PRICE 15 CENTS.

JULY 7, 1894.

THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XLV. * REGULAR EDITION * NO. 967.

ARCHITECTVRE

ENGINEERING

DECORATION

CONSTRVCTION

211 TREMONT ST.

BOSTON MASS.

CONTENTS.

ILLUSTRATIONS.

Additional Illustrations in the International Edition.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XLV. Copyright, 1894, by the AMERICAN ARCHITECT AND BUILDING NEWS COMPANY, Boston, Mass. No 967.

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

JULY 7, 1894.

CONTENTS

WE can hardly realize the extraordinary nature of the state of things now existing in the West, without removing ourselves, by a mental effort to a little distance of time. A generation from now, our grandchildren will read, we hope with amazement, that, according to the newspapers of the period, in the year of grace 1894, General Debs, after having "completely crippled all the railroads centering in Chicago," had "transferred his base of operations to St. Louis," and it was supposed that "the next point of attack would be Cincinnati." In perusing the bulletins which are now appearing from day to day in all the papers, one is strongly reminded of the bulletins which, in 1870 and 1871, described the victorious excursion of Prince Frederick Charles through prostrate France, and it is hard to believe that they refer to the operations of an oath-bound organization, carried on against the commerce of this great community, in order to force compliance with certain demands, as to the nature of which the community knows little or nothing, which are said to have been made by the employés of a manufacturing corporation in Illinois. It is quite possible that those demands may have been well founded, but that they should have been so well founded as to justify plunging the country into civil war — for assaults on persons and property which involve the stoppage of business over half an empire, and the destruction of perishable goods belonging to innocent persons, to the value of millions of dollars, are nothing less than acts of war — is altogether incredible. It is not very long since the people of the Northern States were kept for months in a ferment of indignation at the destruction of private property by the *Alabama*, yet the damage done by Semmes and his gang of pirates was hardly greater than that which is likely to be inflicted upon innocent people by Debs and his "organizers," and it is to be remembered that Semmes at least carried the commission of a nation engaged in a desperate struggle for existence, while the railway pirates have never had a more miserable excuse for their attacks on the people and commerce of the country than in this instance.

THE truth of the story, beginning where it should be begun, seems to be that, some years ago, Mr. Pullman, the head of the great corporation which takes its name from him, conceived the idea of a manufacturing community in which every one should be healthy, happy and good, so far as external circumstances could make him so. With this view, he, and the people who worked with him, laid out and built a town, with good water-supply, good drainage, good streets, and the other advantages which, under ordinary circumstances, can be enjoyed only by the rich, or, at least, the well-to-do. In addition to this, Mr. Pullman and his friends built lecture-rooms, laid out playgrounds, and made other provisions for the comfort and pleasure of the citizens of their new town; and, when all was ready, moved their manufactories there. At the time, it was the general comment that the Pullman Company was permanently secured against labor troubles, for no workman in his senses would voluntarily cut himself and his family off from advantages which he could find nowhere else in the world. For several years this feeling seemed to be shared by the workmen themselves, but the present paralysis of business affected the company, as it has everybody else, and it was found necessary to curtail production. According to the assertion of Mr. Pullman, which is confirmed by independent statements made long before the strike, it was found impossible to sell the cars manufactured, but the works were run at a loss, simply to give employment and wages to forty-four hundred men, who would otherwise have been unable to pay for food and shelter for their families. What the forty-four hundred men found to object to in this arrangement has never, so far as we have read, been explained; but there have been obscure references to a "grievance," and to a refusal of Mr. Pullman to "arbitrate," followed immediately by the news of the "crippling" of fifty or sixty thousand miles of railroad, the cutting-off of the entire Pacific coast from land-communication with the East and the abandonment of trains filled with passengers, or loaded with perishable freight, in the middle of their route. The flimsy pretext that this assault on the persons and property of the citizens of nearly the whole United States was perpetrated in support of the Pullman workmen was almost immediately abandoned. Hardly had the strike begun when a road was struck on which no Pullman cars were ever run. The real reason was, of course, that the conspirators were strong enough on that road to throw it into confusion without spending time in cajoling or threatening the men; but the excuse made public was that the manager had expressed sympathy with Mr. Pullman. On another road, where three or four men had refused to do their duty on trains containing Pullman cars, thereby endangering the lives of hundreds of innocent passengers, and the superintendent had simply ordered their discharge — instead of having them hung to the nearest telegraph pole, which would have been a more appropriate retribution for such a crime — a general strike was immediately ordered, to compel the reinstatement of the miserable recreants in the posts which they had treacherously abandoned. So far as accounts have been at present received, the "struggle," as the projectors and leaders are pleased to call it, between the insolent mischief-makers on one side, and a great, patient and long-suffering people on the other, is growing more audacious and destructive every day, and the State and United States authorities have already been called upon for force with which to meet force.

IT is to be regretted that the people of the United States should have to recover the use of their ordinary highways at the point of the bayonet, but it is better to recover and hold them in that way than to give up the control of them, even for a moment, to people so reckless and malicious, or so unutterably base, as those who have managed the great railroad strikes for the past ten years. The example of the Pullman strike shows how false and dangerous are the doctrines in regard to workingmen which have gained so much credit, and wrought so much misery, within the present generation. According to those doctrines, a man who works with his hands is not a man, but a babe, who must be provided with a clean house, not through the process of cleaning it with his own hands, but by having philanthropic people get up a subscription to hire some one to clean it for him; who must be amused with lectures, picture-shows and other distractions, at the expense of the public, or of amiable private persons, and whom it was right to encourage in every way to think that thrift, industry, sobriety and self-denial were no longer necessary to one so favored, and that yelling and kicking, if long enough continued, were sure to bring him everything to which he might take a fancy. The lesson has not been lost: the babe of the nineteenth century, trained by the lullabies of the political economists, the dandling of the politicians, and the patient indulgence of the more rational part of the community, to combine the greedy helplessness of the infant with the

strength and malice of the man, claws every day more viciously at what does not belong to him, and tramples more recklessly on the rights of other people. In the end, these rights must assert themselves, or perish in the worst of tyrannies; but a part of the harsh lesson by which they are defended should be reserved for the moonstruck philosophers and sentimentalists who have taught ignorant people that, instead of relying on their own exertions for improving their condition, looking out only to preserve and extend their freedom to use those exertions, they were entitled to trample on the freedom of others in order to get what they wanted.

WHAT it might prove extremely profitable, at a time when the whole business community is busy looking into its private affairs, for public authorities to follow this example and overhaul matters of public morality and the behavior of public officials, seems to have occurred simultaneously to those having the power of initiative in every quarter of the country, and, as a consequence, the daily papers are now filled with the details of investigations of the most varied kinds, whose revelations of corruptness fill the guileless private citizen with amazement. These inquiries extend from an examination into the moral rectitude of United States Senators, through the conduct of the police departments in various cities, down to the manner in which those in control of State and municipal penal and charitable institutions discharge their obligations toward the helpless beings temporarily placed under their charge. Everywhere there has been revealed the most astounding conditions of moral rottenness springing in all cases from the same cause. The common aim is "how to be rich, though idle," and in pursuit of this end men will seemingly shrink from no villany. The evidence of this widespread capacity for corruptibility would be disheartening enough, but the really discouraging thing that has been brought to light is the evidence of the perfection of the organization of the scamps, and the absolute want of organization on the part of the public on whom they prey. As might be expected, the very type and essence of corruption is found in Tammany Hall, with its Sagamore, Sachems, Winkiski and distinct leaders, and one cannot but admire the astuteness with which it has completed its organization, and how absolutely individuals who are unable or unwilling to fight its exactions place themselves in its power. Tammany collects, by blackmail and extortion, an annual income equal to that of the City of New York, it accepts no checks, it keeps no books, it banks no money, it deals absolutely in quick cash. Under these circumstances the citizen who pays blackmail, and seemingly all do, has no proof that he has once paid, and could as easily be compelled to pay the same "assessment" several times over as to pay it once. The first effects of publishing the details of the investigation of Tammany methods will be to hasten the perfecting in other cities than New York of the similar systems of blackmail that are already in partial operation. With the leading cities in the power of similar organizations, all it is necessary for these bands of scamps to do is to unite and by their combined resources take final and absolute possession of the central government, after which they can give the world at large an object lesson of the beauties of a government of scamps, by scamps, for scamps. Shades of Lincoln! Is it not time that decent citizens threw aside their apathy and set seriously to work to establish a stronger "organization"?

SOME of the revelations in New York have been such as to especially interest architects. Thus one of their own number, a man standing high in the profession, as a sequence to an examination which no unprejudiced observer could hold to be either open or satisfactory, so far forgot himself, according to verbatim reports, as to tell the examining lawyer in open court that he was a liar. Another interesting bit of evidence was produced showing that, though a builder had fortified himself by procuring, as the law directs, permits from the Inspector of Buildings and from the Bureau of Encumbrances allowing him to erect a passageway bridge over a sidewalk during the execution of his building operations, the police refused to allow it to be built and repeatedly arrested his workmen because he had not "seen" the captain of the precinct with two hundred and fifty dollars enclosed in an envelope. Minor intimations of the venality of the under inspectors of the Building Department, are, of course, only what was to be expected where similar officials in every other department of the public service are shown to be corrupt; but architects and builders may derive some consolation from the fact that witnesses, from the stand, testified to the rectitude of the official at the head of that department with which they had most to do. As showing how Tammany manages to exact toll from every one, an incident that was told us by a friend a few days since has an interest. As the sidewalk in front of his house needed repair, he applied at intervals to the Street Department to have it fixed, his requests, appeals and threats bringing him as little relief as his letters published in the daily papers. At length a wiser friend, though not an older citizen, told him the only way to accomplish his object was to join the junior Tammany club, Pequot, or Sangammon, or whatever it might be, of his district. He saw the point, and the morning after his name was placed on the club roll he found a city force repairing his sidewalk!

M. DE NANSOUTY, the editor of *Le Génie Civil*, gives a short account of the report brought from the Chicago Exhibition by M. Arbel, one of the delegates sent by the Chamber of Commerce of St. Etienne, accompanying it with the earnest and discriminating comments which we have learned to expect from him. As a delegate from a great manufacturing city, M. Arbel was, presumably, very familiar with French machinery and methods of work, and his admiration of American machinery and workshop organization is certainly flattering. In machines, pure and simple, the French probably are quite equal to us, but what surprised M. Arbel, as it did most of the expert foreign visitors who have published their observations, was the multiplicity and excellence of the machine-tools, to use the French expression, which are every day becoming more common in our factories. With the help of these machine-tools, as M. Arbel says, the part of the workman in America consists less in physical exertion, and more in intelligent direction, than anywhere else in the world; and the result is that the American workman, with his machine-tools, his appliances for saving him from interruption and exertion, and his carefully-planned part in the general scheme of manufacture, turns out, on an average, from two to three times as much work as his European colleague. Moreover, the work is better done. Instead of the fitting and adjusting by hand necessary in the French workshops, the Americans, under their system of interchangeability of parts, make nearly everything to gauge, and the assembling of the parts so made is a trifling matter. Even the tools in the best American workshops, are made to gauge, by men specially detailed for the purpose. No workman is allowed to sharpen his own tools, but when a tool loses its edge, the man using it rings an electric bell, and gives it to a boy, employed to do such errands, who takes it to the repair-room, and immediately returns with a fresh one. In this way, the work of the tools is kept uniform, and there is none of the loitering and gossiping around the forges and grindstone which consumes so much time in the foreign shops. In this way, although the American workmen are better paid than the French and Belgians, the cost of the work done by them is less. The American manufacturers, M. de Nansouty says, carry out the same principle in regard to tools. While a French manufacturer, if he saves a little money, hastens to "salt it down" in railroad stocks, or Government bonds, and continues to use the same old machinery that he inherited from his grandfather, the American uses his profits in buying improved machinery and machine-tools which will enable him to do the same work that he was doing before still more rapidly and cheaply, thus investing his savings at compound interest, and, generally, at a high rate. Moreover, when he has bought his new tools, he uses them. The Frenchman is apt, when he has really made up his mind to buy an improved tool, to keep it as an ornament, using it carefully and sparingly. The American, on the contrary, begins by ascertaining how much money he can save by using the new machine. Obviously, as he thinks, if he can save a given fraction of a cent, say, on each pair of shoes turned out with its aid, the more pairs he makes it turn out, the sooner it will pay for itself, and the less he will lose in interest on his outlay. With this idea, the machine is driven well up to its capacity, and, although it of course wears out sooner than if it stands idle, it will generally, by the time that it is unfit for service have earned, not only enough to pay for itself, but enough to provide a machine of still greater efficiency to take its place.

FRENCH STYLES OF ARCHITECTURE.[1] — III.

AN HISTORICAL SKETCH.

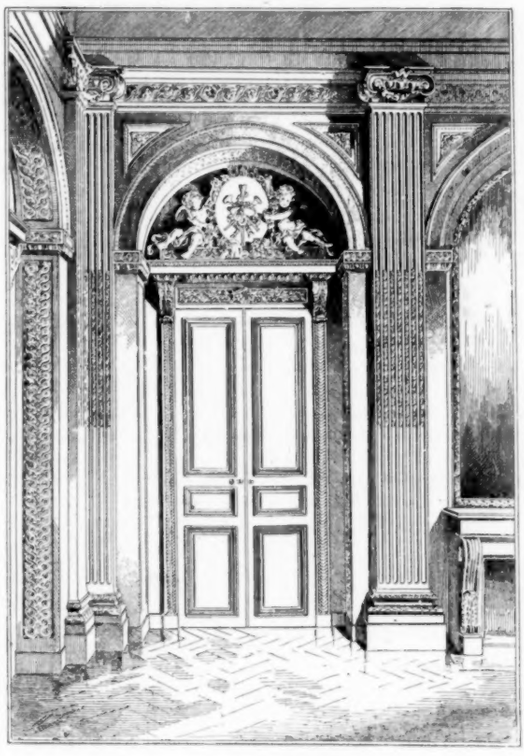


Fig. 16. Doorway in the Château of Issy, (Seine).

BETWEEN the end of Louis XV and the advent of Louis XVI, the transition was fully prepared for, as has been said, by the reaction toward the antique. The close of the reign of Louis XV and the beginning of Louis XVI's are

Fig. 17. Panel Medallion at Versailles.

one and the same. Therefore, we must not, so far as the arts are concerned, assume as impassable limits the dates of the life of a king or of his accession to the throne. Better is it to consider the various influences that determine a transformation at such or such a period of our history. The name of the reigning monarch serves in this case as an aid to the memory, as a simple guiding mark.

The disposition of one of the halls of the Château of Issy (Fig. 16) belongs to this transitional style, which, under Louis XV, was suddenly opposed to the insipid aberrations of the "*rocaille*." We had then approached, under pretext of returning "to the antique," the style of the early years of Louis XIV, a stately, severe, quite Classic style, whose rules Bullet, the first architect of the château in question — erected during the reign of the "grand Roy" — had correctly applied as formulated by the academical professor François Blondel.

Here is an arch between pilasters with capitals, beneath a complete entablature — those "dust nests," the result of an architectural blunder. The profiling is in a fashion as tiresome as it is noble and severe, and is ill adapted to our notions of comfort and neatness in an interior. The robust forms and

Fig. 18. Panel in the Château of Versailles.

the dispositions, which may be monumental in their proper place — on an inner court, for example — to be practicable in the interior of a dwelling, had to degenerate and become thin and stiff.

However, certain fine details retained at this period an apparent reflection of the seventeenth century. Such is the medallion adorned with fleur-de-lis (Fig. 17), crowned with roses and framed with laurels, in the apartments of Versailles. But a Neo-Renaissance was soon produced which made the Louis XVI a pleasing style, notwithstanding the severity of the rectilineal architectural dispositions.

It is in the enrichment of the panels, pilasters or friezes of the wainscoting (small apartments of Marie-Antoinette at Versailles, Figure 18) that we find, as it were, a reminder, a *résumé*, of the decorative niceties of the Renaissance, though distributed with the taste and the skilful reserve which characterized the art of the eighteenth century, at the beginning. It is the antique arabesque, copied by a Raphael, resurrected at the very height of the Regency and adopting the tone of the day.

[1] From the French of E. Rivoalen, in Planat's *Encyclopédie de l'Architecture et de la Construction*. Continued from No. 966, page 146.

But at Compiègne and Fontainebleau, where certain rooms (Fig. 19) and certain *salons* (Fig. 20) were, at divers times

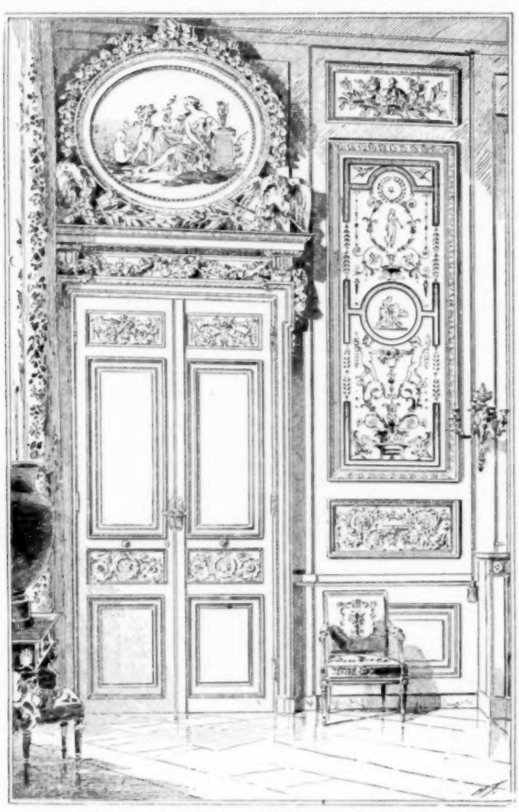


Fig. 19. Apartments of the Empress, Compiègne.

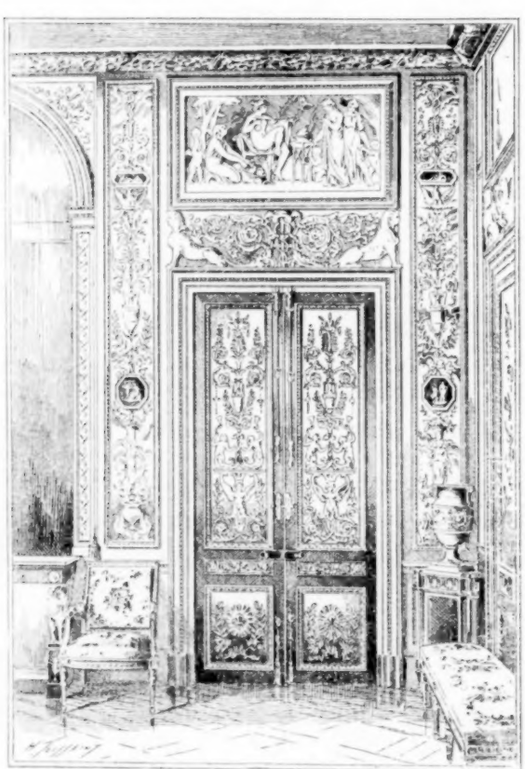


Fig. 20. Salon des Jeux, Fontainebleau.

during the reign of Louis XVI, decorated according to the taste of the moment, we sometimes encounter (Fig. 19) the vigorous projections of the beginning of the reign, and a delicate imitation of the antique frescos then recently discovered at Pompeii and Herculaneum; and, sometimes (Fig. 20), the projections disappear, giving place to flat casings and frames of gilded wood; these are rectilineal and almost smooth, but set off with a few finely chiselled bronze-like mouldings.

In small compartments, thinly and stiffly distributed, there is displayed finally, at the approach of the Revolution, a painted or relief ornamentation, inspired in composition and arrangement, in lightness and delicacy, from antique frescos, bas-reliefs and even cameos; a very original adaptation of decorative elements, borrowed from nature, is mixed with the traditional forms.

The Empire, as has been said, merely took up again — with the artists and artisans of the school interrupted by the Revolution — the art of which typical specimens have just been given. But the French characteristics that still remained, in the last days of Louis XVI, individuality and cleverness — even in imitations from the antique — had suddenly become *pompier*, that is to say too conventional and bombastic, composed in accordance with formulas, and not in accordance with the natural sentiments; these seemed to have been chilled by the convulsive breath of the Terror, both among surviving artists and the new comers. E. Rivoalen.

THE ESSENTIAL CONDITIONS OF SAFETY IN THEATRES.[1] — II.

CONSTRUCTION OF BUILDING.

A THEATRE building, to be structurally safe, requires to be constructed wholly of fire-resisting materials. The natural tendency being to use the largest part of the available funds for the exterior and interior decoration of the theatre, it is advisable that the method of construction and the building materials used should be regulated by strict building laws.

Woodwork is to be avoided in the construction. Its use must be confined to the trim of the doors and windows, the usual doors and the auditorium floor and platforms. The floors of corridors, foyers and lobbies should be tiled. Wooden wainscoting should be avoided, and marble or tiling for stairs, lobbies and foyers and toilet-rooms, and stucco work for the decoration of the auditorium and the boxes should take its place. Exposed iron-work should not be used anywhere, it being unsafe, except when cased with fireproof material. Brick and terra-cotta should be used in preference to stone. The well-known principles of sound, fire-resisting construction should be applied to all parts of the theatre building. All main division-walls should be strong and solidly built, well bonded together, and constructed of brick. These, as well as all staircase walls, should be run, at least, three feet above the roof to form fire-walls. All vertical and horizontal divisions should be fireproof, and this refers not only to the main divisions of the plan, but likewise to all partitions. The external and internal walls must be well bonded together.

Wherever openings are provided in fire-walls for communication, they should be closed with fire-resisting doors. The doors should have stone saddles, and should be constructed either of boiler-iron, or better, of double layers of planks of oak, lined on both sides and at the ends with tin.

The stage proper is the place where an immense amount of easily combustible material is necessarily crowded together. It should be the special aim to make this part of the building, where a fire once started is much more dangerous and much more difficult to fight than in other parts of the house, as fire-resisting as possible.

The floor of the stage proper must necessarily be constructed of wood, on account of the numerous traps, but the fixed portion of the stage floor in the wings or sides of the stage, the entire fly galleries, and the gridiron, or rigging-loft, except the wooden floor covering the same, should be built of iron or steel beams and made fireproof, and the pin rails of the fly galleries should be of iron or steel. The roof of the stage should be constructed of iron and covered with slate, tile, or other fireproof material.

In the fitting up of the under stage, woodwork should be avoided. This is the special department of the stage carpenter, who usually clings to old-fashioned traditions and the use of antiquated apparatus. Much of the equipment of the whole stage, the stage machinery, the traps, the fly rails, the hoisting apparatus, etc., could be made safer and more durable by substituting iron and steel for wood, by using hydraulic lifting machinery with steel wires in place of the old-fashioned hoists, sheaves and ropes, still so much in use. Suggestions tending to improve the stage were made by the "Asphaleia" Society, of Vienna, soon after the destruction by fire of the Ring Theatre in Vienna, where several hundred persons perished by fire and smoke. A number of European theatres, such as those at Halle, in Germany, and at Buda-Pesth, in Austria-Hungary, and the Royal Prussian "Schauspielhaus," in Berlin, have been

[1] An Essay on Modern Theatre Planning, Construction, Equipment and Management. By Wm. Paul Gerhard, C. E., Consulting Engineer for Sanitary Works. Continued from No. 965, page 136.

fitted up in this manner with most satisfactory results. Up to the time of writing, there is, in this country, but one solitary instance of this advanced method of stage construction, namely, in the Auditorium Theatre, in Chicago. It is noteworthy that in the "Asphaleia" stage setting, much of the scenery and scene setting is painted on thin sheet iron, held in light iron frames.

Wherever woodwork is necessarily employed in the construction of the stage and its accessories, it may be made fire-resisting by impregnation, or at least, by the application of fireproof paint. Even the ordinary whitewashing of woodwork helps to protect the same.

The proscenium-wall, forming the main division between stage and auditorium, must be a fire-wall built of brick, and the stage-opening should be arched over. The molded frame or other finish, and all decorative features around the proscenium-opening, should consist of incombustible material.

The auditorium should likewise be fireproof in all its parts. The main floor and the tiers should be constructed of fireproofed iron beams, and brick or tile arches. Iron columns for the support of iron girders should be encased with fireproof materials. The fronts of galleries and balconies should be formed of fireproof material. The ceilings of the auditorium, the balcony and the galleries should be fireproof. The auditorium roof should be constructed of iron, and the roof covered with slate or tile. All boxes in the auditorium, and the partitions between boxes, should consist of fireproof material. Plaster should be used in preference to wood or *papier-maché* for the decorative treatment of the boxes.

The upper floors in the auditorium may be laid with wooden boards, but there should be no hollow spaces underneath, and the floors should be laid on sleepers deeply bedded in concrete. The ceiling of the cellar should be fireproofed with I-beams and brick arches, or other fireproof construction, except as stated above, directly under the middle portion of the stage.

The actors' dressing-rooms and all other rooms necessary on the stage end of the building should be fireproof in all parts. Particular attention should be paid to the dressing-rooms and storage-rooms for wardrobes. The walls and the corridor separating the actors' dressing-rooms from the stage, and all dressing-room partitions must be fireproof. All doors should be of iron or fire-resisting construction. All shelving and cupboards in all dressing-rooms, property-rooms, wardrobes and storage-rooms should be constructed of metal or slate, or other approved fireproof material.

Finally, all halls, passages and foyers, should have fireproof ceilings and floors, and all staircases throughout the theatre should be constructed in a fireproof manner.

All partitions must be built of fireproof blocks. There should be no canvas covering of walls, and wooden wainscoting should be used sparingly and only when applied directly to solid fireproof filling.

All windows in a theatre should be arranged to open, and none of the windows in outside walls should have fixed sashes or iron grilles.

STAIRCASES, ENTRANCES AND EXITS, AND FIRE ESCAPES.

The planning and construction of the staircases and exits of a theatre are of the greatest importance, because they form the principal means of safety for an excited or terror-stricken audience when a fire breaks out, or when there is a sudden panic from any cause. For this reason all stairs and exits must be so arranged as to disperse an audience as quickly as possible. The emptying of a well-planned theatre should not require more than two or three minutes.

All stairs in a theatre should be fireproof and encased in fire-walls. Open stair-well construction should be avoided as dangerous. The stairs should be from four to six feet wide, according to the maximum number of people for which they are intended. The minimum width for fifty persons is 4 feet, and 6 inches should be added in width for every additional fifty people.

All stairs should have easy and even treads. The risers should not exceed seven and one-half inches, and the width of treads should be not less than ten and one-half inches. Winding stairs should be prohibited, except in case the winders have treads not less than 7½ inches wide at the narrowest part. Single or double steps should never be permitted, as they form dangerous stumbling-blocks. Long flights of stairs must be broken by several landings, at least 4 feet wide. The Boston Building Law calls for stair flights to have not less than 3, nor more than 15, steps.

There should be, on each side of all stairs and landings, well-fastened hand-rails turned into the wall at the ends of stairs. Very wide stairs are preferably divided by a strong metal baluster or intermediate central rail. All staircase halls should be made as smoke-proof as possible. The stairs for the balcony and gallery should not communicate with the cellar, so that smoke from a cellar fire may not rise up through the staircase.

There should be, at least, two entirely separate stairs for each part of the audience, one for each side of the building. Inasmuch as the occupants of the gallery have the longest way to the street, and also because the experience of theatre catastrophes teaches that this part of the audience is the one most endangered in case of a panic, there should really be more stairs and exits for the highest tier, although in the theatres erected in the past this precaution has seldom, if ever, been observed. The stairs serving different tiers should not communicate with each other, and the meeting of two streams of people on the same stairs should always be avoided. Each portion of the audience, the parquet, the balcony and the gallery should leave by separate stairs and exits. Each tier should also have separate wide corridors running all around and leading to a foyer and to the staircases.

It is usual to calculate two exits for 300 persons, and three for 500 persons, not including the outside fire-escapes. The more exits there are, the less liability of fierce struggles and jams during a panic, and the less danger there is for old or weak persons from becoming hurt.

The planning of the means of egress, the exits and fire-escapes, in such a way as to effect a quiet and quick emptying of a theatre, requires the most careful study. All aisles, corridors, passages and stairs should be of even or increasing width, must not be tortuous, and should have no obstructions of any kind, such as pay-boxes, cloak-rooms, refreshment-counters, etc. All passages leading to exits must be, at least, four feet wide.

The best arrangement and judicious location of the exits depends to a great extent upon the site of the theatre. If the same permits placing plenty of wide and easily reached exits on all sides of the building, the safety of the audience is assured. The more the audience can be subdivided, the quicker can a theatre be emptied.

The minimum width of exits for 500 or less persons, according to both the Boston and New York theatre laws, is five feet, and twenty inches shall be added in width for each additional 100 persons. The exits must likewise be free from projections or obstructions of any kind.

Many lives have been lost in theatre catastrophes owing to faulty arrangement of the doors. It is imperative that all exit doors be made to open outward, to prevent a jam in case of a panic. The doors in corridors must, moreover, be so hung as not to become an obstruction in the passageway. Sliding doors should never be used. Emergency exits or doors, which are frequently advocated, are not desirable. They have often been found locked when needed, and, moreover, the people are not familiar with their location. *All* stairs and exit doors should be opened for the use of the public at each daily and nightly performance. Exit doors should have proper bolts at shoulder height.

All exits should be as conspicuous as possible and should be plainly marked in large legible letters, and all doors not leading to exits should be lettered "no exit."

In addition to the separate stairs mentioned above, each tier should have exits to, at least, two well constructed outside iron fire-escapes, to be used in case the retreat by the inside stairs is cut off by smoke. All such fire-escapes, to be of any use, must be so constructed with regular steps that they can be used by women and children. These outside fire-escapes should be covered with metal hoods or awnings to prevent, as much as possible, their becoming slippery and difficult to use when covered with snow and ice in winter weather. The New York Law requires the fire-escape balconies to be four feet wide, and the stairs to have not more than eight-and-one-half-inch risers and at least nine-inch treads. They must be built sufficiently strong to carry the weight of a large crowd.

The same care and attention is required in the construction of the stairs for that part of the building containing the stage, the offices and the dressing-rooms. The stairs and exits for the actors and stage-hands should be entirely separate from those for the spectators, and there should be at least two such stairs and exits, preferably one at each end of the stage. There should also be fireproof stairs leading from the fly galleries and the rigging-loft, one on each side of the stage, these places being in case of a stage fire among the most dangerous, owing to the rapid rising of the smoke and the flames. It will be remembered that at the burning of the Paris Opéra Comique, the majority of the audience escaped, while many chorus-singers and ballet-girls were burned to death, because the stage exits and stairs were lamentably insufficient.

Finally, there should be well-fastened iron ladders provided on the outside courts and leading to all roofs of the building, for the use of the firemen.

AISLES AND CHAIRS.

The width and number of aisles in the parquet, balcony and gallery, depend upon the size of the theatre and the number of seats provided. Many narrow aisles breaking the continuity of the seats are better than a few wide aisles. Aisles should be straight and leading directly to the exits, or else the direction of the nearest exit should be indicated on the wall by a conspicuous arrow. The aisles should widen with the number of rows of seats which they serve. The minimum width of aisles is three feet, to which should be added one and one-half inch for every five feet length of aisle.

In the orchestra, or parquet, there should be no steps in the aisles, but the aisles should be inclined under a gradient of not more than one in ten. Gradients should likewise be used for differences in level between the aisles and the open courts.

Aisles should never be obstructed by camp-stools or movable chairs, which become a source of danger when overturned during a panic, nor should standing in the aisles be permitted.

The width and depth of the chairs or seats should not reach below a certain minimum, both for comfort's and safety's sake, and

there should be not more than thirteen seats between two aisles, so that no seat in the audience has more than six seats between it and the aisle.

The frame-work of the chairs should be constructed of fireproof materials, the chairs should be firmly and well bolted, or otherwise fastened to the floor, and the seats should preferably be automatic, *i.e.* self-raising. In any case, they must be hinged so as to be easily raised and placed out of the way to facilitate the emptying of the rows of seats.

Movable chairs should be allowed only in the boxes, and for each of these the number of seats should be limited.

FIREPROOF CURTAIN.

The stage-opening in the proscenium-wall should be closed by means of a fireproof curtain, entirely separating the stage from the auditorium. The object of the curtain is to prevent a fire on the stage or in the flies from leaping over into the auditorium, and to interpose a barrier to the smoke and fire-gases generated in a conflagration. It is, therefore, one of the chief means of safety for the audience, and in theatres where it is installed, kept in good working order, and let down at the first moment of danger, it helps to enable the audience to escape unhurt from the burning building.

Numerous suggestions have been made regarding the material and construction of fireproof curtains. The three principal forms adopted in practice are a curtain of wire gauze, a curtain built of corrugated-iron, and asbestos woven curtains. In European theatres the first two kinds have been tried, whereas the asbestos fireproof curtain is chiefly used in American theatres.

Curtains made of wire gauze with fine mesh have not proved successful in actual use, because while they keep the flames from spreading across the stage opening into the auditorium, they allow the smoke to pass, and also because they increase the panic and confusion by giving the frightened audience a view of the fire on the stage.

Corrugated-iron curtains are better in this respect. They should be accurately guided at both ends and should travel easily in proper vertical metal grooves, placed on both sides of the proscenium-opening, and well fastened to the brick wall, otherwise they are liable to stick fast at the moment when wanted. Such iron sliding-curtains have not, in practice, proved themselves always reliable. It is important that the apparatus for raising or lowering the fire-curtain should be on the stage, and not in the rigging-loft, as was the case in the Vienna Ring Theatre, because this point may be beyond reach soon after the outbreak of a fire on the stage. Unless built very strong, iron curtains are liable to buckle and warp, and do not resist a strong pressure due to the expansion of the air by the heat in case of fire. They should fit tightly, to prevent the escape of smoke and should be strong enough to sustain a pressure for at least ten minutes, to give the audience time to escape. If they are not protected from above by automatic sprinkling-apparatus, or a series of perforated pipes connected with the supply-pipes or roof-tanks so as to allow a sheet of water to run down along the curtain, they may become red hot during a fierce fire and thus endanger the spectators.

On the whole, thick woven asbestos fireproof curtains are lighter and more easily handled than iron curtains, and prove well adapted to check the spread of flames and to keep back the smoke, at least, sufficiently long to permit the complete emptying of the theatre. The asbestos curtain should travel in grooves and should fit the proscenium-opening as closely as possible.

Whatever kind of fireproof curtain is chosen, it should not merely be used in case of an emergency, but nightly, and it should be raised a few minutes before the beginning of, and lowered immediately after, the performance.

It is a good plan, as a further protection of the proscenium-opening, to provide it with a 2½-inch perforated copper pipe, fed from the sprinkler tank by means of shut-off valves operated from the prompter's side of the stage, the descending stream of water forming, when set in operation, an efficient water-curtain.

STAGE VENTILATOR.

Every theatre stage should be provided in its roof with one or more large metal flues, or ventilators, or with ventilating sliding skylights operated by means of ropes and counterweights controlled at the level of the stage, or arranged to work automatically by the burning of a hemp cord in case of a stage fire. The object of this ventilator is to provide an outlet and ready means of escape for the thick smoke and the fire gases. Such a ventilator would also act as a means of increasing the draught and spread of the fire, and on this account it has been objected to by many who were evidently more concerned with the saving of the building from destruction than with the saving of life. But, human life being of greater value than property, the objection raised is evidently of little importance, considering the fact that the ventilator acts as a powerful means of removing the smoke. As frequent theatre catastrophes have sufficiently demonstrated, the smoke is a more deadly agent than fire, and constitutes the chief danger to the audience. Incredible as it may sound, it is nevertheless true, that, on the average, only five minutes elapse between the appearance of fire in front of the proscenium-opening and the total extinction of human life by smoke and fire gases. This worst of all foes, smoke, must be kept from the audience by all known means.

The two appliances, a fireproof curtain and a stage ventilator, act combined as the most important means of protection to the audience in case of a theatre fire. Where these are installed it is, on the other hand, absolutely necessary to provide safe means of retreat for the stage-hands employed in the rigging-loft and in the fly galleries.

In Boston, the building law requires that the combined area of the stage ventilators be equal to $\frac{1}{15}$ the area of the stage-floor, and each ventilator is to have a counterbalanced valve, so as to open automatically, the valve being kept closed ordinarily by a cord of combustible material, run down to the prompter's desk.

The New York Building Law requires metal sliding skylights in the stage roof, of a combined area equal, at least, to $\frac{1}{8}$ the area of the stage. These skylights are to be fitted with sliding sashes, glazed with double-thick glass, not exceeding $\frac{1}{4}$-inch thick. Each pane is to measure at least 300 square inches. The skylights are to be so constructed as to open instantly on the burning or cutting of a hempen cord, ordinarily arranged to keep the skylight closed.

A very ingenious apparatus for stage ventilation was fitted up some years ago in a Chicago theatre. The proscenium-wall was made fireproof and all openings in it were stopped by fire-resisting doors provided with springs to keep them closed. Over the stage an exit for smoke is provided, consisting of a boiler-iron flue, 8 feet in diameter and 30 feet high. In this flue is a valve made of a wooden frame covered with canvas, which is kept closed by a balance weight. A wire cable connection is carried down from the valve to each side of the stage, and there are other cables carried to points in the auditorium under control of the ushers. By pulling any of these cables the valve is opened, while a very simple and ingenious contrivance closes simultaneously the ventilating outlet over the audience chandelier, thus reversing the usual movement of air from the stage to the auditorium ventilator. Should the cable not be worked in time, the valve being of canvas is readily destroyed by fire, and the smoke outlet in the stage roof is thereby opened. The same contrivance may at ordinary times be used for the ventilation of the stage, and during performances it should be opened when it is desired to remove the powder smoke, incident to fireworks or the firing of guns.

FIREPROOF TREATMENT OF STAGE SCENERY.

The usual stage scenery and scenic paraphernalia constitute a conglomeration of highly dried-up woodwork, a perfect labyrinth of ropes and a vast quantity of gauze borders and hanging drapery. This mass of highly combustible and easily inflammable material forms a constant danger and menace to the stage, particularly when brought in close vicinity to gas-lights.

It should be the aim to make the various parts of the stage scenery, such as the wings, the borders, the drop-scenes, and the set-pieces as fire-resisting as possible. The substitution of light iron framework in place of wood for attaching the painted canvas is desirable. Where wooden frames are used they should be coated with fireproof paint.

All scenery, draperies and furniture should be rendered non-inflammable by chemical treatment. The treatment, to remain effective, should be renewed periodically. This is easily accomplished where a theatre is used by the same company during the entire season, but it is difficult to insist upon where different travelling companies occupy the theatre in succession. The fire-proof treatment of scenery is required in the New York theatre law, but practically the law is a dead letter.

The woodwork constituting the floor of the stage proper and the traps in the under stage, should be rendered uninflammable by chemical treatment.

All scenery for large theatres should be stored in a separate fireproof scene-dock, forming an annex to the theatre building.

STAGE CONSTRUCTION AND STAGE MACHINERY.

I have already stated that the stage construction and machinery of the majority of theatres is antiquated, and that the system followed from time immemorial is susceptible of much improvement. In fact, what is wanted is a radical improvement and innovation, tending to render this part of the building much more secure, and at the same time more convenient in management.

In a paper in the *Journal of the Society of Arts*, on "Scenic-Illusions and Stage Appliances," Mr. Percy Fitzgerald, F. S. A., relates that "for the new Paris Opera House, built by Garnier, a novel plan of stage construction was offered and seriously entertained. This was to divide the whole stage into small platforms, each supported on pistons moving up and down in hydraulic presses. A lever, put in motion by the stage-manager, would thus elevate or depress any section of the stage to the height or depth required." He continues by saying "this was ingenious and it was elaborated with care and nearly adopted, but the objections were insuperable. The space below the stage was lost, being filled with pumps and apparatus; there were nearly a hundred pistons, but the real danger was the almost certainty of some part of the machinery getting out of order." He adds that "the system was actually adopted at the new Vaudeville, but never came into use."

The system rejected for the Paris Opera House has since then been introduced into a number of smaller theatres, with absolute success. Its great advantage consists in reducing the risk of fire,

by substituting simple iron construction, iron supports and iron machinery for the innumerable wooden traps under the stage, and by replacing the inflammable canvas and gauze scenery stretched on wooden frames by scenic decorations painted on sheet-iron, held in light iron frames. Woodwork is used only for the stage platforms, but not for their support. This is the new system of the "Asphaleia" Society of Vienna. It has been used on the stages of the new theatres at Buda-Pesth and at Halle, and also partially in a Berlin theatre. Independent of this system, several other theatres have adopted iron in place of wood for construction, and steel wires in place of hemp ropes for hoisting apparatus; for instance, the new theatre in Rouen, France, the new Hofburg Theatre in Vienna, and the Royal Theatre in Edinburgh.

The Buda-Pesth Theatre is considered to be one of the most scientifically and perfectly equipped theatres in existence. Its whole stage floor is divided into many traps of different size and shape, some circular and some oblong, which are operated by pistons worked by hydraulic power. By touching a lever, any section can be raised, lowered, or inclined, and thus the stage may be transformed into terraces or gradual inclines, instead of the usual method, consisting in building up such scenery on the stage. The rigging-loft is constructed entirely in iron. The scenery of the "Asphaleia" system is equally novel. There are no flat drop-scenes and no side-scenes or *coulisses*, and borders are done away with. The whole stage forms a clean open space. In this is hung from above a large continuous curtain, or "horizon," as it is called, open toward the front and forming three sides. This is painted so as to represent different sky effects, and the horizon may be moved and by the use of proper light, the scene is readily changed. The movements of the horizon are also controlled under the stage by means of hydraulic machinery. The scenes are represented by detached pieces.

Apart from the novelty of the scenic effect, this new system is highly commendable, because it eliminates the chief elements of danger from fire in theatres, and also because it replaces hand-labor in the shifting of scenery and rearrangement of the stage, by a scientifically constructed mechanical power-system.

HEATING.

The heating of a theatre should always be done by a centralized system, in order to avoid the necessity of having many fires to look after, and of having a number of smoke-flues, each of which constitutes a danger. Heating by warm-air furnaces is only adapted for very small theatres, and even in these it is objectionable on account of danger of fire, and because it rapidly dessicates woodwork and scenery, and renders the same still more easily inflammable. The choice of the system for larger buildings lies between warming by steam and by hot water. Whichever system may be preferred, it is essential that the heating of the auditorium be accomplished largely by the indirect method, which consists in the introduction of a constant supply of fresh air suitably warmed at heating stacks, placed at the basement or cellar ceiling. The indirect-heating system may be supplemented by a few direct steam-radiators placed near the exits, where there is frequently an unpleasant draught from the rush of cold air from out-doors.

The stage is generally heated by direct heating coils or radiators, and care should be taken to keep the stage building at such a temperature, even when there are no performances, as to prevent the freezing of the water in the fire stand-pipes, and in the automatic-sprinkler system.

The dressing-rooms, toilet-rooms, offices, stairs, corridors, foyers and lobbies, are also heated by means of direct radiators.

The steam boiler must never be placed directly under the auditorium, or the stage. It is desirable to place it in a separate and detached building, or, at least, to remove it to a vault under the sidewalk. The boiler should be of the sectional, safety type. Special care is, of course, required in the construction of the boiler-flue. The boiler-room should be enclosed by brick walls, the ceiling should be fireproofed, and all doorways leading to the boiler-room should be of iron, or better, double tin-lined wooden doors. If the boiler-room is equipped with automatic-sprinklers, care should be taken to have the fusible-solder joint arranged so as to stand a higher temperature without opening.

All steam pipes must be kept from direct contact with any woodwork, and they should be encased with double thimbles where they pass through floors, to avoid the danger of wood becoming charred and ignited.

Floor registers are objectionable and are not permitted by the New York theatre law. Heating coils or radiators should not be placed in any aisles, passages or corridors where they would constitute an obstruction, but should be placed in recesses or niches.

LIGHTING.

The lighting arrangements of theatres, and particularly of the stage and the stage scenery, require the most thoughtful consideration and the greatest care in execution and arrangement, as they form one of the chief causes of theatre fires. The days when theatres were illuminated by candles or oil lamps are happily past. Gas-light, which is infinitely safer than either method, has long ago taken their place, and is now as rapidly being replaced by the still safer, and therefore much to be preferred, incandescent electric-light.

In the auditorium, gas-lights have proved objectionable on account of the immediate heat and vitiated atmosphere which they create. On the stage, all open flames used in the lighting up of the wings and borders, as well as the foot-lights, were a constant menace to the highly inflammable scenery and to the light costumes of the dancers. It is, therefore, safe to assert that, at least for the two principal parts of a theatre-building, electric-lighting has many advantages over gas-light. The introduction of the incandescent glow-lamp for the lighting of the stage and scenery increases the safety of a theatre-building perhaps more than any other safety-appliance. Of course, it is necessary that the wiring should be done in the best manner, according to the rules of the Fire Underwriters.

But the electric-current is not always available, and the installation of a special electric-plant may, in some cases, particularly for smaller theatre enterprises, prove too great an expense. Therefore, where the theatre depends on the use of gas, the gas-piping should be arranged with extreme care, and the management of all gas-lights should be under the control of a specially trained employé. All gas-pipes should be of wrought iron, and no lead or other pipes should be permitted. The piping must be put together in a proper and workmanlike manner and must be absolutely gas-tight under a severe pressure test. The joints of flexible India-rubber gas-pipe, for the border and bunch lights and for stage chandeliers, must be carefully watched, and the rubber tubing should be protected from injury by being surrounded with spiral wire.

The gas-meters should be placed in well-ventilated brick vaults, closed with fireproof doors. There should be, at least, two distinct supply-mains, one for the stage and the main lights in the auditorium, and another for the staircases, corridors, lobbies, the entrances and exits, and the rear portion of the auditorium. This second line may also be used for supplying the dressing-rooms and offices in the stage building, although a third separate gas-main for these would be still better. Each main should be controlled by a shutoff valve, located in the sidewalk and accessible from out-doors, to turn off the supply of gas if not required. The stage gas-main should lead to a large gas-table, or distributor, located on the prompter's side of the stage, and at this table there should be a series of shut-offs, each with bye-pass to control, separately and independently, the lights in the auditorium, the central chandelier, the foot-lights, the wing-lights, the border-lights, the ground-lights, the stage chandelier and the bunch-lights. The lights in the stairs, passages, lobbies, should be controlled only by a shut-off located in the lobby.

All gas and electric-lights surrounded with glass, should have fastened underneath a fine mesh wire netting. All open gas-flames must be protected by wire cages, or guards, which should be strongly fastened to the gas-brackets. The wire cages should be of sufficiently large diameter (at least ten inches) so that the wire may never become heated to more than 250° F. All side-lights should have stiff brackets. Swinging or jointed brackets should not be permitted. All fixtures should have strong pin stops. It is of advantage to have all gas-brackets in foyers, halls and stairs so arranged as to have detachable keys, so that the lights cannot under any circumstances be tampered with. All these lights should be protected against draught by glass globes, but on the stage and in dressing-rooms all open flames should have wire cages.

All open flames should also be kept safely away from woodwork. The foot-lights should have a wire network and should be protected with a strong wire guard, two feet distant from the foot-lights to prevent actors from coming too near to the lights. The trough for the foot-lights should be formed of fireproof material. All border-lights should be suspended by wire ropes. The lights in the wings should not come lower than five feet above the stage level.

The central chandelier in the auditorium, the foot-lights and the border-lights, as well as all other rows of gas-lights, should be lighted with electric flash-lighting which is a safer method than the lighting up by means of spirit-lamps on poles, or by other open lights. Sun-burners in the auditorium ceiling are preferable to chandeliers, and are usually arranged so as to assist in the ventilation of the main body of the theatre. The central lustre is hurtful to the eyes and in the way of the sight-line of the upper gallery, and its entire abolishment is much to be desired. All ducts used for carrying heated air from gas-lights should be made double and constructed of metal with intervening spaces. The ceiling ventilators in the auditorium should have valves arranged so they may be shut off to prevent smoke in case of a fire being rapidly drawn up towards and through them, before the audience has departed.

Provision should be made for plenty of gas-light in all actor's dressing-rooms, otherwise the actors may feel tempted to use candles in "making up."

Where lime or calcium light is used on the stage for special illuminations, it should be most carefully handled and manipulated.

Every theatre should, in addition to the gas or electric light, have for the sake of safety, an auxiliary system of lighting the passages, corridors, and all stairways and exits by means of oil lamps or candle lanterns, so that in case the gas is turned off, as happened in the Vienna Ring Theatre and the Brooklyn Theatre fires, or in case the electric-light fails, the exits and stairways are not left in total darkness. These oil or candle lanterns should be placed out of the way, in niches in the walls, closed by glass doors, so they cannot be extinguished by a draught of air or by smoke. It is

advisable to provide the lamp niches with fresh-air supply and a vent-flue carried outdoors. The oil burned in these lamps, as well as in those used on the stage in the presentation of plays, should be vegetable or colza oil, or sperm or whale oil, and not the mineral oil or kerosene. All oil should be stored in fireproof vaults, and the trimming and filling of the lamps should only be permitted in daytime. The oil lamps at exits should be provided with red and white glass, so as to be plainly distinguished. The auxiliary lights should be kept lighted from the time the theatre is open until the theatre and stage are emptied. The New York law requires all parts of the building devoted to the public, all outlets leading to the street including the open courts and corridors, to be lighted during each performance, and to be left lighted until the whole audience has departed. It also specifies the use of at least two, or more, oil lamps on each side of the auditorium in each tier, the same to be placed on fixed brackets, about seven feet high, to be filled with whale or lard oil, or else candles.

LIGHTNING-RODS.

I have not been able to find on record a single case of the burning or destruction of a theatre from being set on fire by lightning, but there are instances of theatre buildings having been struck. On March 20, 1784, lightning struck the theatre at Mantua, in Italy, during a performance, at which about 400 spectators were present. Of these, two were killed and ten severely injured. On the 26th of July, 1759, the theatre at Feltre, in Italy, was struck by lightning, and Arago relates that many in the audience were killed or injured, and that the lights were extinguished by the electrical shock. In both cases the building did not take fire. There is always, in the event of a theatre being struck by lightning during a performance, the danger of a serious panic. It, therefore, seems proper and wise to provide theatre buildings with the protection which a well-constructed system of lightning-rods affords. The Frankfort-on-Main Opera House is protected by thirteen lightning-rods, subjected to inspection annually.

VENTILATION AND SANITATION.

The efficient ventilation of the auditorium, of the stage, of the actors' and supers' dressing-rooms, and of the toilet-rooms, a thorough system of cleanliness and removal of dirt and rubbish, and finally, a safe and well-arranged system of drainage and plumbing, are important requirements, constituting together the question of "Theatre Hygiene," but they have but very little direct bearing on the subject of fire-prevention and fire-protection in theatres, and will, therefore, not be discussed here in detail.

The Boston Building Law wisely prescribes that every theatre should have a system of ventilation so contrived as to provide fifty cubic feet of fresh air per minute, or three thousand cubic feet per hour for each occupant, and for each light other than electric-light.

The old-fashioned central chandelier, or lustre, which constituted a chief feature in the older theatres, and which when gas-light came into use was utilized to assist in the ventilation of the auditorium, is happily going out of fashion. In more than one instance it carried death and destruction, by creating during a fire a strong current of air from the stage into the auditorium, thus leading the smoke and fire gases to the upper galleries and suffocating the people. Serious accidents have also occurred through the falling of the chandelier during a performance.

I do not wish to be understood as being opposed to ceiling ventilation in the auditorium. This is necessary, even in the case of theatres lighted with electricity. But a judicious arrangement of the ventilators and registers is required. The ventilator over the stage, when fully opened, should be larger than the combined area of the ventilators in the auditorium ceiling. This, together with the fact that the stage ventilator is nearly always higher than the one for the audience, would assure a movement of air away from the auditorium towards the stage. To make quite sure of this, it is a good plan to have the vent-registers in the ceiling of the auditorium controlled from the stage, so that in case a fire breaks out on the stage, the person whose duty it is to lower the fireproof curtain, and to open the stage-roof ventilators, will also simultaneously close the vent-register in the auditorium ceiling. The smoke and fire-gases will thereby be effectively prevented from passing over into the auditorium. In any case, the ventilation of the stage and the auditorium should be arranged entirely separate.

Wm. Paul Gerhard.

[To be continued.]

THE ITALIAN RENAISSANCE.[1] — V.

HINTS TO ARCHITECTURAL STUDENTS. — FLORENCE.

Had it not been for climatic considerations, necessitating the visiting of Naples and Rome before August, the studies of the travelling class would certainly have begun in Florence. Here was the cradle of the Renaissance, and the focus of its early activity. From Tuscany emanated the most potent influences which went to the upbuilding of the splendid fabric of fifteenth and sixteenth century art throughout Italy. The completion of the Duomo, the noblest of Florence's Gothic monuments, by the erection of Brunellesco's majestic dome, was the beginning of the architectural Renaissance, as Ghiberti's bronze doors for her old Lombard baptistery, and Luca della Robbia's glazed terra-cotta decorations were the pioneer works in the domain of Renaissance decorative detail.

The monuments of the Renaissance in Florence are so numerous and so profoundly interesting to the student of style; so touched, moreover, by the romance that clings to every manifestation of the exuberant artistic, political, religious and social life of Florence, during the fourteenth and early fifteenth centuries, that they fascinate the beholder by a charm not to be encountered in Rome, or Milan, or Naples. They speak of the intensity and richness of Florentine life and thought, in that most wonderful period of modern history. They reveal a versatility, a wealth of creative resource, a flexibility in the adaptation to new ends of the rediscovered treasures of antique art-form, and a universatility of all-pervading artistic spirit, such as the world has never seen, before or since. We cannot here recount the story of the rise and development of the Renaissance of architecture in Florence, but must content ourselves with brief allusion to the most important epoch-marks of that development.

The foundation of this Renaissance was undoubtedly laid in the journey of Brunellesco to Rome in 1403; a journey made with the distinct intention of devoting himself to the study of the antique monuments of that civilization, whose recovery and re-constitution seemed to be the dream of the scholars and artists of his time. It was under the inspiration of Roman art that he created that master-piece of construction, the dome of the Duomo at Florence, begun in 1420 and completed only after his death, which took place in 1444, a work neither Gothic nor Classic; suggested, in part at least, by the ancient dome of the adjacent Baptistery, but itself the beginning of a long series of domes, which were to be the most striking and imposing contributions of the Renaissance to architectural form. It was followed by a series of works from the same hands, in which the Classic orders, consciously copied or imitated, Roman round arches, coffered and panelled vaults, and carved mouldings were employed for the detailed apparel of his various designs. Contemporary with him were Luca della Robbia and Ghiberti, whose various works in the domain of the accessory arts, executed in terra-cotta, bronze, stained-glass or wood, mainly for ecclesiastical uses, form a notable chapter in the development of the decorative details of Renaissance art. At the same time, palace-building received a great impulse in the erection of such splendid residences as the Medici (now Riccardi) palace, by the great Michelozzo (about 1430); the Pitti, built for Luca Pitti from designs by Brunellesco, about 1435–40, though not completed until the following century by Ammanati; the Rucellai by Brunellesco's other great contemporary student of Classic art, the famous Leo Battista Alberti, (1460), and near the close of the century, the imposing Palazzo Strozzi, (1489), by Benedetto da Majano and Cronaca. In these, and other less imposing structures, the traits of the heavy fortified palaces of the turbulent Middle Ages gradually disappeared, and the orders began to take their place in exterior design, though very timidly at first. Heavy vaultings were replaced by flat ceilings of carved, painted and gilded wood or plaster; mullioned windows by square-headed windows with pediments, columns, brackets and balconies. Meanwhile, a revolution in the details of architectural design was effected in the monuments, pulpits, loggias, altar-pieces and doorways, with which old churches were embellished. In these minor works Florence is especially rich, and as they engaged the talents and labors of the most distinguished architects, sculptors, and metal-workers of Tuscany, they constitute one of the most interesting and splendid phases of Florentine art. The names of Mino da Fiesole, Benedetto and Giuliano da Majano, Luca della Robbia, Donatello, Ghiberti, Desiderio da Settignano, and Benedetto da Rovezzano have gained much of their luster from the fonts, crucifixes, ciboria, pulpits, doors, altars and tombs, which they executed for various churches and monasteries in Florence.

In all these works of the Quattro cento,— the fifteenth century — Classical formalism is wholly wanting. Imitation of Classic architectural forms is only approximate, and the individual fancy and invention of the artist finds the freest range. He resorts to antique art for suggestions only, imbibing its spirit, learning from it its secrets of order and proportion, of sequence of profiles, of carving of mouldings, of combinations of arch and pilaster, but treating every detail with perfect freedom, adapting every suggestion to the special problem and material in hand, transmuting all by the touch of independent genius or unerring taste. Early in the sixteenth century, however, the beginnings of a change are observable. Something more than mere suggestion is drawn from the springs of antique art. With oft-repeated and more minute inspection of its ruins came the growing consciousness of a certain uniformity and system in Roman architecture. At the same time the onward march of the civilization of the Renaissance had brought about a change in the demands of palace-building, and a desire for a more textual reproduction of the glories of Roman architecture. The massive rock-faced masonry of the earlier palaces vanishes; with it disappear the arched panels over the door-ways, such as della Robbia loved to decorate, and the fanciful Corinthianesque pilasters and finely-wrought entablatures of small mouldings that had so long prevailed. In their place, the stately Roman orders, the triangular pediments, the formal arcades, or piers, between pilasters or engaged columns, now form the elements of architectural design, and formal dignity drives out the freer fancifulness of earlier compositions. This

[1] Continued from No. 962, page 100.

phase of architectural design, however, never reached in Florence the affected and pretentious development which afterwards characterized Vicenza and Genoa, and Rococo and Jesuit styles are happily infrequent in their manifestations in Tuscany. The Serristori Palace, by Baccio d'Agnolo, built at the end of the fifteenth century, marks the beginning of this tendency towards Classical formalism, and the Pandolfini, Larderel, Bartolini and Guadagni palaces are later examples of its results; all of them, however, characterized by the never-failing taste and refinement of the Tuscan architecture.

Michael Angelo and Ammanati are the chief representatives of the Baroque period in Florence. But Michael Angelo appears chiefly as a sculptor, in works which have rendered his name immortal. His architectural genius here finds expression mainly in interior design, as in the Library and the new Sacristy of San Lorenzo. The façade which he designed for that church was never built. The garden front of the Pitti is by Ammanati, and the list given below shows a few palaces and chapels belonging to the close of the sixteenth and to the seventeenth century. But even these are for the most part creditable or, at least, inoffensive works, and Florence is, on the whole, singularly free from the vulgarities which abound in cities where there is much work of the seventeenth and eighteenth centuries. Florence, was, in fact, a complete and finished city by the end of the sixteenth century, with little left to be done, either in church or palace-building. It has thus an aspect of harmony and of unspoiled antiquity which Venice alone of other Italian cities can rival. No Borromini ever attempted to revamp her Gothic or early Renaissance churches.

The bibliography of the Florentine Renaissance is almost that of the Italian Renaissance itself. Of special works there are also many. The general student may be referred to three among them, in particular: The "*Architecture Toscane*" of Montigny and Famin, Cellesi's "*Sei Fabriche di Firenze*," and (although not a specifically architectural work), Yriarte's "*Florence*." The student will also do well to read such works bearing on the history of Florence, on its life and its arts other than architecture, as Mrs. Oliphant's "*Makers of Florence*," C. C. Perkins's "*Tuscan Sculptors*," and George Eliot's "*Romola*."

CHURCHES OF THE RENAISSANCE IN FLORENCE. — FIFTEENTH CENTURY.

1. DUOMO, or CATHEDRAL OF SANTA MARIA DEL FIORE: the DOME, 1420–1434, by *Brunellesco*; the LANTERN, also from his design, completed after his death (1462).
2. SANTA CROCE, the PAZZI CHAPEL: about 1420, by *Brunellesco*; earliest example in Renaissance architecture of the pendentive dome; terra-cotta decorations by *Luca della Robbia*. Also by *Brunellesco* the SECOND CLOISTERS.
3. SANTA MARIA DEGLI INNOCENTI: Church and Foundling Hospital, about same date 1420–1430, by *Brunellesco*; completed by *Francesco della Luna*.
4. SANTA TRINITA, the SACRISTY: 1421. (The church was wholly rebuilt in sixteenth century; façade by *Buontalenti*.)
5. SAN LORENZO: rebuilding begun by *Brunellesco* in 1425; the cupola belongs to a later date; completed 1461. OLD SACRISTY by *Brunellesco*, domical design, adorned by *Donatello*. The CLOISTERS are also by *Brunellesco*.
6. SANTA MARIA DEL CARMINE, the BRANCACCI CHAPEL: date uncertain; decorated 1423–1425, by *Masaccio*, *Masolino* and *Filippo Lippi*; the rest of the church mainly rebuilt in eighteenth century.
7. SAN MARCO: a mediæval church rebuilt by *Michelozzo*, but altered in sixteenth century, and with a very late façade (1780); SACRISTY: 1437, by *Michelozzo*; the MONASTERY, rebuilt by the same, 1436–1443.
   (CAPELLA MEDICI in SANTA CROCE: by *Michelozzo* [1460?] See 2.)
8. SANTISSIMA ANNUNZIATA: a much altered thirteenth century church; ROTUNDA OF CHOIR: 1444–1472, by *L. B. Alberti* (very late decorations); CHAPEL OF THE VIRGIN: canopy from designs of *Michelozzo*, executed by *Portigiani* about 1448.
9. SAN MINIATO AL MONTE, CHAPEL IN NAVE: under the raised choir, 1448, from design by *Michelozzo*; CHAPEL S. GIACOMO: 1459, by *Antonio Rossellino*.
10. SANTA MARIA NOVELLA: a thirteenth and fourteenth century church; the MARBLE FACADE by *L. B. Alberti* in 1456–1470; (lower portions, however, of much earlier date.)
    (CAPELLA RUCELLAI in SAN LORENZO: 1460, by *L. B. Alberti*; See 5.)
11. CAPELLA RUCELLAI: in Palace of same name, 1467, by *L. B. Alberti*.
12. SANTO SPIRITO: erected 1476–1487, from designs by *Brunellesco*; the DOME by *Salvi d'Andrea*; the CAMPANILE later by *Baccio d'Agnolo*; the SACRISTY: 1489–1497, by *Giuliano da San Gallo* and *Pollajuolo*, with portico by *Andrea Sansovino*; FIRST CLOISTERS by *Parigi*; SECOND CLOISTERS, by *B. Ammanati* (1564).

SIXTEENTH CENTURY.

(Very few new churches were built during this century. Several were rebuilt or added to, but the chief activity was in palace-building.)

13. SAN SALVATORE DEL MONTE, at San Miniato: 1504, by *Cronaca*, and called by *Michael Angelo* "la bella villanella."
    (THE DUOMO: exterior cornice and gallery of the DOME, by *Baccio d'Agnolo*, early in the century; See 1.)
    (TOWER OF SAN MINIATO: 1519, by *Baccio d'Agnolo*; See 9.)
14. CHURCH AT CAMALDOLI: rebuilt in 1523, by *Vasari*; altered in 1763.
    (SAN LORENZO, the NEW SACRISTY: 1523–1535, by *Michael Angelo*, with the monuments to Giuliano and Lorenzo de Medici; also the BIBLIOTECA LAURENZIANA, by the same, 1529. The STAIRS were built from his design by *Vasari* in 1571, and the ceiling by *Tasso* and *Carolo*, also from his designs. The rotunda of the Biblioteca Delciana is recent: 1841, by *Pocciatti*; See 5.)
15. SAN SALVATORE D'OGNISSANTI, remodelled in 1554 (and again in 1627).
    (Alterations and "restorations" in SAN MARCO and SANTA TRINITA; façade of latter by *B. Buontalenti*; See 4 and 7.)
    (SAN SPIRITO, the SECOND CLOISTERS: 1564, by *B. Ammanati*.
16. SAN EGIDIO: porch by *Francesco Buontalenti*, about 1580.
17. SAN GIOVANNINO DEGLI SCOLOPI: an early church rebuilt in 1580, by *B. Ammanati*; completed 1661, by *Alfonso Parigi*.
18. MADONNA DELL' IMPRUNETA, in the environs of Florence, 1589.

SEVENTEENTH CENTURY.

(SAN LORENZO, the CHAPEL OF THE PRINCES: 1604, by *Matteo Nigetti* from design by *Giovanni de' Medici*; See 5.)
SAN SALVADORE D'OGNISSANTI: (See 15) remodelled 1627; façade by *Matteo Nigetti*.

19. The BADIA: an early church rebuilt 1625, by *Segaloni*, leaving only part of the choir of the original edifice untouched (for monuments and details see, later, the list of minor works).

EIGHTEENTH CENTURY.

The ecclesiastical architecture of this century in Florence is wholly insignificant. A new façade for *San Marco* in 1780; the remodelling of the church at Camaldoli in 1763 and of Santa Maria del Carmine in 1771–1780 make up substantially the whole record.

NINETEENTH CENTURY.

The two main achievements of this century in Florentine church-architecture have been the façades of SANTA CROCE, erected 1859–1863, from a design alleged to be by *Cronaca*, and of the DUOMO by *De Fabris*.

A. D. F. HAMLIN.

[To be continued.]

THE FRIEZE OF THE PARTHENON: A SUGGESTION.

WHERE has always been a curious and unexplained anomaly about the celebrated Parthenon at Athens. Marvellous as it is in design and execution, its position upon the building was so unfortunate, that it could scarcely have shown to any better advantage there than it does to-day, ruinous and incomplete, in the gloomy halls of the British Museum.

The Parthenon, as we all know, had a double row of columns across each end, and a single row along each side. The frieze surrounded the top of the cella, or solid part of the edifice, within the outer row of columns, and could not be seen except by standing within the columns and looking perpendicularly up. If the observer sought to improve his angle of vision by going outside, not only did he find the spaces between the columns less than their diameters, but the heavy architrave soon concealed the frieze altogether, being several feet lower, and only eight feet outside of it. Besides this, the only light it received, coming from below and from the direction of the spectator, was calculated rather to conceal than display the shadows upon which the effect of such a relief so much depends.

A French writer who visited Athens in 1674, before the Venetian bombardment, after describing the Parthenon as being then almost in its ancient perfection, goes on to speak of the frieze, which, he says, was so elevated, that it was with great difficulty that the eye could discover its real beauty, and it was only from a piece that had accidentally fallen, that he obtained an idea of its wonderful workmanship.

In the construction of the Parthenon itself there are some other curious irregularities. The outside columns are equal and equidistant all round the building. But the inner ones, of which there are six at each end, are not only smaller in diameter, but their bases are two steps higher, and their capitals also a little lower than the outside ones. Neither do they range exactly with the outer ones, being somewhat closer together, but the two end or corner ones range with the side walls of the building.

In other words, if we could suppose all the outside columns with their architraves to be removed, we should have a hexastyle temple, *i. e.* a temple with six detached columns at each end, supporting the pediments, but no columns at the sides. In this case, the frieze would run around the outside of the whole structure, columns and all, and would thus be entirely exposed to the light and view.

Our suggestion is, that although the Parthenon was, as we know, substantially built at one time, it is yet within the bounds of possibility, that Ictinus may originally have planned the smaller inner edifice with the frieze, and after it was completed, or nearly so, decided to enlarge it by adding the larger row of outside columns. There may have been many reasons for this. The Athenians, as the temple approached completion, may not have thought it a sufficiently splendid shrine for their virgin goddess, or some unexpected addition to the public coffers, by victories or otherwise, may have permitted a larger outlay than was at first contemplated, or it may have been thought necessary that the great Panathenaic procession should march entirely round the temple, under the portico, — these, and similar reasons, will suggest themselves to every one.

Certain it is that the frieze, entirely outside the building, and receiving the ever-varying play of light and shade on all its parts, would have produced an effect quite impossible when it was covered by the heavy portico. It can easily be seen, in any art-museum, where casts of this frieze are displayed, that the best effect of all the lines and shadows is obtained when the frieze is about as high above us as our distance from it, and the light comes from above.

The comparative flatness of the relief is often urged as a consequence of its unfortunate position, but this would seem to be a necessity in any sculpture so high above the eye.

There is an equal difficulty in assigning any æsthetic reason for the dissimilarity between the inner and outer columns, supposing the whole composition to be one design. It is true that a false perspective may have thus been created, but theatrical tricks of this kind are hardly consistent with the refined art of Phidias.

The small temple of Niké Apteros, (wingless victory), which also stood in the Acropolis, is often cited as one of the most charming examples of Greek architecture ever executed. It was built some thirty years before the Parthenon, and had columns at the two ends only, while a frieze, not unlike that of the Parthenon, ran around the whole exterior. In other words, this little temple, which, before the erection of the Parthenon, was the most admired, if not the most conspicuous object on the Acropolis, was a clear

prototype of what the Parthenon itself would have been without its external colonnade. Is it impossible that the Athenians, when the time came to rebuild the Parthenon, should have decided to fashion it, though on a grander scale, after the graceful little temple which they had so long admired and loved?

This gem of ancient art was destroyed, unfortunately, in the same disaster which wrecked the Parthenon, the Venetian siege in 1687. Portions of its frieze are in the British Museum, with the other Elgin Marbles.

It is one of the most singular paradoxes of history, that the Parthenon, the most splendid building of antiquity, after standing almost uninjured for more than twenty centuries, should have been destroyed by Christian bomb-shells, and that even in the present century, its choicest sculptures should have been carried away captive by the nation which stands in the forefront of Christianity and civilization. We can hardly wonder that among the strange compensations which time often brings about, a strong sentiment is now taking shape all over the world in favor of the restoration of these sculptures to their original position, if not, indeed, the restoration of the Parthenon itself. Rearing its matchless proportions again, as of old, on its commanding site beneath the sunny skies of Greece, it would be the brightest gem, perhaps, in the whole girdle of the earth.

Surely there could be no fitter acknowledgment of modern civilization to Greek art, than the rehabilitation of the ancient glories of Pericles and Phidias on the summit of the Acropolis.

A. W. Colgate.

A PUBLIC BUILDINGS BILL.[1]

IN the House of Representatives, June 16, 1894, Mr. McKaig introduced the following Bill to provide for the securing of plans and for the erection of the public buildings of the United States:—

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That the President, by and with the advice and consent of the Senate, shall appoint a commission on public architecture consisting of three architects of high scientific and artistic attainment and large practical experience, and two officers of the Engineer Corps of the United States Army. If necessary, a separate appointment of any or all of three members of the commission who are architects may be made for each building under consideration, and members of the commission for one building may act upon other buildings. That the commission under the general direction of the Secretary of the Treasury shall discharge all the administrative duties relating to the procuring of designs and the appointing of architects for all the buildings hereafter erected by the Government of the United States.

Sec. 2. That the Secretary of the Treasury shall be the president of the commission *ex officio*, and the Supervising Architect of the Treasury Department shall be a member of the commission *ex officio*. In the absence of the president of the commission one of the members shall be elected as chairman by ballot, and he shall preside at the meetings and perform such other duties as the rules of the commission may prescribe; and the Supervising Architect of the Treasury shall act as Secretary of the commission.

Sec. 3. That the Secretary of the Treasury shall convene the commission whenever in his judgment the exigencies of the service require it.

Sec. 4. That the commission shall adopt rules and regulations governing competition in the procuring of designs, and for the government of its meetings and the general performance of its duties. The members of the commission shall be paid their actual expenses and subsistence and a per diem allowance of ten dollars while actually engaged in the performance of their official duties, but no per diem allowance or salary shall be allowed to any civil or military officer on account of his being employed on the commission, but his actual travelling expenses and subsistence shall be paid while engaged thereon.

Sec. 5. That in case the limit of cost provided by law is one hundred thousand dollars, or over, the commission shall select by ballot, for each building, five architects to prepare designs in competition; in case the limit of cost is less than one hundred thousand dollars, the commission may, in its discretion, select by ballot an architect without competition. No architect shall be eligible for entering as a competitor, or for appointment, who has not had at least ten years' experience as an architect in chief, and unless he can satisfy the commission, through work already done by him, or otherwise, that he is competent to take charge of the economical construction of the building. The commission shall cause to be made and issued to the competing architects, surveys, schedules of requirements for the building, limitations of cost, and all facts which might control or influence the character of the required design. The commission shall specify the number and character of the drawings required, and fix a definite time for their completion. The Secretary of the Treasury, upon the recommendation of the commission, shall pay to each unsuccessful competitor, to reimburse him for expenses incurred in preparing the competitive drawings, the following amounts: For designs for buildings to cost not more than one hundred and fifty thousand dollars, the sum of one hundred and fifty dollars, and for each and every one hundred thousand dollars of the limit of cost of the building above that amount, the additional sum of one hundred dollars; but in no case shall more than one thousand dollars be paid to any unsuccessful competitor.

Sec. 6. That the commission shall reject and return to the author any drawings which have failed to exactly comply with the requirements and regulations adopted by the commission for the competition, and no compensation for their preparation shall be paid, and the author thereof shall be debarred from all further participation in the competition. The commission shall carefully examine the drawings of each competitor in competition and shall select one design as the design of the proposed building, and shall recommend its author as the architect of that building and return forthwith all other drawings to their authors. The Secretary of the Treasury shall thereupon appoint the architect so recommended and he shall perform all the customary duties performed by an architect in private practice, namely: The making of all preliminary sketches, the modifications of his design to meet possible requirements of the commission, the preparation of a set of general working-drawings to procure estimates; the preparation of a set of general details on a larger scale, a set of full-size drawings for moulded, carved or ornamental work, and a set of all other original drawings and specifications required by the commission. He shall supervise the construction of the building, and no payment shall be made to any contractor until the certificate of the architects has been received by the Secretary of the Treasury that the work has been executed in conformity with the contract. He shall file a complete set of the construction drawings in the Treasury Department, from which all duplicates shall be made, which duplicates shall be paid for out of the appropriation for the building. The architect shall be paid for his services a fee of five per centum upon the total cost of the work and the usual travelling expenses. The expenses of the commission and the fees of the architect shall be paid by the Secretary of the Treasury out of the appropriation for the building in the erection of which they were incurred.

Sec. 7. That the Secretary of the Treasury, upon the recommendation of the commission, shall authorize the architect to employ a competent clerk-of-the-works, at a salary to be established by the commission, and he shall be paid for his services out of the appropriation for the building.

Sec. 8. That the Supervising Architect of the Treasury Department, under the direction of the Secretary of the Treasury, shall be the representative of the Government in all matters connected with the erection and completion of public buildings and the payment therefor. He shall receive proposals for the work and, with the approval of the architect of the building, he shall award the contracts therefor. He shall perform all other duties that now pertain to his office except such duties as are vested by this Act in the architect of the building.

Sec. 9. That all Acts and parts of Acts inconsistent with this Act are hereby repealed.

[1] Referred to the Committee on Public Buildings and Grounds and ordered to be printed.

BOOKS AND PAPERS.

A LITTLE pile of pamphlets has accumulated on our table, waiting for the notice that we have, until now, been too much occupied to give them. The most important of these[2] is one of the thorough studies which the Germans know best how to make, devoted to Water Glass. It is not every one who cares to know anything about water-glass, but those who have occasion to inquire about it generally want to learn all that they possibly can in relation to it and its uses, and Herr Bernhard has covered the ground, in the one hundred and seventy-six pages of his treatise, with admirable completeness. The price of the book is not marked in our copy, but we may suppose that, like the other technical hand-books issued by the same publisher, it will cost, in paper covers, about two, or two and a half, marks — forty-eight to sixty cents. This would be a trifle, in comparison with the value of the book to any one who wanted information on the subject; and it may be remembered that books in foreign languages are free of duty under the present tariff, and probably will be so under the next one; so that importations can easily be made through the Post Office by sending a foreign money-order to the publisher.

Architects have a general idea, derived from their High School studies in chemistry, that water-glass is a silicate of soda, containing more alkali than common glass, and, in virtue of the large proportion of alkali, soluble to a certain extent in water. Many of them may even remember having seen brick or stonework covered with a glossy varnish of the substance; and a good many more, of mature years, have unconsciously paid an exorbitant price, in their grocery bills, for bottles of a solution of it, to be consumed under the name of "washing fluid," in purifying the family linen. Herr Bernhard, however, informs us that it was not until 1825 that Professor

[2] "*Das Wasserglas*," seine Darstellung und Anwendung: von Ludwig Bernhard. Mit dreizehn Abbildungen. Frankfurt a. M. Verlag von H. Bechhold.

Fuchs, of Munich, published a treatise fully describing the composition and uses of the substance to which he gave the name of "water-glass." It is true that a soluble silicate of soda had been known long before. Even in the seventeenth, and perhaps in the sixteenth, century a "liquor silicii" was known, which had the property of petrifying wood, and a soluble silica even exists native in England; but Professor Fuchs was the first to bring the preparation of the substance within rational processes of manufacture, and to point out the varied uses to which it is applicable. Naturally, the most important of these uses, in his opinion, was the protection of inflammable material from fire, and the Court Theatre in Munich had, under his direction, its exposed woodwork and painted scenery varnished with it. He soon discovered, however, that the bright, clear varnish of silicate soon grew dull, and scaled off, or dropped away in powder; and, until this day, no one has been able to devise means of preventing it from doing so. Its applications for other purposes have, nevertheless, been multiplied, and the annual consumption of water-glass is now about thirteen thousand tons a year, much of which is used in solution, either by itself or mixed with colors, for painting interior and exterior wood, stone or brick work; while three thousand tons are used annually in soap-making, and nearly as much in the preparation of artificial stone.

At present, water-glass is usually made from infusorial earth, melted with soda or potash, and dissolved in boiling water; but the finely-powdered quartz from the stamp-mills of gold and silver mines has been successfully employed, in place of infusorial earth. The combination of the silica and alkali is effected by fusing together at a heat above the melting-point of iron. The glass so made is dissolved in water, and is then usually evaporated to a thick syrup, which is packed in barrels and sold. Occasionally this syrup is found hardened to a tenacious mass, very similar in appearance and consistency to citron. In either of these forms it is easily diluted with water to any desired extent. In a somewhat dilute condition it can be mixed with various mineral pigments, and applied, with much advantage, to brick, stone or plastered walls, cheese or milk being often added to give smoothness and consistency to the wash. For making artificial stone, a still weaker solution is employed, which has the property of hastening the hardening of concretes made with Portland cement, probably by supplying available material for the network of crystals of silicates and aluminates of lime, which slowly forms itself in the pores of concrete, and gives it the resistance characteristic of it.

One of the most curious uses of water-glass is in the manufacture of soap. For many years, the smooth, oily-feeling silicate syrup has been used by laundresses, in preference to the corrosive "washing soda;" but it is found that silicate of soda or potash can be added to ordinary soap, in some cases to the extent of sixty per cent, without much injury to its quality, and with profit to the manufacturer, who is thereby enabled to sell large quantities of water, combined with the soap and silicate, as soap. Rosin was once much used for this purpose, but has been, we are told, almost entirely superseded by the silicate. It is said, we do not know with how much truth, that the "ready-mixed paints" so popular in this country are often prepared with silicate of soda, which affords means of mixing a large amount of water with a small amount of linseed oil, much to the advantage of the manufacturers.

A still more modern application of soluble silicates is to textile industries. It is found that these substances not only, by virtue of their alkali, remove greese from cloths or yarns soaked in them, but have the property of destroying the woody parts of flax and hemp, without injuring the fibre. It is, therefore, becoming common to immerse new cloths in successive baths of silicate solution. The first two baths remove greese and oil, and the cloth is then placed for a short time in a much stronger solution. The last bath attracts the bits of woody substance left in the cloth, disintegrating it so that, in the subsequent operations, it falls away in dust; while even silk mixed with the linen or cotton fibres is not injured. On the contrary, the cloth, whether of cotton, linen, silk or wool, is left in a very favorable condition for dyeing.

THE ILLUSTRATIONS

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

HOUSES OF MRS. MILLER AND MRS. McGUCKEN, WEST 76TH STREET, NEW YORK, N. Y. MR. C. P. H. GILBERT, ARCHITECT, NEW YORK, N. Y.

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

ST. ANDREW'S CHURCH, DETROIT, MICH. MESSRS. CRAM, WENTWORTH & GOODHUE, ARCHITECTS, BOSTON, MASS.

GARDNER'S COTTAGE AND BARN FOR E. R. VAIL, ESQ., WILLIAMSTOWN, MASS. MR. F. R. COMSTOCK, ARCHITECT, HARTFORD, CONN.

CHÂTEAU ST. AGIL, FRANCE.

CHIMNEYPIECES IN HOUSE OF R. L. STEVENS, ESQ., BERNARDSVILLE, N. J. MR. CHARLES EDWARDS, ARCHITECT, PATERSON, N. J.

A DRAWING-ROOM MANTEL. MR. E. G. W. DIETRICH, ARCHITECT, NEW YORK, N. Y.

SKETCH FOR A COTTAGE. MR. J. H. CRAMER, ARCHITECT, BEAVER, PA.

[Additional Illustrations in the International Edition.]

CENTRAL NORTHERN PORCH OF THE MACHINERY BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

[Gelatine Print.]

NEW ENTRANCE-LODGE, DINORBEN COURT, HANTS, ENG. MESSRS. CHARLES SMITH & SON, ARCHITECTS.

THE entrance lodge which forms one of our illustrations has been recently erected at Dinorben Court, Hants.

AN INGLE NOOK. MESSRS. C. SMITH & SON, ARCHITECTS.

THIS sketch shows an extension of a living-room in an architect's small suburban house. The length of the room has been increased five feet, by pulling out the old chimney-breast and inserting an iron girder to carry the breast of room over. The additional space thus obtained is fitted up in oak with book-shelves, cupboards, etc., and forms a comfortable and interesting feature in the room.

PROPOSED HOUSE AT HORSELL, ENG. MR. J. HENRY BALL, ARCHITECT.

THIS house is to be built on the hill overlooking the church and village of Horsell. It is so arranged that every living-room and all principal bedrooms face south. The walls are to be faced with Chobhan bricks and the roof covered with local-made tiles. Simplicity of plan and style are necessary, as the accommodation shown is provided for 1,800*l.*

DETACHED RESIDENCES AT SURBITON, ENG. MR. R. LANO PEARCE, ARCHITECT.

THIS villa, now nearing completion, has been erected facing and in St. Andrew's Square. The nature of the site necessitated cellars under the greater part of the building. The front and sides are in red brick and red tile hanging, the front gable overhanging eighteen inches, and having rough-cast, etc.; the roofs also are tiled. Clear lead glazing has been introduced in the windows, and the ceilings of the reception-rooms and hall are panelled.

EXHIBITIONS

BOSTON, MASS. — *Annual Summer Loan Exhibition of Paintings; also, New Accessions to the Print Department:* at the Museum of Fine Arts.

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

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

NOTES AND CLIPPINGS

AN ELECTRIC SCULPTURING MACHINE. — An instrument somewhat in the nature of a "pantograph," but on a more elaborate scale and intended for use in sculpture work, has been invented by M. Delin, a French maker of statues for churches, who asserts that by means of his new apparatus he can shape a block of stone into a rough copy of a finished figure. He has the two marbles placed upright on revolving horizontal tables, which are so connected as to rotate simultaneously and with very precise agreement. A sculpturing tool, operated by electricity, is suspended from the ceiling before the block to be cut, and so fixed that it advances and recedes in unison with a tracer held before the model in the workman's hand. The tables on which the figures stand may be raised or lowered together at the operator's will, and thus every portion of the mass under the graver can be conveniently reached. — *Invention.*

PROTECTION OF PILES. — The protection of piles against the "teredo navalis" by casings of concrete has been tried with success on the Louisville and Nashville Railroad. According to a paper by Mr. R. Montfort, M. Am. Soc. C. E., the trestles on the railroad were subject to the attacks of the teredo. Many piles were found all eaten off close to the bottom of the water. In 1876 creosote was applied, but ten years later it was discovered that the teredo had commenced its attacks upon the creosoted piles. It was then determined to use a thin coat of cement mortar or concrete applied to the piles from the surface of the mud or sand by a shell of wrought-iron of several sections, each in two segments, so as to be easily taken away. The space between the shell and pile was made water-tight, the water being pumped out, and the concrete poured in. The shell was kept on three or four days to allow the setting, the clamps were then removed, and the shell applied to the next pile. This plan has been found to have protected the pile from all attacks. The concrete casing in one case recorded was covered with oysters, barnacles, etc., and the concrete was found so hard that heavy blows were required to break it. The piles examined were found to be completely free from the teredo after several years. Latterly vitrified-clay pipe has been used to encase the piles for economical reasons. The pipes were fastened together by a composition of pitch and sand applied hot. A test was made with a pile infested with the teredo in a live state. A pipe was placed round it, filled with sand. At the end of twenty-four hours it was found the teredos were all dead, and in forty-eight hours the bodies had disappeared. The utter destruction of the teredo by this means is therefore secured. The sand is inimical to its growth or progress, as the teredo is never found to attack a pile below the surface of the mud or sand into which it has been driven. For further particulars of the process, we refer the reader to Mr. Montfort's paper in the *Transactions* of the American Society, where the methods of strengthening and protecting the trestles and piles are described and illustrated, and the wrought-iron shells used for the concrete are shown in detail. Old pile structures can be treated in the manner described when the superstructure requires renewal by placing frames of timber on the heads of the old piles. — *Building News.*

DISINFECTION OF SEWAGE BY MEANS OF LIME. — The practical employment of lime for the disinfection of sewage, as recommended by Pfuhl, is as follows: In order to render free from danger fresh sewage that may contain the organisms of typhoid fever or Asiatic cholera, it is necessary that lime be added to the sewage in the proportion of, at least, one to one thousand. In this proportion, disinfection is complete in from one hour to one hour and a half. It is necessary that during the addition of the lime the sewage be kept in motion, so that there will be a homogeneous distribution of the lime throughout it, for it has been shown by experiment that in sewage not so stirred, lime may be added often to an extent of three to one thousand, and yet living typhoid bacilli may be detected after two hours, a condition evidently due to the restriction of the activity of the lime, to and immediately about the point in the still sewage at which it was deposited. In practice, it is further to be observed that the disinfectant activity of the lime is frequently interfered with through the presence of precipitating substances, such, for example, as the salts of sulphuric acid. It is also necessary that the lime should be of the best quality and freshly burned, so that in calculating the amount necessary for a given volume of sewage, only pure calcium hydrate will come into the computation.— *International Medical Magazine.*

BRICKS MADE OF CAST-IRON. — "While I was in Germany last year," said W. L. Burgess, of New Haven, "I came across several walls surrounding some of the public institutions that were constructed out of cast-iron bricks. These bricks certainly have many advantages over the old-fashioned clay bricks, though they may not prove to be superior in all respects. In form and size these bricks resemble our ordinary bricks, but they are composed of cast-iron and hollow. The shell is so thin that the brick weighs less than one made of clay. A wall is built of such material without the use of mortar, and no skilled labor is required in laying them. The upper and the lower sides of the bricks are provided with grooves and projecting ribs, which fit into each other easily and perfectly and form a wall of great strength. There are also two large circular openings in the upper side of each brick, arranged so as to receive projections on the lower side of the brick that is to be placed above it. One of the projections is hook-shaped, which secures a solid hold. A wall of these bricks is put together very quickly. After the wall is built it is covered with paint. This closes all the cracks, rendering the wall air-tight, and prevents the bricks from rusting. The bricks are very durable, and a building constructed of them would be practically fireproof." — *St. Louis Globe Democrat.*

WATER-WORKS STATISTICS. — It is almost incredible that the water-works supplying the cities and towns of the United States should represent an investment of $430,000,000, or nearly one-tenth as much as is invested in railroads. The miles of water-mains in New England are nearly equal to the miles of railways. There are only sixty-eight water-works in eight Southern States, while the total number of cities and towns in the whole country supplied with water-works is about 1,700. Probably two-thirds of the supply is furnished by the municipalities, and the balance relies on corporate enterprise. The daily consumption per head in London is only thirty-one gallons; Paris, thirty-six, and Hamburg, forty-six. Consumption of water is constantly increasing in American cities. Brooklyn and Washington in twenty years increased more than fifty per cent.; Buffalo, Chicago and Detroit measured the increase at almost three-fold in the same time.— *Wall Street News.*

SEWER AIR AND MICROBES. — No less than one hundred samples of air from a Berlin sewer have been examined by Dr. Petrie, and on one occasion he is said to have found no organisms in it at all. In another experiment only one bacterium was traced and three moulds. Curious as it may seem, it would, therefore, appear that drain air, as regards freedom from microbes, is frequently superior to that which we inhale in our houses, and compares very favorably in this respect with the air in crowded reception-rooms. Mr. Laws, commenting on these experiments, says that although the organisms of sewer air probably do not constitute any source of danger, they may contain some poisonous chemical substance capable of affecting the general vitality to a very serious extent. — *Invention.*

EXCAVATIONS AT POMPEYA, GUATEMALA. — A new Pompeii is said to have been discovered in Guatemala. According to the paper *La Union Libero Americana*, in a place or village named Pompeya, the remains of a very old city have been discovered and excavations have been begun. At a depth varying between fifteen and twenty feet were discovered large quantities of domestic utensils, pieces of furniture, war weapons in silex perfectly made, and many articles used by the Indians. There are also idols in stone, ornamented with turquoises, fine pearls and other precious articles. Inside the houses many skeletons were discovered, showing that the people who lived in those prehistoric times were of a great stature, most of them measuring seven feet. — *N. Y. Tribune.*

A BABYLONIAN CURSE. — According to Scripture, curses were known from the beginning of man; but the earliest curse the world has authentic record of, is found inscribed on a door socket of King Saegm, of Babylonia, 3800 B. C., in the Assyriological collection of the University of Pennsylvania. The inscription, which has been translated by Dr. Hermann V. Hilprecht, of the University, calls down the vengeance of the gods Bel, Shamash and Nuina upon the bold disturber of the stone. This American collection is said to be exceeded in importance only, by those of the British Museum and the Louvre. It is largely the result of the special expeditions to Niffer on the Euphrates, sent out by the University during the past six years. Part of the collection, including the stone mentioned above, was exhibited at Chicago, where it was awarded several medals.— *Cincinnati Commercial Gazette.*

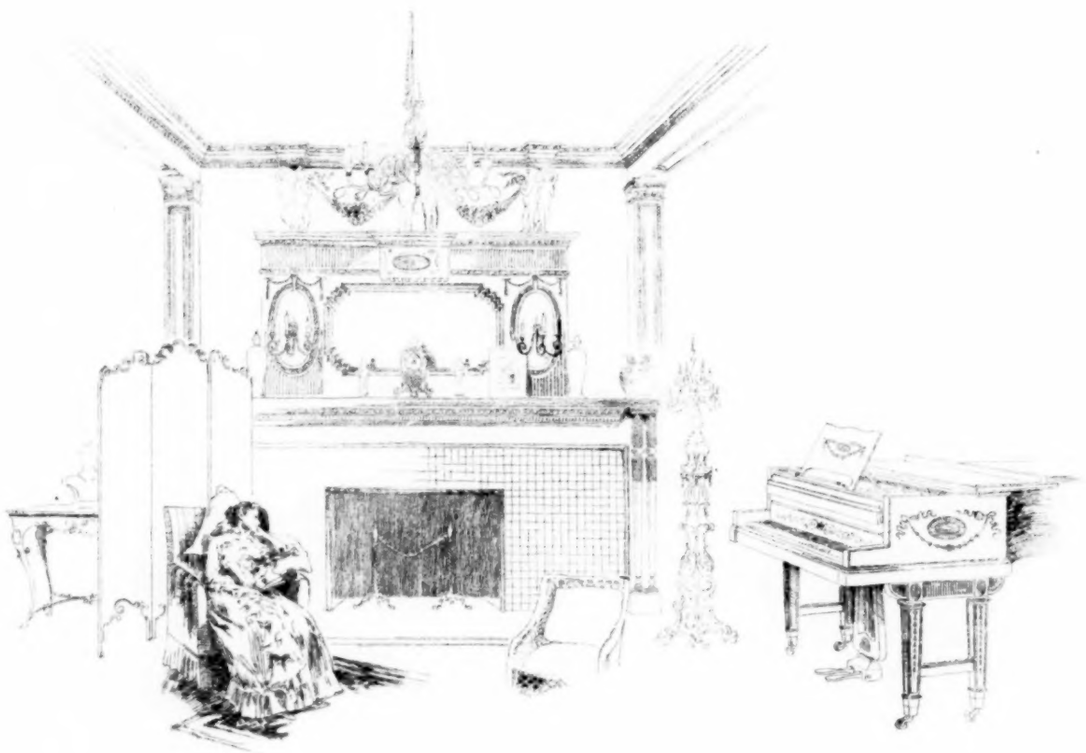
ROMAN COINS FOUND IN MASHONALAND. — *Africa semper aliquid novi affert.* Roman coins have been discovered in King Solomon's mines! A Mashona native, grubbing about near the famous Zimbabwe ruins, came upon eight coins, all in a fair state of preservation, which are undoubtedly Roman. One of the coins bears the legend "Constantivs Caes" How on earth did they get there? There are plenty of theories as to who those ancient gold-seekers were who left the massive circular walls and solid conical towers, the temple fortresses of Mashonaland. In fact, every man is at liberty to make his own theory. But nobody has made one yet which could comfortably bring in Roman coins and Constantius Cæsar. Perhaps Mr. Theodore Bent dropped them on his recent excursion. Roman coins are the sort of thing an antiquarian might carry about with him, and while jolting about in Mashonaland a man might drop anything. — *Westminster Gazette*

TRANSPARENT BRICKS FOR HOT-HOUSES. — Experiments with glass building-bricks were begun in 1891, by M. Falconier, an architect of Lyons. These bricks are hollow, being blown like bottles, and are given forms — such as cubes, hexagons, etc. — that permit of ready laying. A bituminous cement, with a base of asphalt, is used with them. The bricks serve as double windows, giving protection against both cold and heat; they are good insulators of humidity and noise, and they lend themselves readily to the decoration of buildings, either by their form or color. Many applications are foreseen. The bricks are neater than marble in meat-markets, and especially adapted for bath-halls, hot-houses, hospitals, refrigerating establishments and buildings in which absence of windows would be an advantage. A hot-house of glass bricks is of about ordinary cost, saves fuel and resists hail. — *Ashton, England, Reporter.*

TIMBER CULTURE IN TENNESSEE — Tennessee is one of the few States that have not been stripped of their timber without concern for future needs and climatic conditions. About fifty per cent of the land in Tennessee is still wooded. There are 26,880,000 acres in the State altogether, of which nearly 13,000,000 are timbered. Only three States in the South have a greater timber acreage — North Carolina and South Carolina and Georgia. As the altitude of the forests of Tennessee varies from 200 to 6,000 feet above the sea's level, woods of every kind known to the United States are to be found there. In value, the oak has the first place, but the ash, of which there are two varieties, the white and the blue, is hardly less important. Even in Tennessee the forests of ash are now found only in districts remote from the railroads, but so rapid is the growth of this tree, that it is being planted as an investment. A farmer who set out a grove of ash trees covering ten acres twelve years ago now has 12,000 trees eight inches in diameter on an average, and thirty-five feet high. There were no expenses of cultivating, and the ten acres of 12,000 trees are worth at the present time between $7,000 and $8,000. Besides oak and ash, Tennessee possesses three varieties of elm, two of gum, two of fir, three of hickory, two of locust, three of maple, two of pine, three of poplar, and two of walnut. Among other trees found in abundance are the beech, birch, buckeye, red cedar, wild cherry, cottonwood, cypress, dogwood, basswood, mulberry, tupelo, sycamore, and the sassafras. Of oaks there are no less than twelve varieties. Cedar, unfortunately, is going very fast. Bucket factories in the State use 5,000,000 feet of this timber every year. Telegraph companies use it almost exclusively for poles. Nearly 1,000,000 feet goes each year to St. Louis, where it is made into fence-rails. The rapidity with which the cedar is being consumed has opened the eyes of some of the friends of the forests in Tennessee, and a warning has been sounded.— *N. Y. Evening Post.*

S. J. PARKHILL & CO., Printers, Boston, U. S. A.

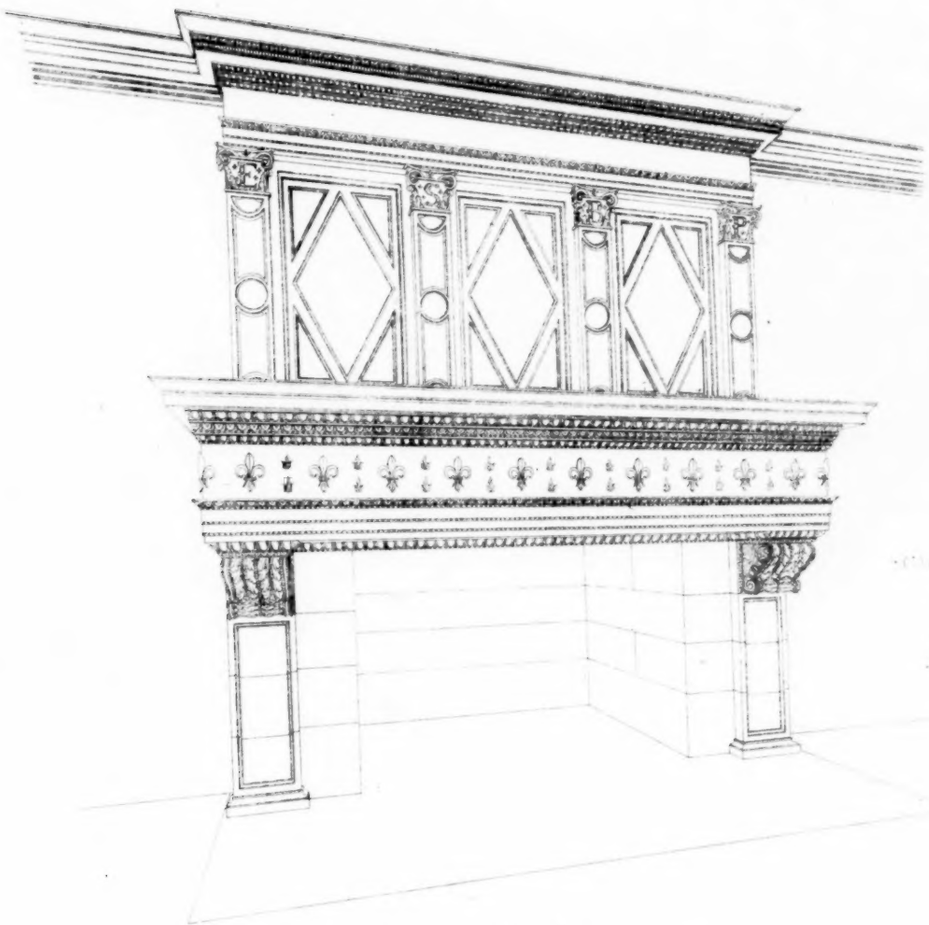
Sketch for "Cottage"

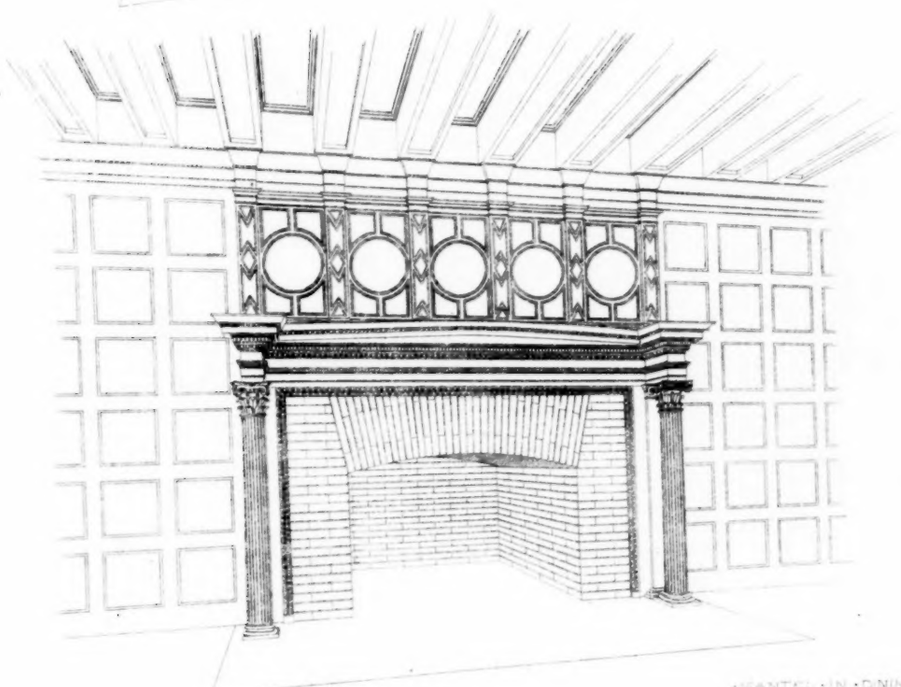


Drawing Room Mantel

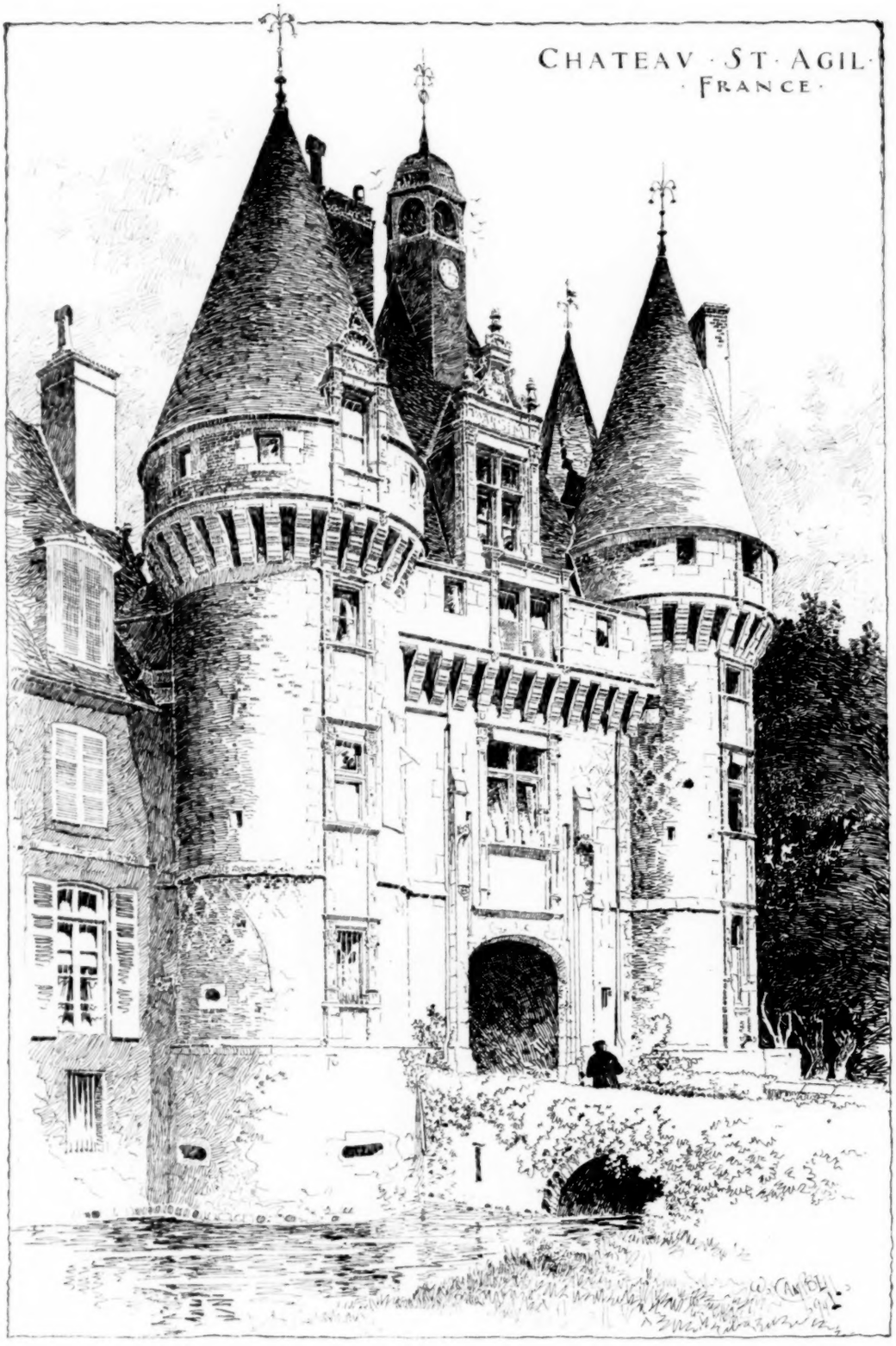
E.G.W. Dietrich, Architect.

Heliotype Printing Co. Boston



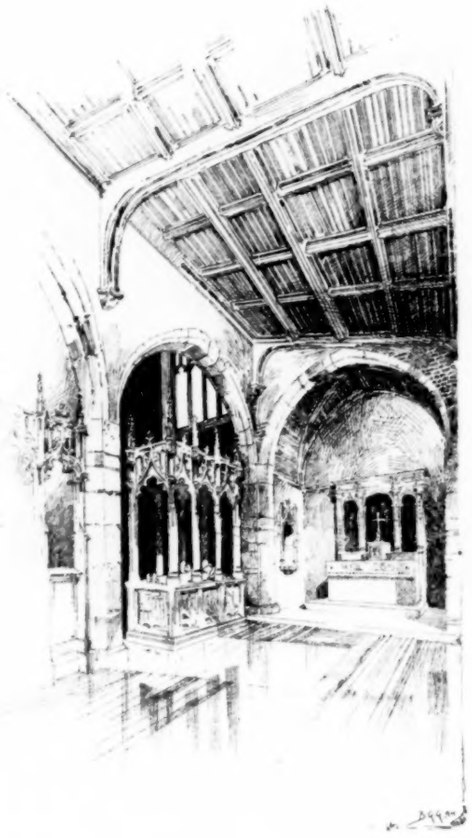


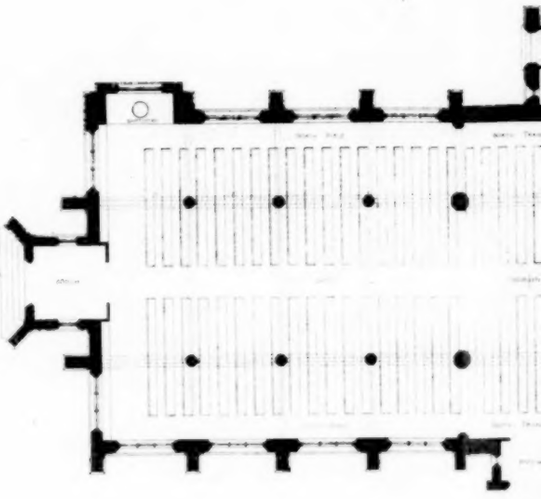
MANTEL IN DINING ROOM
HOUSE OF MR. R. L. STEVENS
HOBOKEN, N.J.
GEORGE A. FREEMAN, ARCH'T. PATERSON, N.J.

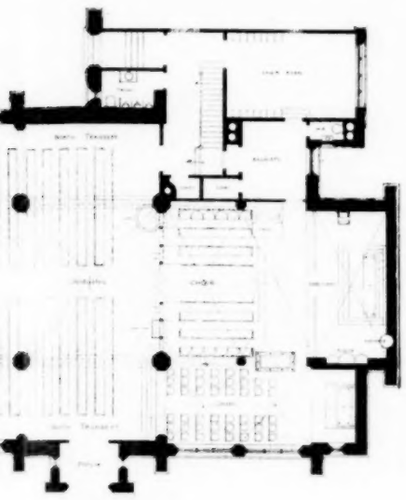

CHATEAV · ST · AGIL ·
· FRANCE ·

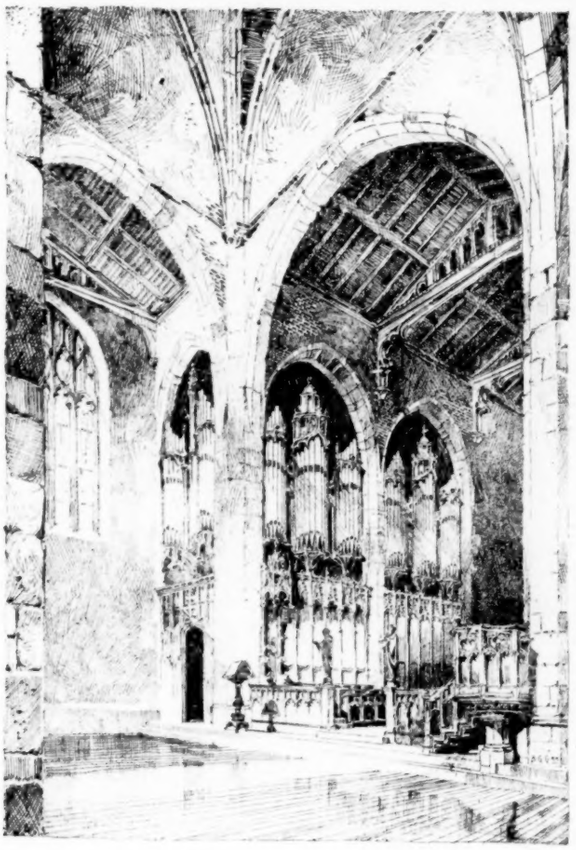
COACHMANS HOUSE AND BARN
FOR MR EZRA R VAIL
WILLIAMSTOWN MASS
F R COMSTOCK ARCHITECT
HARTFORD CONN

GROUNDS COTTAGE FOR EZRA R VAIL ESQ
WILLIAMSTOWN MASS
F R COMSTOCK ARCHITECT
HARTFORD CONN









St. Andrew's Church,
Detroit Mich.

Cram Wentworth & Goodhue
Architects

Heliotype Printing Co. Boston