists has declined, the outsiders — the militia, so to speak — are coextensive almost with the ranks of labor. It is not indulging in guess-work to say that if a general improvement in values take place, it would be accompanied by a widespread industrial or trades-union movement for more pay. Where, ten or fifteen years ago, one wage-worker was in debt for a house five are now, and, while this fact decreases the intensity of trades-unionism itself, it strengthens the determination of those wage-workers to have more pay. As soon as a man owns part of a house he ceases to be a trade-unionist. The ownership of a few plastered bricks exercises a magical effect. The exceptions to this prove the rule. The extent and growth of house-ownership among wage-workers, the more that is known of them, are very encouraging. The multiplication of homes, as the census reports show, is increasing, and with this increase come new standards, political and social. If some writers in magazines and daily papers would take actual facts for their texts, there would be less pessimism written concerning Socialistic tendencies in American society. The tendency is rather the other way as home-ownership grows. These considerations may not belong to a trade-review, but they are suggested by the appearance at frequent intervals, from reputable sources, of disquieting conclusions drawn from the social problem, as it is called. There is a development in progress which is working out its own conclusions in its own way. Going over some twenty or thirty of the great industries, there is found nothing wrong or depressing. While prices are low, buying and selling is done on a safe basis. The conflict of competitive forces is not over. The five hundred million dollars borrowed for mainly unproductive purposes in Australasia will not work lasting harm, but it will be a long time before another one hundred and thirty million dollars will be subscribed by British investors. People know how to work and save, but not how to invest wisely. A summary of the unwise investments during the past ten years would put a dozen South Sea bubbles out of sight. The world has learned a lesson, and from it will soon come a profit that will spread peace and prosperity with as lavish a hand as disaster has been spread through mistaken notions of good investments.

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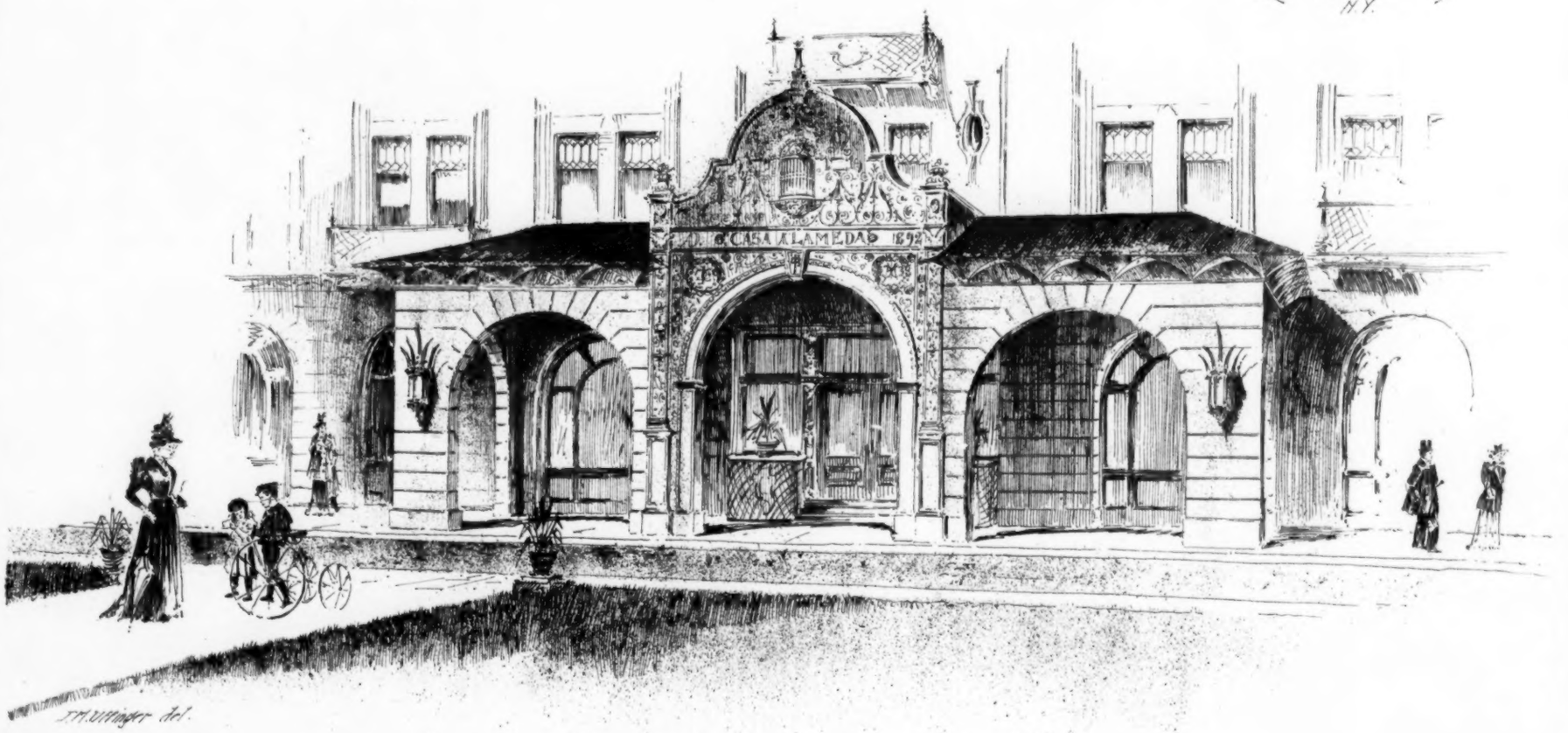

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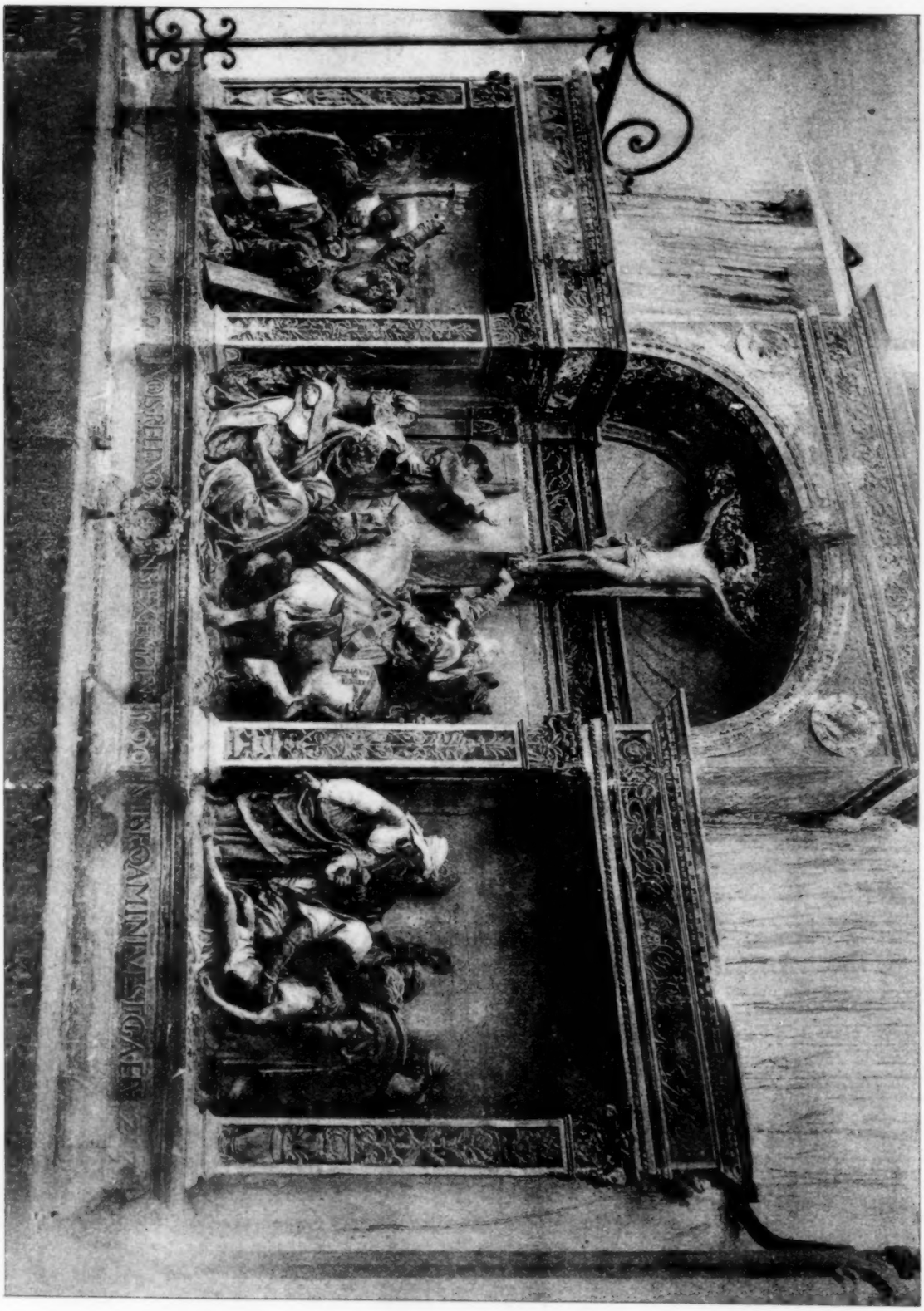

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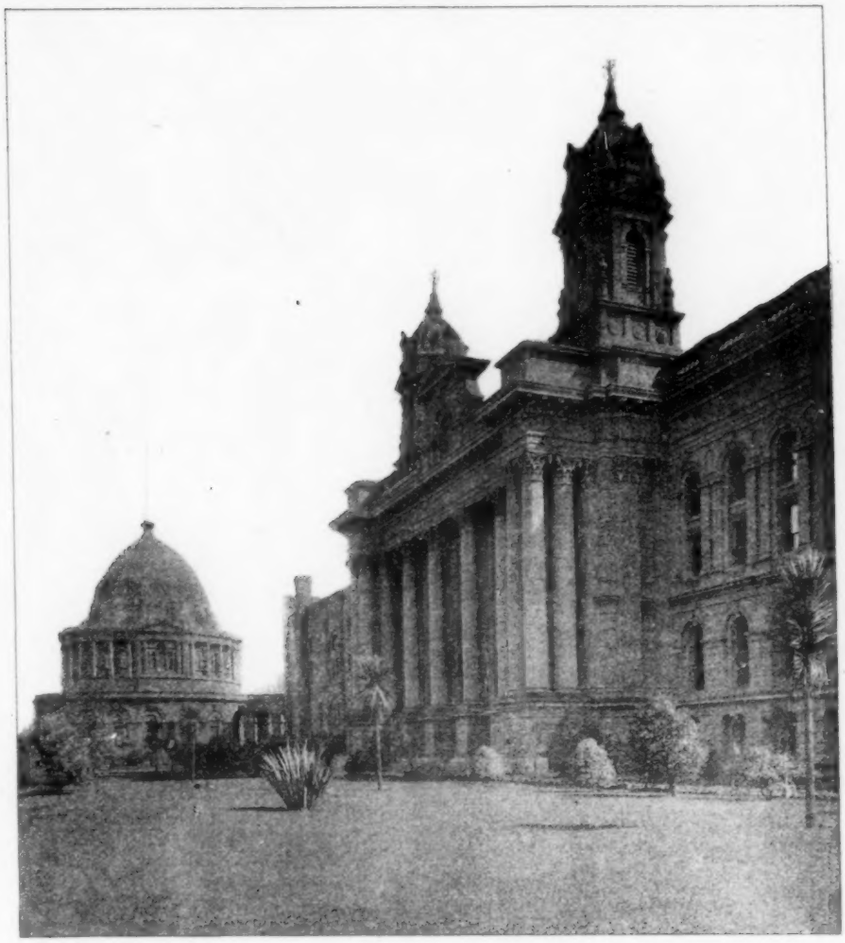

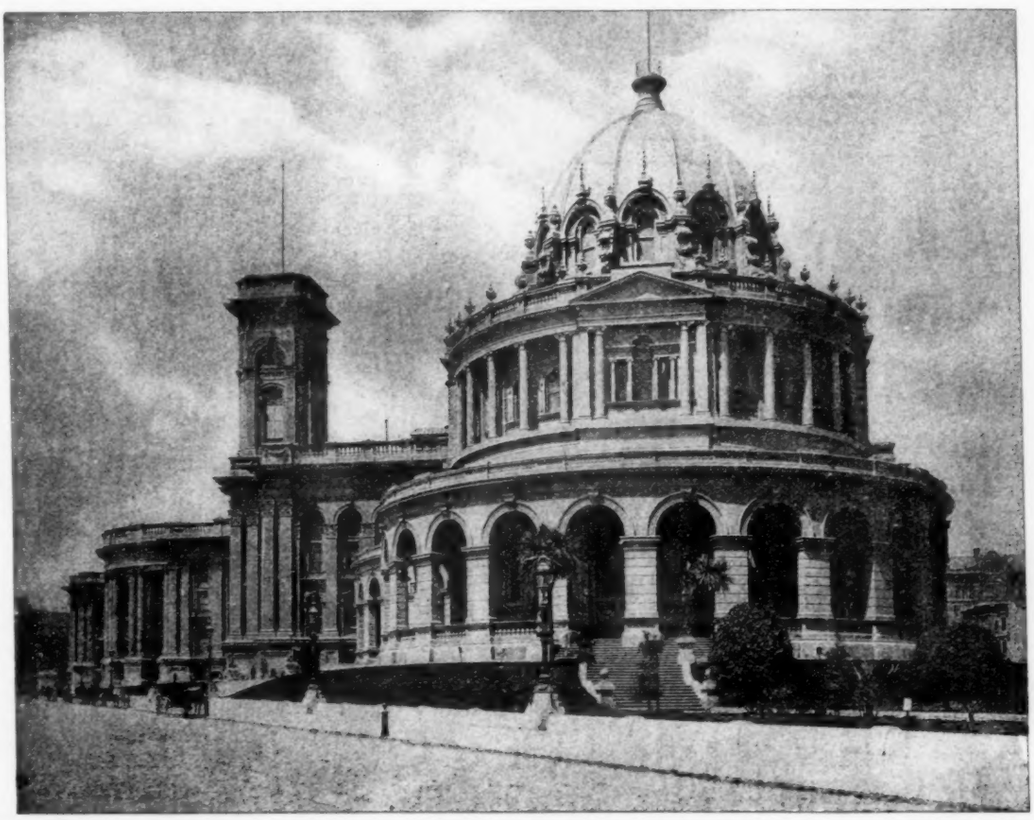

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