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TO OUR SUBSCRIBERS.

DURING the coming year we shall pay especial attention to the architectural features of the World's Fair at Chicago.

The gelatine plates of the INTERNATIONAL EDITION in particular will be largely selected from World's-Fair subjects, and subscribers to that edition, will receive also *twelve extra helio-chromes* mainly from the same sources, to be issued at intervals during the year.

All *new* subscribers for the year 1893, who remit to us their subscriptions *direct, in full*, before January 1, will receive the December numbers of this year gratis.

IN its review of the collection of essays by Norman Shaw and others, on architecture as a profession, the *Builder*, disgusted, probably, with the fictitious sentimentalism which leads one of the essayists to say how "pathetic" it seems to him to see builders imitating the work of architects, and to realize that they find "a bit of cut stone, a Gothic capital, or a terra-cotta plaque, in situations for which they are quite inappropriate," to be "necessary to their happiness," just as if he did not know that these ornaments are stuck on by the worst class of builders simply to assist them in swindling the most ignorant class of customers, goes rather to the other extreme, as we think, in saying that architecture and engineering ought to be united, or rather, ought never to have been divorced from their ancient union. "That alliance," it says, "would do more to raise architecture than for architects to aim at being sculptors," and it thinks that there should be only one class of constructors, and that we "ought to see every work of engineering a work of architecture also, and every architect capable of building a viaduct as well as a street house." To a certain extent this is reasonable, and architects ought to be, and, we think, generally are, as familiar as engineers with the scientific principles of construction, but that they can with advantage treat their problems as an engineer does his, is altogether too much to say. No doubt, when bridges and viaducts, like the older ones in Rome and Florence, and some of those in Paris, were intended to be beautiful, it was desirable to have an architect design them, and architects still design such things where a beautiful effect is the primary consideration; but the editor of the *Builder* must know perfectly well that in nine-tenths of the engineering work of the present day the problem set before the designer is simply to get the strength required to resist dead-load, live-load, wind-pressure and thrust, with the smallest possible expenditure of material and labor. In fact, nearly all structural engineering work is designed by, or for, contractors, who bid for the job in accordance with the designs they submit, and the one who has succeeded in "skinning" his project down to the lowest possible cost gets the contract. It is obvious that this sort of design is entirely unsuited to the temper and training which an architect should possess. It is one thing to study construction as the mediæval architects studied it, keeping beautiful effects always in their minds, and using every new method of balancing pressures as a fresh artistic motive, and quite another thing to design a building with a sole view to straddling the space in the cheapest possible manner, without wasting a moment in considering the proportions of voids, spacing of horizontals, pitch of roofs, and the other considerations which take up so much of the architect's attention.

MOREOVER, although the *Builder* thinks that it is useless to try to unite sculpture and architecture, it does not follow that the mental training of architects should not be like that of sculptors. The *Builder* says that a man who tries to practise both arts is "only likely to be either a poor sculptor or a bad architect," which is true. It is equally true, however, that a person who tries to play both the violin and the piano is apt to be an indifferent performer on both, yet, in all except technique, the education of the pianist is the same as that of the violinist. The difficulty appears to be, with both sides, that writers fail to realize the true value of the æsthetic part of an architect's work. We suppose that, in good American offices, for every hour that the draughtsmen and principals spend in laying out the preliminary lines of an elevation, or a detail drawing, they spend twenty in getting the openings prettily proportioned and arranged, the silhouette graceful, the string-courses and cornices agreeably spaced, and of nice profile and projection, and the ornamental details well placed, and suited in line, scale and style to the rest of the design, and, when drawn at a larger scale, gracefully composed and modelled. In many cases, the proportion of time spent in "studying" designs in this way is much greater. We have known a whole day spent in making a full-size detail of a stair-baluster, which a builder's clerk would have drawn in five minutes, and there are plenty of drawings to be found in the offices, on stout linen paper, which have been worn into holes by rubbing out and modifying a difficult bit of design.

ALL the work of these twenty hours out of every twenty-one is purely and solely æsthetic, as much so in every way as the time that the sculptor spends over his clay, or the painter over his easel, and, to do the work successfully, the architect or draughtsman needs exactly the same mental qualities that the painter and sculptor use in their work, namely, power of concentration of the mind upon a certain ideal, to which the design must be brought to conform, experience in rejecting inharmonious combinations, and skill in representing the forms which must be used in parts of the composition. It is hardly necessary to say that neither the engineer nor the builder have any use for æsthetic study of this sort, and would consider the architect's twenty hours thrown away; so that, if we are to prevent the public from coming to the same conclusion, and thereby discourage an art which has already enough to struggle against, there is certainly a good deal of reason for trying to keep architecture as intimately connected as possible with the two other great æsthetic occupations of sculpture and painting, and to dissociate it from those employments in which the lowest bidder bears off the palm of victory. At the same time, the way to maintain the rank of architecture as an art is certainly not to weep over builders who buy cheap gimcracks, and stick them up at random over their miserable houses, in the hope of attracting customers, as if they were the true artists, or to assert continually in public that modern architects care for nothing but "business," and that the mediæval hod-carriers were the high-priests of architecture. The facts are just the other way. In the Middle Ages, as is perfectly well known, there were good

architects and bad architects. The work of the bad ones has mostly been destroyed, but there are some fourteenth-century churches in England as ugly as any Yankee carpenter ever conceived, notwithstanding the advantages which their designer is supposed, erroneously, to have derived from carrying the stones on his back up the ladders. As to the good architects, we have the best of evidence that they pursued their calling, not as poetical essayists imagine, but very much as they do now. They made drawings and specifications, scores of which are still extant, paid stated visits of superintendence to their out-of-town buildings, examined and approved the accounts, and, in general, carried on business in much the same manner as a member of a nineteenth-century Institute of Architects. This did not hurt their artistic qualities any more than it does those of modern architects, or of painters and sculptors, many of the most eminent of whom are very shrewd business-men; and, while it is to be regretted that architects should have to spend so much of their time on administrative details, it is not true that by doing so they lose their artistic capacity, if they ever had any worth saving.

THERE has been a good deal of talk recently about holding a World's Exhibition in Berlin, and it looks as if the idea might be carried out. By beginning operations as soon as the Chicago Fair closes, the exhibition ought to be ready to open about 1896, which is not too long before the next one in Paris, which is appointed for the year 1900. As there has never been a great international exhibition in Berlin, and as, moreover, Germany has taken little or no part in those held in other countries since 1876, there should be much of interest to show to visitors, and as Berlin is now one of the greatest and richest cities of the earth, and is quite conscious of the fact, it will undoubtedly do its best to entertain them with suitable magnificence. What may, perhaps, be called the beginning of serious work is described in the *Deutsche Bauzeitung*. We all know that a decision of any city, or powerful association in a city, to hold a great exhibition, is usually followed by a wild rush of land-speculators, all frantically urging the claims of whatever tract they may be interested in, as the most suitable place for the erection of the exhibition buildings. It is asserted, and probably with truth, that the Columbian Exhibition would have been held in New York, instead of Chicago, had it not been for the land-speculators, who fought so persistently and vindictively for their several locations, that the committee, finding that the choice of any one would endanger the success of the exhibition, by the powerful influence which the united resentment of the advocates of the others would bring against it, abandoned the whole affair. In Berlin, therefore, the happy idea occurred to some of the architects to forestall this danger by having the merits of different sites discussed long beforehand, and by disinterested persons; and, with this purpose, the Berliner Architekten-Verein, the great professional society, instituted a competition among its members, offering prizes, amounting to five hundred marks, or one hundred and twenty-five dollars, for the best schemes for a site, in the neighborhood of Berlin, for the necessary buildings. The competitors were not obliged to indicate the buildings, or even the exact boundaries of the site, it being only required that the available ground should be of sufficient extent to accommodate such buildings as experience at Vienna, Paris and Chicago has shown to be necessary for the purpose; but each competitor was required to furnish a plan, at a small scale, showing the relation of the site proposed by him to the city itself, and to all lines of communication, together with topographical indications, and a memoir, giving details of the facilities for transportation of visitors and goods.

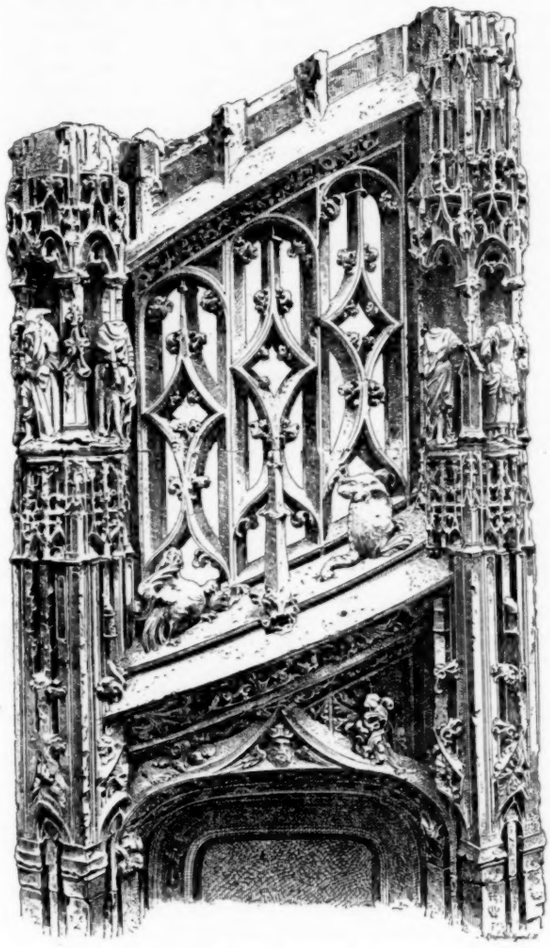
SOME of the instructions laid down for competitors are worth remembering by those who have such affairs to care for. The first consideration to be kept in mind was the selection of a site, not only large enough, but possessing sufficient natural beauty to please visitors, remembering that a view of water is, if not essential, at least an important factor in an attractive landscape. The second requirement of the site was cheapness; and competitors were instructed to select, if possible, parks or public grounds, so as to keep the enterprise out of the way of private speculation. The third consideration was, naturally, ease of access to the exhibition grounds. With us, railroads would be built to such an exhibition, wherever it might be; but railroads in Germany are not built so easily as here, and, as the Berlin programme of instructions said, inconvenient access might endanger the prospects of the entire exhibition, for even the most beautiful site would fail to attract the multitude, if it could only be reached by an unreasonable expenditure of time, trouble and money. The response in the society to the invitation to compete was quite enthusiastic. It is generally found that architects like friendly competitors. Where they are not expected to spend too much time and money on drawings, they enjoy trying their strength against each other, as well as the intelligent criticism which they get from their fellows; and twelve well-studied projects were sent in.

AS the comparative merits of the various plans could hardly be commented upon without an elaborate map, giving the topography, as well as the artificial characteristics of the country about Berlin, we will not attempt it here, but persons interested will find, in the *Deutsche Bauzeitung* of November 9, a criticism of the principal designs, with a small map, which, used in connection with larger ones, will give a good idea of the problem, and its various solutions.

THE *British Architect* describes an extraordinary clock, which is said to have been made at a factory in the Black Forest, for an English customer. In addition to giving the year, month, day, hour, minute and second, together with the time of rising and setting of the principal heavenly bodies, and the numerous other details common to clocks of this character, the instrument in question shows the time at Berlin, St. Petersburg, Greenwich, Madeira, Shanghai, Calcutta, Montreal, San Francisco and Melbourne. Moreover, it furnishes to its fortunate owner a large amount of sentimental as well as astronomical enjoyment. Every evening, at eight o'clock, a figure of a man appears, and rings a bell for prayers. Thereupon a little chapel is lighted up by electricity, and a maiden enters, who chants the "Prayer of the Virgin." At sunrise, every morning, music is heard — the German hymn, "The sun awakes," and a golden sun appears on the dial, and at the full of the moon another hymn, "Guter Mond, du gehst so stille," sounds from the interior. At midnight of the thirty-first of December, two trumpeters announce the birth of a new year. On the first of May, a cuckoo sings, who is replaced on the advent of June by a quail. The price of this extraordinary piece of mechanism is said to have been four thousand dollars, which seems cheap enough. It would not be a bad idea, we think, for some enterprising architect to persuade a town-hall building-committee, or some body of the sort, for whom he was making a design, to import one of these wonderful German clocks, for the delectation of the public, and their own glorification. As pieces of machinery, they appear to be durable. The famous Strasburg clock lasted for centuries, and may, for all we know, be still in service, while we can attest that the little procession, five years ago, still walked around the less celebrated clock on the gateway at Berne, at the striking of the hour, and that the bears still wagged their heads, and the other figures went through their small duties.

THE Boston City Government has taken a praiseworthy step, in establishing a censorship of theatrical posters, which have of late years taken on a decidedly vicious tendency. The particular straw which, if we may be permitted to use the expression, broke, at last, the back of the aldermen's patience, was a flashy poster by Chéret, which was imported by the proprietors of the Boston Theatre to advertise a new play. It is well-known that Chéret has done a great deal of such work in Paris, but this appears to have been the first of his productions shown here, and it is not very much to be regretted that it is likely to be the last. Several complaints having reached the Board, in relation to the poster, it was ordered removed. The proprietors of the theatre demurred for a time, urging that the picture was by "a distinguished French artist." The aldermen failed to perceive any necessary connection between this fact and that which the managers sought to establish — that it was morally unobjectionable, and insisted on their order, which was finally complied with. Then, to provide for future occasions, an ordinance was passed, under which no theatrical poster can be displayed in the city until it has been sanctioned by a committee of three aldermen.

OFFICE-HELP FOR ARCHITECTS.[1]—IV.



Staircase Cage, St, Maclou, Rouen, France. From "*L'Art pour Tous.*"

SECTION VIII. — WOODS:

§ 96. Growth: — The formation of wood in a tree is in circular layers inside of the bark, usually one layer per year. This layer is formed in the fall of the year by the returning sap, and is usually separated from the last layer by a narrow annular space. As it forms, it compresses the layers inside of it. This causes the centre or heart of the tree to be usually the best and hardest part. We must, therefore, in all timber reject the outside newly formed or sap wood, with the bark. In certain timber (oak for example), rays are noticed radiating from the heart in radial lines known as medullary rays. These are elements of weakness and should always be nearly parallel in direction to the depth of the timber.

§ 97. Felling: — Timber should be felled either in August, when for a time the flow of sap is very sluggish, or else in the late winter, before the sap has begun to run. Either time gives good results.

§ 98. Seasoning: — Is the process of removing the sap from the timber, either by washing it out or by evaporation. When washed out, the timber requires to be thoroughly dried afterward. Timber is seasoned when it has lost about one-fifth of its original weight, and dry when the loss reaches one-third. The best method is to stack on dry ground with free circulation of air around and protect by sheds from the rain, snow and severe winds. It should have two years of exposure before use; but that is rarely possible, and it only remains to the architect to so distribute his material as to avoid unpleasant consequences. For all trim, exterior and interior finish, floors, etc., all the stock should be kiln-dried, *i. e.*, placed in steam-heated rooms, stacked so that air can freely circulate around the pieces, and then a current of warm dry air passed constantly over them for from 52 to 100 hours. Material so treated must be most carefully kept from any dampness as it will absorb it like a sponge.

§ 99. Cutting: — The usual manner of cutting a log and the manner of its shrinkage, is shown in Figure 15*a*. For quartered timber the cutting is shown in Figure 15*b* and by reference to Figure 15*c*, the effect of the shrinkage will be seen

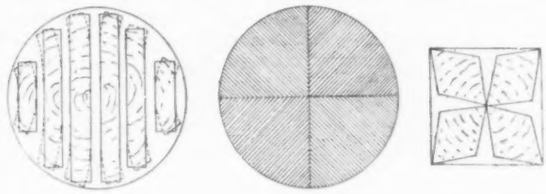


Fig. 15*a*. Fig. 15*b*. Fig. 15*c*.

Timber Shrinkage.

to affect only the thickness of the planks. After cutting, all soft or sap wood and bark should be removed, and the lumber stacked to season.

§ 100. Shrinkage: — Timber shrinks along lines parallel to the annular rings: it does not shrink along radial lines, nor parallel with the grain to an appreciable extent. If the timber has been twisted in growing, which is evidenced by a difference in the direction of the annular rings at the ends of the plank, it will twist badly in shrinking and should be condemned.

Timber is usually cut in the manner shown as Standard Figure 15*a*, and then shrinks in the manner shown by the dotted lines. When cut quartered, Figure 15*b*, it usually only changes in thickness. This, however, is rather an expensive method of cutting, and should only be done for fine interior finish.

§ 101. Characteristics: — Good, well-seasoned timber should show a clean, bright, uniform and sweet-smelling surface when cut. A watch placed at one end of a thirty-foot piece should be distinctly heard at the other end. In cutting with a saw, it should work freely without binding or clogging. Heart should run straight through. Seasoning cracks should always be parallel to the depth of the timber. If of any size and unavoidable, allowance should be made as they are elements of weakness. Knots, if small, nearly the same color as the wood and gradually dying off into the wood, may be permitted, otherwise not, as the timber is weakened thereby. The annular rings should always be firmly united, and finally, there should be absolutely no rot in the pieces. In trees of a resinous character, whenever strength is desired, the tree should never be bled, *i. e.*, have the sap drawn from it before felling. Timber that has been bled will be brittle, and is liable to dry-rot.

Generally: — Timber grown in a forest is better than isolated trees. Timber grown on dry ground is better than when grown in swamps or moist ground.

Of two pieces of timber of the same kind, the heavier and the darker piece is the stronger. The closer and more regular the annual rings, the stronger the timber. Timber that shows

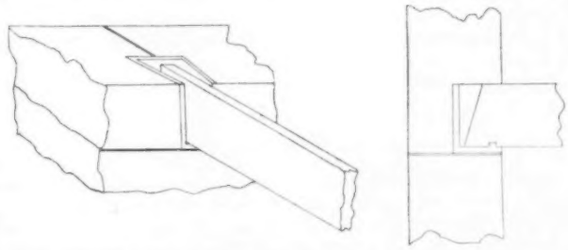


Fig. 16. Goetz-Mitchell Beam-block: Beam in Wall. Section.

the slightest sign of dry-rot is worthless. Very light timber is probably rotten. Loose knots show that the heart of the timber has begun to decay, and should be viewed with suspicion.

§ 102. Rot: *Dry-Rot:* — Is due to imperfect ventilation which prevents the evaporation of the sap and destroys all cohesion between the fibres of the wood, causing it to assume a character very like "punk."

It will occur whenever the timber is so surrounded as to

[1] Continued from No. 883, page 132.

prevent free access of air to it, and is contagious, but can be prevented from spreading by thoroughly coating all timber exposed to it, when perfectly dry, with strong acid and paint.

Wet-Rot: — Is due to alternations of wet and dryness or to moisture and heat, and is due to excessive evaporation, destroying the cohesion between the fibres. To avoid, see § 103.

§ 103. Preservation: — (*a*) *Framing Timber:* — When of sufficient size, should have a hole 1″ in diameter bored through the centre, with a ½″ transverse hole at each end. It should either be always dry or always immersed in water. If neither condition is possible, it should be impregnated with creosote under a pressure of thirty pounds per square inch, until it has absorbed at least three pounds of creosote for each cubic foot, or it should be similarly treated with dead oil of coal-tar, using twelve pounds per cubic foot. If placed in sea water, it must be similarly treated to keep out the "teredo navalis."

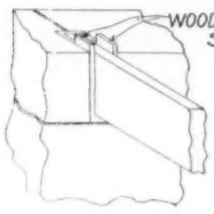


Fig. 17. Goetz-Mitchell Beam-block: Beam in Wall.

When built into masonry walls, it should never be masoned in tight, so as to exclude the air. Either cast-iron or concrete beam-blocks Figure 16 should be used, or else wooden strips ⅛″ thick placed on the two sides, Figure 17, and removed after the beam is in place. Columns should always be bored and ventilated. In framing open-air structures, care must be taken to so make the joints that no lodgment is formed for moisture. In painting timber, it must be first thoroughly dried.

Posts meant to go into the ground should either be dipped in coal-tar or else charred.

If a semi-fireproof construction is desired, either nail porous terra-cotta slabs to top and bottom surfaces, or else use "slow-burning construction" as hereafter described.

(*b*) *Finishing Material:* — Is usually given several coats of paint or varnish. These should never be applied until the material is absolutely dry and should then be put on in such a manner as to absolutely exclude all moisture.

All woodwork in contact with or near outside masonry walls should have the back painted. All trim, etc., should be left in the shop three or four days after being worked, and then be primed before being sent out.

Shingles that are to be colored should be dipped in Cabot's creosote stain for at least two-thirds of their length, after being given a chance to dry out. Fuller instructions regarding the finish will be given under "Painting."

§ 104. Uses: — Wood is used for the frame of buildings when the amount of money to be expended will not permit of a more permanent construction, and for the interior finish of a very large class of buildings.

A great variety of woods is used, but their use varies with the section of country, so the only safe plan for the architect is to inform himself as to the practices in any locality that is new to him, before specifying.

The architect should also have a complete set of samples of the various woods, finished in hard oil and labelled. No description can convey an adequate idea and an hour's talk with an intelligent cabinet-maker will fully inform him as to uses, etc.

Strength, framing-details, etc., are discussed later.

SECTION IX. — GLASS:

§ 105. Composition: — A silicate of at least two metals belonging to different groups, one of which must be alkaline.

§ 106. Manufacture: — The various constituents, the principal one being silicious acid, are mixed in a pulverized state in a specially prepared clay vessel and fused, then refined, and all impurities removed and then either blown in cylindrical shape or cast. The molten liquid is called "metal." The method of manufacture and the constituents define the kind.

§ 107. Kinds: *Crown-Glass:* — Is ordinary window-glass manufactured in a way that has now become obsolete, being superseded by

Sheet-Glass: — Which has the same composition and is made by the workman dipping a tube with an enlarged end in the molten metal until from seven to ten pounds are gathered up. Then it is blown out slightly, taken on a blowing-tube and still further manipulated until a cylinder about 15″ in diameter and 45″ long is formed. This cylinder has the two ends trimmed off, is then cut longitudinally and gradually warmed, then it is placed on a large flat stone supported by a carriage where it is heated until it softens sufficiently to open out flat; then the carriage is pushed into the annealing-chamber and the sheet taken off. The sizes vary up to 4′ 0″ x 10′ 0″, which is the largest, and in thickness from $\frac{1}{16}$″ ("single thick") to ⅛″ ("double thick"), weighing from fifteen to forty-two ounces per square foot. It is usually sold in boxes containing fifty square feet for imported glass, and one hundred square feet for domestic glass, as nearly as may be. There are three grades in the market — French, the best, then German and American, each equally good. Sheet glass is sometimes placed on a large flat stone on which is spread dampened felt, then pressed down until all air is excluded and then smoothed and polished as described for plate-glass, when it is called "patent plate."

Plate-Glass: — The metal, prepared with great care, is melted in large pots and then cast on a cast-iron table which is perfectly flat. The width and thickness of the plate is determined by means of metal strips, called "guns," which are fastened on, and on which a heavy metal roller travels. The ends of the guns are tapered, so that when the roller is at one extremity, it and the guns form three sides of a shallow rectangular dish. The molten metal is poured on and the roller passed along slowly, forcing the metal in front of it, and rolling out the sheet.

The sheet is then annealed. When this is finished, it is called "rough plate" and is used for vault-lights, skylights, floor-lights and the like. Sometimes the cast-iron bed-plates have ribs formed in them, or a pattern, which is impressed in the glass, which can be used for the same purposes.

For polished plate, the plate is carefully examined for flaws, which are cut out, leaving the largest size sheets practicable; then the plate is fastened to a revolving stone by means of plaster-of-Paris and two heavy shoes, shod with cast-iron, are mounted over it. The stone is then revolved and sand and water fed on to the surface; the shoes revolve also, going over all parts of the plate and grinding it down to a plane. Then emery powder is fed on in successive degrees of fineness until the plate is made absolutely smooth and all grit removed. Then new rubbers shod with very fine felt are put on and liquid rouge is added for the polishing. When one side is completed, the other side is similarly treated, the plate losing about forty per cent in weight by the operation.

There are practically two makes — the French, which when looked at endways shows perfectly clear and white, and which on exposure to the elements gradually loses its polish, and turns faintly yellow, and is therefore best suited for mirrors and interior work, and the American or German, which resist the elements better and show bluish when looked at endways. The price is practically the same for all, though being very slightly less for the American.

§ 108. Uses: — Uses have been indicated above generally. Some vault-lights are made with considerable care in the casting, so as to be very nearly transparent. They are cast in a great variety of forms and are even sometimes made to act in part as lenses, but the writer places but little reliance on their efficiency in this respect.

§ 109. Mirrors: — As above indicated, mirrors should always be made of French plate but, as they are purely decoration, they are beyond the scope of this work.

§ 110. Miscellaneous: — For other data, see "Miscellaneous Tables" at end of work.

SECTION X. — CAST-IRON:

§ 111. Composition: — A combination of the metal iron with from one per cent upward of carbon.

§ 112. Manufacture: — The iron is separated from the ore by heating it intensely in a blast-furnace together with some material called a flux, which will combine with the impurities. The entire mass is melted, the melted iron settling in the bottom, from whence it is drawn off and run into moulds, called pigs, 3′ 0″ long 4″ wide and deep and weighing 275 pounds, about. The slag is also run into moulds and is either wasted or used in a variety of ways. The pig moulds are usually made either in a strongly-binding sand or else of iron, the pig from iron moulds being the better.

Just before the iron is ready to be drawn, it recombines with a certain proportion of carbon, varying from one per cent to five per cent.

§ 113. Kinds: — Cast-iron is of two general kinds:

White: — In which the carbon averages 2.5 per cent and which is very hard and very brittle.

Gray: — In which the carbon averages about 1.02 per cent. The gray iron is softer than the white, is much more tough, and is suitable for certain purposes in building.

In the iron trade, eight varieties are recognized.

No. 1. Very gray.

No. 2. Slightly less gray than No. 1 } called "melting iron" since they are used for fine castings.
No. 3. " " " " No. 2 }

No. 4. Best gray forge } do not become quite so liquid as Nos. 1, 2, 3, but are tougher and stronger.
No. 5. Gray forge }

No. 6. Strong forge — slightly less gray than No. 5.

Nos. 5 and 6 are used in the manufacture of wrought-iron.

No. 7. Mottled.

No. 8. White.

Nos. 1, 2, and 3 should be used for very delicate moulded and modelled work. Nos. 4 and 5 for all castings requiring strength, and Nos. 6, 7 and 8 only for special purposes under the supervision of a specialist.

Iron improves in quality each time it is melted up to five or six times, and some qualities gain through a greater number of meltings.

§ 114. Moulding: — Is done either in sand moulds coated, on the surfaces with which the iron will come in contact, with iron moulders' blacking, which is usually oak charcoal finely ground, or else in iron moulds called "chills."

When hollows are desired, they are secured by placing "cores" in the moulds. The cores are made of dry sand, flour, sour beer, etc., mixed to form a paste, and baked hard in an oven. Leaves and other ornaments that are deeply undercut are usually cast separately, and then tap-screwed on after erection. The models must be made to a proper shrinkage-scale, and then moulds made from them, around which the sand is pressed and confined in flasks; when sufficiently hard, the flasks containing the sand are removed, usually in two parts, and the mould withdrawn.

§ 115. Castings: — In casting with cores, great care must be exercised that the cores do not float out of position, making the casting too weak in one place. Blow-holes must also be provided for the escape of gases, and the mould so placed and manipulated as to permit all slag and impurities to float away from the body of the casting.

Care must be taken that the metal is about of uniform thickness throughout; that all angles are rounded off; that all thin projecting pieces are provided with braces; that spokes of wheels and similar figures are made with a curve and not on radial lines, and that cooling takes place slowly and uniformly.

§ 116. Characteristics: — Thoroughly good cast-iron when broken should show a uniform texture, close grained, and a light bluish gray in color, with a metallic lustre. Near the edges, the color should be lighter and the grain finer. When the edges of a casting are struck with a hammer, they should dent slightly.

A fracture that shows mottled or crystalline is unsafe. In chilling, cast-iron shrinks $\frac{1}{8}''$ per foot. Cast-iron expands 0.006′ per 100′ for each change in temperature of 10° or, for the latitude of New York and ordinary range of temperature, about 1″ per 100 feet between the coldest winter and the hottest summer days.

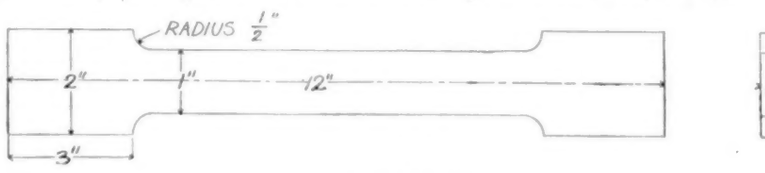


Fig. 18. Test Piece.

In cooling, strains of unknown amount are set up which often result in the cracking of the casting. Blow-holes and pieces of cinder are often found throughout the mass, greatly weakening it. Sometimes the core floats out of position then greatly weakening the strength of the casting.

Some founders are able to produce exceedingly cheap columns by casting them directly from the blast-furnace, but the result is almost entirely worthless.

Cast-iron oxidizes very slowly and when the surface of the casting is left as it comes from the sand, it possesses this quality in a maximum degree.

For columns or shapes intended to carry stress, it should never be cast of a less thickness than $\frac{5}{8}''$. For curbs, ornamental work and the like $\frac{1}{4}''$ is the minimum thickness permissible.

§ 117. Preservation: *Bower-Barffing:* — The iron is thoroughly cleaned with wire brushes and acid, placed in an air-tight oven (muffle) and steam at 60 to 70 pounds pressure turned on. This forms a surface of magnetic oxide of iron that will not rust.

Galvanizing: — Is coating the iron with zinc. All galvanized work should be painted two coats, three to four weeks after erection.

Asphalting: — The iron is cleaned, heated and dipped into a bath of hot liquid asphaltum.

Painting: — See "Painting" later, Chapter XI, Section VI.

§ 118. Strength: — Cast-iron possesses great compressive strength, greater than wrought-iron, and about one-sixth the tensile strength but, by reason of its uncertainty, is never used by engineers and should never be used by architects where it is likely to be subjected to heavy strains, except in small simple castings where failure would not endanger lives.

§ 119. Uses: — As indicated above, cast-iron should not be used for columns, since it is likely to be fatally weak in some spot that cannot be detected until failure occurs. It is objectionable, especially for exterior columns, since it cannot be so treated as to properly resist the bending-moments due to wind-pressure.

Its best use is for ornamental work in connection with fire-proof buildings, for stairs, elevator-enclosures, railings, panelled-fronts to floor-openings and the like, which uses will be more fully indicated later.

SECTION XI. — WROUGHT-IRON:

§ 120. Composition: — Iron containing not to exceed 0.11 per cent of carbon.

§ 121. Manufacture: *Hot-blast:* — In this, the best quality of pig is used, all the carbon burned out by the air blast and then the proper amount added.

This is practically the method employed in making steel, which see.

Puddling: — The melting pigs are fused in a puddling-furnace and mixed with either red hematite or black oxide of iron. They are melted slowly, being constantly stirred by the puddler to thoroughly mix all of the materials together. When the process is nearly complete the purified iron separates in small lumps which, as the temperature is raised, become sticky and adhere to the paddle which is rolled around, gradually collecting the purified iron into a ball or bloom of about 60 pounds weight.

The bloom is taken out, placed under a powerful hammer and then passed through the blooming rolls which squeezing out the melted slag, convert it into a bar and then into a piece of metal 4″ wide, $\frac{3}{4}''$ to 1″ thick and 10′ to 12′ long.

The puddled bars are rather weak and before being used, must be reheated and worked a number of times.

In the manufacture of commercial shapes piles are formed in piles of proper shape, heated in a furnace and then passed through rolls until they are reduced to the ultimate size. (Fig. 19.) This process adds greatly to the strength of the material, presses out all impurities and leaves the mass homogeneous in texture, uniform in size and ready for market. In using sections it is well, however, never to use the maximum weights of any section as they usually are less thoroughly worked and are consequently weaker.

§ 122. Characteristics: — The best grade of wrought-iron is tough and fibrous in character; when fractured the area of the section should be considerably reduced, being drawn down uniformly; the fracture should show fibrous and silky, and

absolutely without any crystals. It possesses great ductility, can be bent, hammered and drawn when cold, and very much abused without materially affecting its strength. When stress is applied up to one-half of the ultimate, the material is practically uninjured.

When used in building under proper conditions of load, its compressive strength is as great as its tensile strength. It

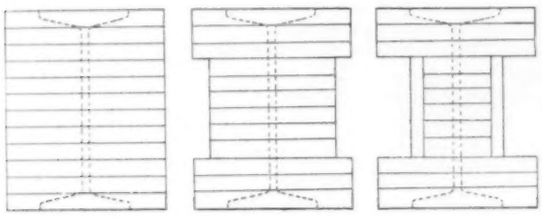


Fig. 19. Methods of Piling for Wrought-iron Beams.

oxidizes rapidly when unprotected. It does not withstand fire well, but can easily be fireproofed.

Expansion and contraction are practically the same as for cast-iron — 1″ per 100′ in the latitude of New York for the usual range of temperatures. Can be joined by welding so as to show no loss of strength, this is done either by electricity or by heating in a forge and using a hammer to join the parts. May be used for any purpose in building either for strength or ornament and may be relied upon to always develop full strength.

Care must be taken to have the metal come fully up to the standard and for that purpose, see "Tests."

§ 123. Tests: — An average piece of wrought-iron prepared as shown in Figure 18, by being cut from a piece with the grain, should show:

Elastic Limit 20,000 pounds to 23,000 pounds per square inch.

Elongation 15 per cent to 18 per cent.

Ultimate Strength 40,000 to 45,000 pounds per square inch.

An opinion should also be obtained from the person making the test as to how the material compares with the average of the material.

§ 124. Preservation: — Galvanizing makes a fair protection but for heavy pieces is liable to be broken, and after its continuity is once destroyed, it will all go eventually.

Painting when properly done, as hereafter described, forms a coating that will last (if not broken off by abrasion or worked off by exposure to the weather) forever. Two coats should be applied at the mill, and two coats immediately after erection.

Portland cement or Rosendale cement are not dangerous unless there is dampness present, then they convey it to the iron, and rapid oxidation takes place if the iron has not been protected.

Lime mortars have a preservative effect.

Small articles of wrought-iron, anchors and the like, should be galvanized and then dipped in grease immediately before being set in place.

§ 125. Uses: — Primarily wrought-iron is used for columns, girders and the framing of structures, but is also used for a variety of ornamental works — grilles, gates, railings, light enclosures, lathing, doors, windows, cornices, and a thousand similar articles.

For wrought-iron grilles and the like, scope is given for the exhibition of the skill and taste of the individual worker, and more truly artistic work results, than is the case with cast-iron, but the product is of course much more expensive.

Many of the sheet-metal ornaments are rolled or stamped and are very cheap.

(To be continued.)

CONSTRUCTION.[1] — XVII.

TO-DAY when we no longer build these colossal structures, consisting of widely varying parts, we do not suspect the effects manifested under such circumstances, and we are very much astonished when we see them taking place, and causing the most serious disorders. It is easy to reason theoretically about these enormous weights unequally distributed; but in practice, through lack of precaution in details, and through abandoning the execution to the methods of habit, we are reduced very frequently to acknowledge our weakness, to blame the art that we profess, the soil on which we build, the materials, the contractors, everything and everybody except the perfect ignorance in which we have been left, under pretext of keeping up the classic traditions.

We admit freely that the architecture of the Romans was superior to Gothic architecture, so much the more freely since, to us the architecture of the Greeks, of the Romans, or of the western nations of the Middle Ages, is good from the moment that it remains faithful to the principles admitted by each one of these three civilizations; we will not dispute about a matter of taste.

But if we wish to erect monuments like those of ancient Rome, we must build as the Romans built; have space, slaves, a powerful will; be the masters of the world, impress men, and take materials wherever it shall seem good to us. Louis XIV played the part of a Roman constructor seriously, even to sometimes pretending to build like a Roman. He commenced the aqueduct of Maintenon like a true emperor of the ancient city; he commenced, without being able to finish. Money, workmen, and more than all that, the imperious reason, were wanting. In our great railroad constructions we also approach the Romans, and this is the best that we can do; but as to our domestic constructions, the monuments or the dwellings in our cities, when we pretend to ape the Romans, we are only ridiculous, and we should act more wisely, it seems to us, in profiting by the elements used among us with reason and success by generations of artists, who have admitted principles agreeing with our needs, our means, our materials, and the modern spirit.

We have now said enough about the construction of the Middle Ages to make clear wherein its principle differs entirely from the Roman principle of construction, how the processes that suit the one do not suit the other, and how the two methods are the result of opposite civilizations, ideas and systems.

Having admitted the principles of equilibrium, of active forces opposed one to another to produce stability, the builders of the Middle Ages, because of the natural tendency of man toward abuse in everything, could not but end by exaggerating, in the successive applications of these principles, whatever they might have that was good, rational, or ingenious. Still, we repeat, the abuse is felt less

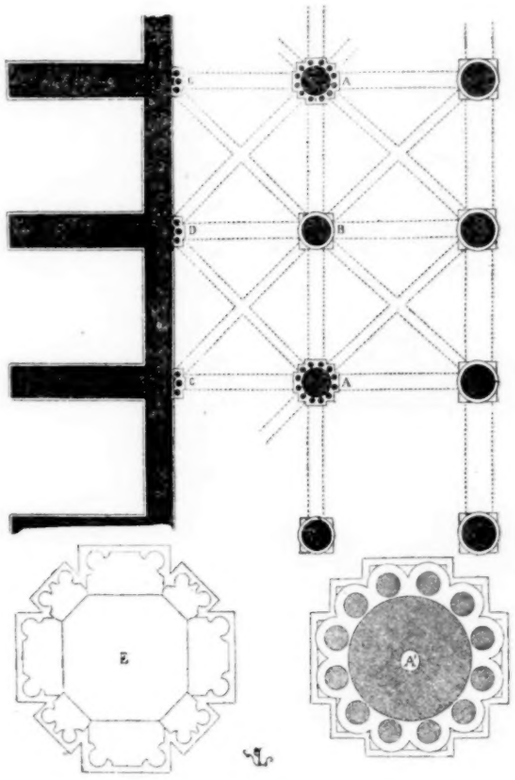


Fig. 92. Double Aisles of Nave, Cathedral of Notre Dame, Paris.

in the provinces of the Royal domain, and particularly in Ile-de-France, than in the other countries whither the Gothic system had penetrated.

It is easily seen that so early as the middle of the thirteenth century, the builders were perfectly at ease among these problems of equilibrium so difficult to solve in edifices of very great size, and often of very frail materials.

[1] From the "*Dictionnaire raisonné de l'Architecture Française*," by M. Viollet-le-Duc, Government Architect, Inspector-General of Diocesan Edifices, translated by George Martin Huss, Architect. Continued from No. 881, page 152.

In the North they built only in stone, but they employed at the same time and in the same edifice, facing stones in courses set upon their natural bed, the large stones sunk in mortar, an easily compressible mass, and the blocks set against the stratum, rigid, inflexible props, that might in certain cases be of great assistance. Elasticity being the first of all the necessary conditions in monuments erected on slender supports, it was still necessary to find, besides that elasticity, absolute rigidity and resistance. It is through lack of the power or the will to apply this principle, in all its exactness, that the Cathedral of Beauvais could not be maintained. There, elasticity is everything. That monument may be compared to a wicker cage. . . . But we shall return to it later, for its faults are an excellent lesson. . . . Let us not leave so soon our Cathedral of Paris. The section of one of the buttresses of the towers shows us clearly that the builders at the beginning of the thirteenth century did not pile the stones one upon another without purpose, and without noticing the effects which were produced in large edifices, in accordance with the laws of weight. Their masonry lives, acts, fulfils a function, is never an inert and passive mass. Today we build our edifices somewhat as a sculptor makes a statue: provided the human form is passably observed, it is enough; but it is none the less an unorganized block.

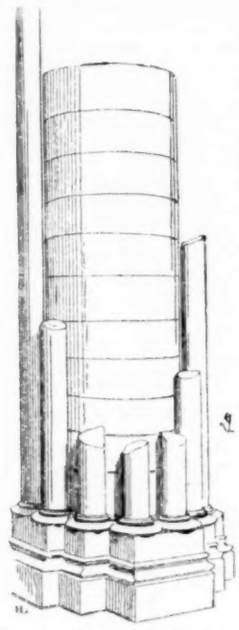


Fig. 93. Aisle Pillar, Notre Dame, Paris.

The Gothic building has its organs and its laws of equilibrium, and each of its members co-operates with the whole by an action or a resistance. Every one cannot see the interior of the buttresses of the towers of Notre Dame at Paris, and we foresee an objection that has often been addressed to us, namely: that our imagination has led us to attribute to these artists of past centuries intentions that they never had. So let us take for the benefit of these doubting spirits, an instance that they can easily verify in this same monument. The great vaults of the nave in the Cathedral of Paris are composed, as every one can see, of diagonal arches including two compartments and intersected by a transverse arch; it is the early system of Gothic vaults explained in detail in this article.

The result of this arrangement is that the piers of the great nave are unequally loaded, since they receive, alternately, either a transverse arch alone, or a transverse and two pointed arches; and yet the piers of the great nave are all of equal diameter. This is something of a shock to the reason, especially in a very large edifice since these unequal weights ought to produce unequal degrees of settling, and since, if the piers supporting three arches are strong enough, those supporting only one are too strong; but if, on the contrary, those supporting only one arch are of a suitable diameter, those which support three are too slender. Apparently there is no answer to be made to this criticism, and we must admit that it took us a long time to explain such apparent disregard of the simplest principles among artists who always proceed by reasoning.

Nevertheless, this is a proof that we must never be hasty in passing judgment on an art that we are scarcely beginning to decipher. Let us enter the aisles of the cathedral, double in the nave as about the choir; but let us remark in passing, that this nave was built fifteen or twenty years after the choir, and that the architects at the beginning of the thirteenth century, who built it, profited by mistakes made by their predecessor.

We notice that the piers which separate the double aisles of the nave are not all alike. We see alternately a monocylindrical column consisting of courses (drums) of stone, and a central column also consisting of courses, but flanked by ten [*sic*] small columns, each in one piece and set against the stratum. (See plan, Fig. 92.)

Why this difference in construction? Is it caprice — a whim?

But, however little, one may have studied these monuments, he remains convinced that caprice has no share in the plans of the builders of that period, especially in case of such an important member in architecture as a pier.[1]

The question, "Why that difference?" being put, we shall with some care soon solve it.

These intermediate piers *A*, surrounded by pillars set against the stratum, reach the height of the pillars of the great nave, which support the heaviest weight, namely, one transverse and two pointed arches. Now, we must know that originally the flying-buttresses of the nave were not those which we see to-day, and which date only from the second half of the thirteenth century. These original buttresses were in double flight; that is, they first rested on an intermediate pillar placed upon the piers *A* and *B* of the double aisle, and then were buttressed in their turn by secondary flying-buttresses clearing the spaces *A C* and *B D*. (See the word "*Cathedral*," Fig. 2, giving the sections of the nave of Notre Dame at Paris.)

Certainly the flying-buttresses destined to balance the transverse and pointed arches of the great vaults were stronger than those destined only to balance a simple transverse arch scarcely weighted. Perhaps even the intermediate transverse arch of the great vaults was not balanced by a flying-buttress, which would not have hindered the vaults from keeping their curvature, since, in the two transepts, we still see simple transverse arches thus left to themselves without undergoing deformation. The previous explanations contained in this article have shown that the vertical pier carrying the vaults plays only a subordinate part, and that a great part of the weight of the vaults, being drawn off by the flying-buttresses, rests upon the abutment of these flying-buttresses.

Hence it was reasonable to give to the pillars destined to carry the piers on which rested the flying-buttresses, or at least the more powerful flying-buttresses, a greater resistance. But had the architect given greater diameter to the piers *A* than to the piers *B* (Fig. 92), these pillars *A* would still have been compressed by the very heavy weight that they had to support, and their settling would have occasioned very serious disorders in the higher structure, the rupture of the flying-buttresses, and hence the deformation of the great vaults. Still, the architect did not wish to give to these pillars *A*, such a thickness as to render difficult the building of the vaults of the aisles, and to produce an unfortunate effect; so he has, as usual, employed an artifice; he has surrounded his cylindrical piers, built in courses, by strong columns set against the cleavage — ten [*sic*] resisting, incompressible supports (Fig. 93), with the certainty that this system of building could undergo neither settling nor deformation, and that consequently very strong flying-buttresses, resting upon these piers, could undergo no displacement. This arrangement had also the advantage of leaving above the capitals, between the transverse and pointed arches, a strong course *E*, resting directly upon the central column *A* (Fig. 92).

The method of laying the materials (stones) either upon their natural bed, or perpendicularly to it, was rapidly improved during the first half of the thirteenth century. In this, there was, in fact, a means to which we, who claim to have invented everything, resort every day, while we use cast-iron in our constructions with much less intelligence, we repeat, than that shown by the Gothic builders when they sought to obtain incompressible and rigid supports by the use of certain stones of excellent quality.

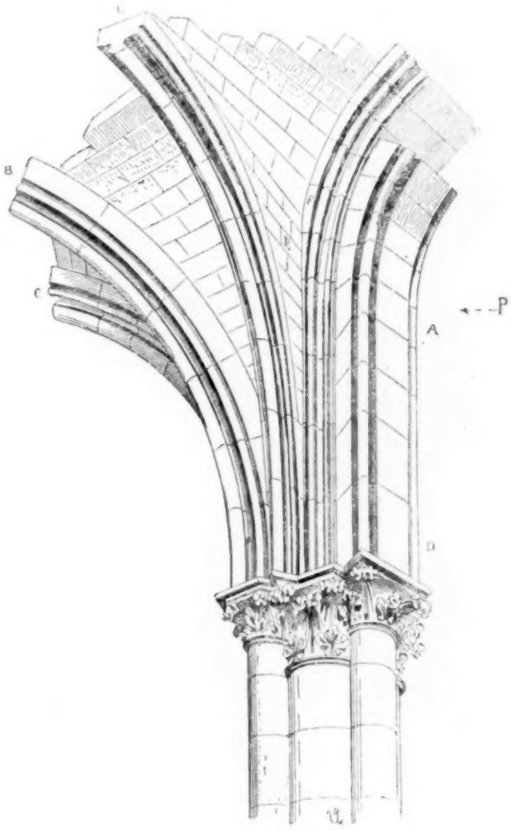


Fig. 94. Vaulting in Chancel, Notre Dame, Amiens.

[1] Caprice is an explanation admitted in many cases, when one speaks of Gothic architecture; it has the advantage of reassuring the consciences of those, who would rather cut through a difficult question with one word, than try to solve it.

Let us see other applications of these principles still better reasoned out.

The choir of the Cathedral at Amiens, built some years before that at Beauvais, is, from the point of view of Gothic construction, a master-piece, particularly in the lower parts.[1]

Let us first examine the piers of the chancel of Notre Dame at Amiens. These piers give, in their plan, a large cylindrical column 120 centimetres in diameter, flanked by four columns, three of which are 45 centimetres in diameter, and one 35 centimetres. These four columns are built only one-fourth part into the central cylinder. The abaci of the capitals are made to receive exactly the arches of the vaults, as appears in Figure 94, and the contours of these arches are themselves shaped with reference to their functions.

The archivolts *A*, consist of a double row of voussoirs, and support the wall.

The transverse arches *B* of the aisles which sustain only the vault and prop the structure, have a more slender contour, and their whole resistance is upward, like a groin or a rib.

The pointed arches *C* are shaped after the same principle, but narrower than the transverse arches, their burden being lighter and their function less important. A single stone of impost, the first one *D*, has its upper bed horizontal; above this stone each arch detaches itself and is formed of independent voussoirs.

It will be observed that the triangles *E*, filling the vaults, rise vertically to the point where their meeting with the extrados of the second arch *F*, serving as wall-arch, permits them to follow its curve.

If we suppose a horizontal section of this structure at the level *P*, we obtain Figure 95, on which we have traced with white and dotted lines, the alternate arrangement of the courses.

At *S* is a structure, solidly built, not of rough stones, but by means of courses piled up to form a support, and to balance the pier supporting the upper gallery.

If we cut the pier vertically through its axis *M N*, we shall have the section (Fig. 96).

A is the level of the capitals at the beginning of the vaults of the aisle; *B*, the impost of these vaults with its temporary tie-rod *R*, placed there only during building in order to keep the piers in position and check the lateral thrust of the arches until these piers are weighted (see "*Chainage*"); *C*, the transverse arch, which is free; *D*, the courses projecting in corbel to receive the buttress *E* of the gallery on the first story.

This buttress, built of large pieces of stone set against the stratum is joined to the principal pier *I*, by an intermediate lintel *F*.

In *G*, is the course forming a roof for the gallery, an upper passage on a level with the supports of the high windows, and a connection between the two piers.

At *H*, is the detached column, built like the buttress of great pieces of stone, and consequently rigid, which sustains the top of the flying-buttress.

The whole burden is thus brought upon the pier *I*, first, because

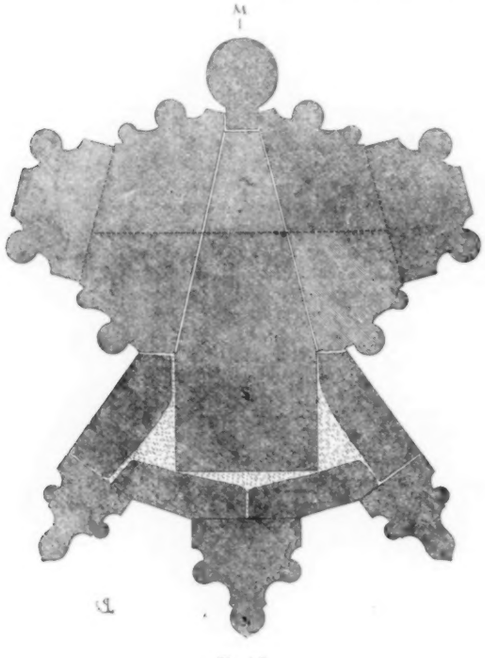
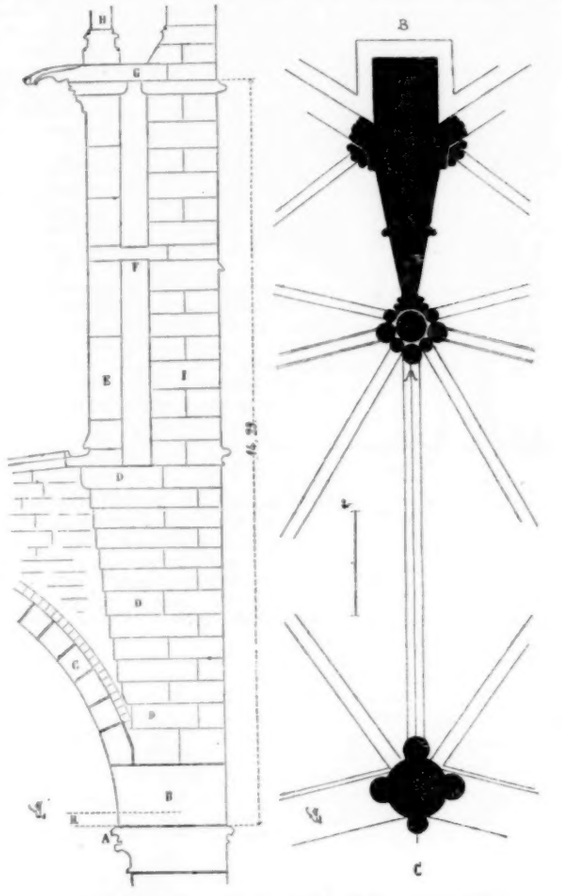


Fig. 95.

from that pier start the arches of the vaults, and next, because since the pier *E*, as well as the column *H*, is composed of stones set against the stratum, the settling and the weight are hence produced upon that pier *I*.

This weight being much greater than that resting upon the pier *E*, it results that the courses *D*, forming a corbel, completely destroy any tendency to sway or bend, on the part of the buttress *E*.

The transverse arch *C*, is free, and can not be put out of shape by the pressure of the piers *E*, since that does not act upon its haunches.



Figs. 96 and 97. From the Chancel of Notre Dame, Amiens.

This construction is very simple: still it had to be discovered; but the following fact shows the extraordinary sagacity of the architects of this remarkable part of the Cathedral at Amiens.

The aisles and radiating chapels of the circular part of this edifice give, in horizontal plan above the bases, Figure 97.

The flying-buttresses that balance the thrust of the upper vaults are in double flight, or, in other words, they rest upon a first pier set upon the cluster of columns *A*, and upon a second pier set upon the abutments *B*.

Cutting through *C B*, these flying-buttresses present the outline (Fig. 98). This section shows clearly that if the weight bearing upon the piers *C* is considerable, that bearing upon the piers *A* is still greater, since it is active, and produced not only by the weight of the pier *D*, but by the pressure of the flying-buttress. Every structure built in courses settles down, and this settling is the more marked, as the weight is heavier.

Any settling that takes place in the piers *C* will not bring us danger, so long as the piers *A* settle less, for by examining Figure 98 we shall see that the lowering of the pier *C* by several millimetres, if the pier *A* resists, will result only in pressing the flying-buttresses harder against the haunches of the high vaults and in fastening the whole structure together with more power, by pressing it towards the interior, which cannot be put out of shape from without, since it is in the form of a polygon; but the pier *A* must not settle as much as the pier *C*.

The whole resistance of the structure depends upon this condition. Now, the following is the manner in which the builders have solved the problem.

The piers *C* have been erected in courses separated by thick joints of mortar, according to the method of masons at that period; the piers *A*, are on the contrary composed of groups of columns built of large pieces of stone, a species of posts (to borrow a term in carpentry), which cannot settle like a quantity of courses set in beds of mortar.

Not wishing to give to these piers *A*, a broad impost, in order not to obstruct too much the entrance to the chapels, they find no better means to make them very rigid under the weight that they have to

[1] See the word "*Cathedral*" for the historical outline of the structure of Notre Dame at Amiens. The upper parts of the choir could be finished only with insufficient resources.

support, than to compose them of a group of almost monolithic columns, and, in thus diminishing the number of joints, to remove every cause of settling.

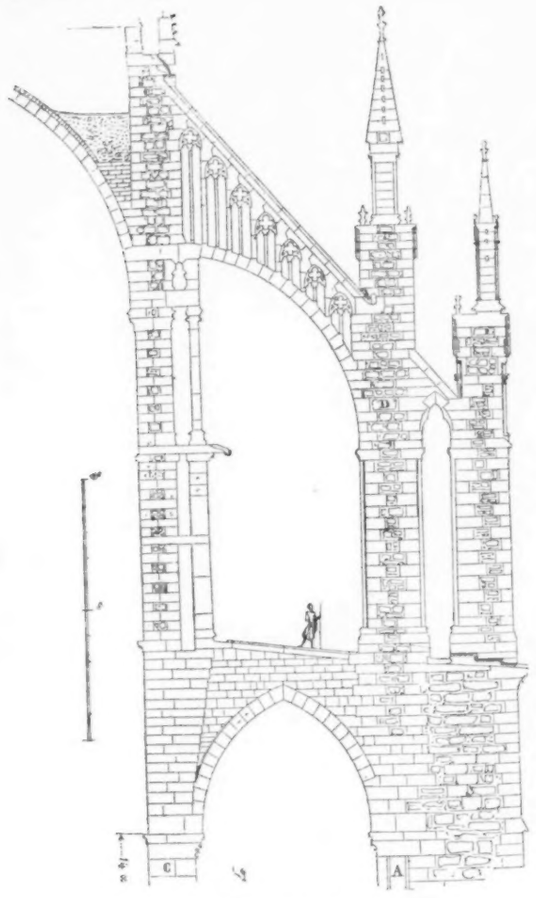


Fig. 98. Chancel Buttress, Notre Dame, Amiens.

Let us notice that the materials at the disposal of the architects of Picardy, can be set with impunity against the cleavage, and that if they have erected these columns of the piers *A* in several pieces, it

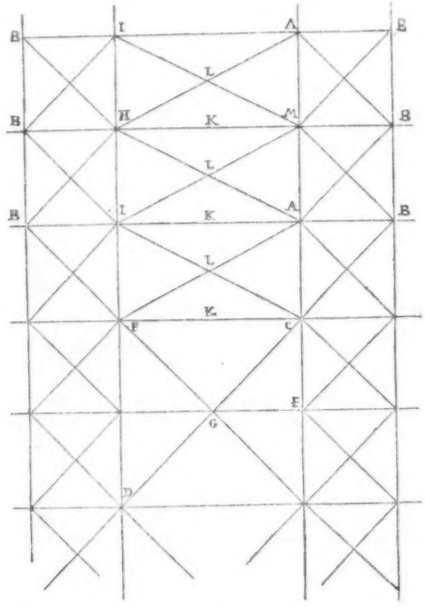


Fig. 99.

is because they could not procure monoliths ten metres high; they have taken the largest stones that they could find, varying between one and two metres, while the piers *C* are built in courses from fifty to sixty centimetres high.

At Amiens, theory and practice have conquered the difficulties presented by the building of a nave fifteen metres wide, from axis to axis of the piers, by 42.50 metres of height under the key, and flanked by aisles seven metres wide by nineteen metres high under their key.

This vast construction has kept its position, and the movements which must necessarily have taken place in so extensive a building have not been able to alter its solidity.

Then architects had given up crossed vaults having two compartments; for, wishing to distribute the thrusts equally among the points of support, separating these compartments, they had adopted since 1220, oblong vaults with pointed arches, in accordance with the plan, (Fig 99). This was more logical, for the piers *A*, *M*, *I*, *H*, were equal, and the supports *B* all alike, and the flying-buttresses of the same strength.

The builders were now coming to formulas: their artistic feelings must have been shocked by these vaults crossed over double compartments, and appearing to throw their weight upon alternate piers, and whose pointed arches *C D*, by their inclination, had concealed the windows cut from *C* to *E* under the wall-arches.

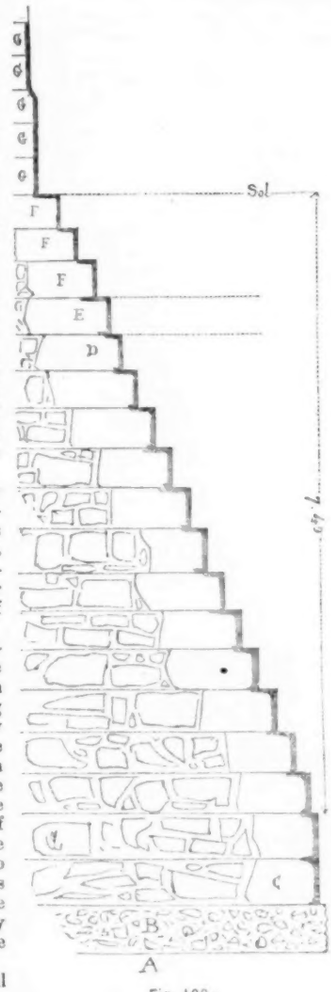


Fig. 100.

Furthermore, as we have already said, these pointed arches, having a diameter *C D*, very long in comparison with the diameters of the transverse arches *C F*, obliged them to raise the keys *G* considerably; which interfered with the laying of the tie-beams of the timbers, or necessitated considerable raising of the copings of the wall-arches *C E*.

In building the vaults with pointed arches in compartments, the pointed arches *A H* being semicircular, it was easy to keep the keys *L* of these pointed arches from rising above the level of the keys *K* of the transverse arches *A I*, and *M H*, which were in tierce-point.

Our readers are now able, we believe, to understand in general, as well as in detail, the building of a large church in the thirteenth century, such as, for example, the Cathedral of Beauvais.

In order to avoid repetition, and to gather up the scattered methods of which we have just been giving an idea, we shall follow step by step, one of those great constructions from the foundation even to the timbers of the roof. If we choose the Cathedral of Beauvais, it is not because that edifice is perfect as to execution, but because it is the truest and most absolute embodiment of the theory of the builder at the middle of the thirteenth century.

Part of this edifice fell down less than a century after the completion of the choir; and yet it was designed in such a way as to enable it to stand for centuries. This disaster which has completely altered its character, was due to indifferent execution, the lack of rigid supports, or their too slight resistance, and especially to the nature of the materials which were neither large nor solid enough. If the architect of the choir at Beauvais had possessed the materials of Burgundy, those used at Dijon, and Semur, for instance, the excellent lime-stones of Chatillon-sur-Seine, or yet the stone of Montbard, of Anstrude, or of Dornecy, or even as might have been possible, the stone of Laversine, of Crouy, and of certain hard ledges in the valleys of the Oise, or of the Aisne, the choir of Beauvais would have remained standing.

The master-builder at Beauvais was a man of genius, who wished to reach the utmost limits possible in the use of building-stone; his plans were correct, his arrangements profoundly learned, and his conception admirable; but he was badly seconded by his workmen, and the materials at his disposal were insufficient. His work is none the less a very valuable subject for study, since it furnishes us with the means of learning the results which the thirteenth century method of construction could reach. We have given in the article "*Cathedral*" (Fig.

22), the plan of the choir of Beauvais. This plan, if compared with that of the Cathedral of Amiens, shows that the two parallel compartments near the piers of the transept are narrower than the two following; the builder thus avoided too active thrusts upon the two piers of the transepts forming an entrance to the choir. As to the two following compartments, they are usually wide, almost 9 metres from axis to axis of the piers. The need of giving free spaces is so evident at Beauvais, that the piers of the circular space are not joined by pillars at the sides to receive the archivolts, but only in the manner of radii of the apse, to receive the groins of the great vaults, and the transverse and pointed arches of the aisle.

In conformity with the method of the builders of that period, when they are not led aside from their theory by questions of economy, the foundations of the choir is admirably built. The chapels rest upon a solid circular masonry, covered by facing-stones, as in the Cathedral of Amiens, and presenting on the outside a strong water-table, likewise faced in large stones, carefully dressed, and set in thick beds of mortar. This base of solid masonry is connected with the wall supporting the detached piers of the chancel by radiating walls under ground.

In the Cathedral of Amiens, wherever we have been able to examine the foundations clear to the bottom, we have found, on the outside, the profile, Figure 100.

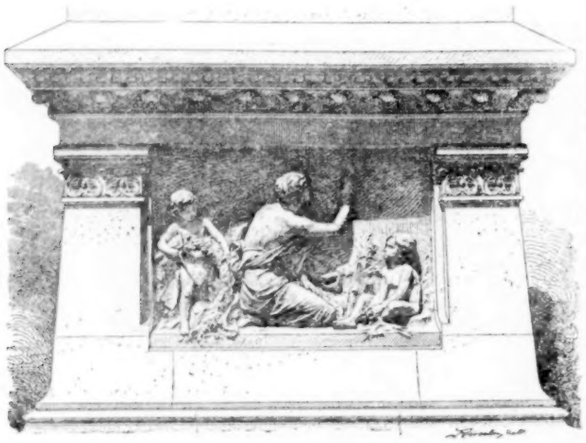
At *A* is a course of clay, 40 centimetres thick, set upon the natural clay. At *B*, is a bed of concrete 40 centimetres thick; next, from *C* to *D* 14 courses from 30 to 40 centimetres thick, each of stone obtained from the quarries of Blavelincourt, near Amiens.

This stone is a mixture of chalk and silica, and very strong, so that it can be cut out in large pieces. Above this we find a course *E* of stone from Croissy, then three courses of sandstone under the outer earth. Above the ground level, the whole building rests upon six more courses of sandstone, well faced and of extreme hardness. Behind the facings of the foundation is a mass of large fragments of silex stone from Blavelincourt and Croissy, sunk in a very hard and well made mortar. It is upon this artificial rock that the immense cathedral rests. For Notre Dame at Paris the foundations are likewise built with the greatest care and faced in strong ashlar of great thickness, the whole resting upon solid soil — that is, upon the lower sand of the Seine, which is in large grains of a greenish color. As for the piles which people pretend exist under the masonry of most of our great cathedrals, we have never found any traces of them.[1]

Now let us return to Notre Dame of Beauvais.

(To be continued.)

ARTISTIC PROPERTY IN EUROPE, PARTICULARLY IN REGARD TO ARCHITECTURE.



From the Tomb of Mme. Paulin Talabot. From *La Construction Moderne.*

AT Milan has been held, by invitation of the International Literary and Artistic Association, which has its ordinary headquarters at Paris, an International Artistic Congress, in which many notabilities have taken part from all countries, and particularly from France and Italy. The proceedings of this Congress have so much importance, on account both of the object with which they were concerned and the authority of the persons who took part in them, that your journal can do no less than give some account of them to its readers.

From the nature of your periodical, you do not occupy yourselves with the literary questions, or with those particularly concerned with literature, which were brought under discussion in the Congress of Milan. You limit yourselves simply to the mention of those which relate to artistic property, and more especially to architecture.

The property of artists in their works is a question which is now actively discussed in all the countries of Europe, in France as well as in Italy, in Russia, as in Spain, in Germany and in England. Legislation in Europe on this question progresses uncertainly, and it is for this reason that the study of the subject is pursued in the abstract field of public discussion, in which measures are matured which are incorporated later in the laws of States.

The International Literary and Artistic Association, which, with the Italian Society of Authors, whose seat is at Milan, organized the present Congress (the fourteenth session), was so prudent as to confide to the distinguished advocate, Albert Vaunois, of the Court of Appeals at Paris, the duty of preparing an extended report on the vital question of artistic property in general; and M. Vaunois, having accepted the commission, considered the question entrusted to him in all its various aspects.

He divided his study under the following heads: I. The Alienation of Works of Art, with the respective rights of the author and the purchaser. II. The Usurpation of the Name, and Imitation of the Signature of the Artist. As you will see, the subject, in its general lines, could not be better presented than in this way. You will observe that M. Vaunois, after developing with much sagacity the different points of his essay, and explaining with logical and just reasoning the gravity of the question which he was preparing for the discussion of the Congress, drew a comparative picture of the state of European legislation upon each one of these two questions. The two comparative pictures are too important, and too interesting for your readers, not to describe them to you. Here is one: A considerable number of statutes admit that, in case of alienation of a work of art, the right of reproduction remains with the artist. So it is in Germany, by the law of January 9, 1876, Article 8 (except that in case of a portrait the right passes to the person who gave the commission); so in Belgium, by law of March 22, 1886, Article 19; in Denmark, by law of March 31, 1864, Article 9; in Hungary, by laws of 1884, Article 64 (with the same restriction as in Germany in regard to busts and portraits); in Italy, by the decree of September 19, 1882, Article 18; in Mexico, under the Civil Code of 1871, Article 1313; in Norway, by the law of May 12, 1877, Article 6; in Sweden, by the law of May 3, 1867, Article 3; in Switzerland, by law of April 23, 1883, Article 5 (exception being made of architectural designs); in Venezuela, by law of May 12, 1887, Article 9.

The statutes favorable to the purchaser are, on the other hand, those of the following countries: Austria, by the law of October 19, 1846, Article 11; Colombia, law of October 26, 1886, Article 62; Great Britain, law of July 29, 1862, Article 1. In this category should be included France, where the statute law is mute, but the view of jurisprudence appears to have been defined in a decision of the Cour de Cassation, May 27, 1842:

"In view of these facts, and in order to secure uniformity of legislation, it is necessary," said M. Vaunois, "to protest against laws unfavorable to artists." With this intention, he proposed to the Congress to vote the following order of the day: "The alienation of a work of art does not signify, in itself, the alienation of the right of reproduction." This vote came from the Milan Congress thus changed: "It is desirable that it should be stipulated in the declaration of the Union for the Rights of Authors that the alienation of a work of art does not involve, in itself, the alienation of the right of reproduction, which remains the property of the artist, without, however, entitling the latter to injure the purchaser of the work in his rights as owner."

To me, the less rigid vote proposed by M. Vaunois appears more just than logical. In regard to the usurpation of the name and the imitation of the signature of the artist, the Congress made no amendment to the order of the day proposed by M. Vaunois. Here, as before, noting the necessity for coming to a uniformity of legislation on the important question of the forgery of signatures in works of art, the distinguished advocate mentioned the differences which exist in the laws, and in the application of penalties to persons guilty of fraud in works of art. Certain recent laws on the rights of authors have adopted, according to M. Vaunois, the only admissible solution of such a question, by making a special offence of the usurpation of the name, and imitation of the signature. Belgium, by Article 25 of the law of March 22, 1886, condemns to imprisonment for a term of from three months to two years, and to a fine of 100 to 2,000 francs, persons guilty of this offence. In Japan, an imperial ordinance of December 28, 1887, Article 21, attached to it the penalties of counterfeiting; in Luxembourg, the Penal Code of 1879, Article 195, gives one of six months in prison; Monaco, by ordinance of February 27, 1889, Article 18, assimilates it to counterfeiting; Switzerland, by the Federal law of April 22, 1883, Article 13, imposes imprisonment, which may extend to one year, or a fine; Tunis, law of June 15, 1889, Article 9, gives prison for from three months to two years, and a fine of from 100 to 2,000 piastres, while, even in France, no precise or rational legislation exists on the subject. Therefore, M. Vaunois proposed the following order of the day, which the Congress adopted by a great majority of votes:

"The usurpation of the name of an artist, or the fraudulent imitation of his signature, or of any other distinctive seal, monogram or other mark adopted by him, is a crime, and should be punished by the criminal laws. Those who knowingly sell, expose for sale, keep

[1] It is with these piles, at Notre Dame at Paris and at Notre Dame at Amiens, as with so many other fables that have been repeated for centuries about the building of Gothic edifices. It would be impossible to build a great cathedral on piles. These edifices can be founded only upon broad bases; the loads being very unequal in height, the first condition of stability is to find a perfectly homogeneous and resistant mass under ground.

in their warerooms or introduce into the national territory objects with names, seals or signatures forged as noted above, should be punished as accomplices in the crime."

The punishment proposed is severe, even for the dealers in artistic works; but it does not follow that it is not just.

Let us now come to the question of architecture. It is obvious that architecture and all the decorative arts are concerned in the preceding questions; and in whatever way a picture or engraving may be treated, in the same way may be treated an architectural design, or plan, or ornamental composition.

The architectural questions proposed for the discussion of the International Congress at Milan were two in number. Both of them were assigned for consideration and report to the advocate George Harmand, who, in one, was assisted by the French architect Charles Lucas, the Secretary of the Association for Mutual Defence among the French architects.

Naturally, the report on the subject was written and delivered in the public session of the Congress by Mr. Harmand himself. The questions assigned to him for consideration were as follows:

"Artistic property in the material of architecture. (I) The existence of a right of architects to artistic proprietorship. (II) The modifications which should be made in the Convention of Berne in regard to architecture."

The second question was brought into discussion before the first. To understand it well, it is necessary to remember that in the enumeration of artistic works which were taken under the protection of the Convention of Berne, the fourth article of the third paragraph comprehended only works of design, of painting, sculpture and engraving; only in the fifth paragraph is mention made of designs, sketches and models relating to architecture, but these are classed with those of geography and topography, and scientific diagrams in general.

It is easy to understand, now, the reason for the question which was discussed at Milan, and which was nothing else than an echo of the one which was proposed to the Congress of Neuchâtel the year before; and it is natural, in consequence, that the resolution should have reached a vote at Milan, in connection with the following order of the day, which was proposed by the advocate Harmand. The order, as proposed, was: "It is desirable that, in Paragraph 3 of Article 4 of the Convention of Berne[1] works of architecture should be classified among the artistic works defended." M. Harmand would have wished that the clause "and that they should be mentioned immediately after works of sculpture," might be added. This clause, reasonable in itself, was regarded as superfluous, the important point being to assert distinctly the right of architectural designs to be classified among artistic designs, and in certain cases, among geographical maps and plans, as they were by the Convention of Berne, which was modified in the way which I have indicated to you.

Now for the other question: "Of the existence of the right of architects to artistic property"—a question, certainly, of the greatest importance, which the advocate Harmand explained at every point with much detail and great clearness, so that, if he erred at all, it was in wishing to develop too minutely his argument. But this is a case where the maxim applies "*quod abundat non vitiat.*"

He considered, therefore, the question in its general aspect, and then made an examination of the relations of architects to the State, relatively to the reproduction of works of design and construction. You will please note well this distinction, which appears to me very important. He discussed next the relations of owners and architects, in relation to the right of reproduction of works designed and constructed; and treated, moreover, the right of the architect to control the execution of works designed or constructed by him. He then read the various resolutions which he had prepared as follows:

"1. The architect ought to enjoy the same rights of artistic property as the painter, the sculptor and other artists, and it is desirable that all the legislation of the States of the globe should recognize these rights.

"2. It is desirable that in laws which recognize these rights, the architect should be released from all legal implications by which he is deprived of the privilege of reserving for himself the enjoyment of the said rights; and that it should be made the duty of the purchaser to stipulate, if he wishes, the rights which he intends to acquire beyond the possession of the executed work.

"3. The architect ought to retain, especially, the right of reproduction by the proprietor of the architectural designs which he has carried out; and nothing but the enjoyment of the artistic portion of the architect's design should pass to the proprietor who holds the absolute ownership of the edifice constructed from it.

"4. The architect who has made architectural designs, or who has imagined designs which have not yet been carried out, should have the right to control his designs.

"5. If it should not be conceded that, in works executed for the State, the architect remains proprietor of the right of reproduction, it is desirable that the sale of reproductions of such designs should take place under the supervision of the State, and that the product of such sale, derived, as it is, from the appropriation of the author's right, should be paid either into the fund for the support of museums, or that of some charitable establishment."

All these resolutions were illustrated and justified by Mr. Harmand with ample arguments, which gave occasion for a lively discussion, in which arose at last, brought up by M. Oppert, a distinguished Orientalist, and member of the Institute of France, the eternal question of the greater or less claim which architects have to be inscribed among artists, rather than among men of science. This question, raised for the thousandth time by M. Oppert, a nervous, little old man, unable to stand still a minute, was rejected as inopportune, really because it had already been substantially decided by us in favor of the architect-artist; and particularly because, in the discussion of the day before, on the amendments proposed to the Convention of Berne, it had been answered in the sense opposite to that which M. Oppert wished for. On that day it was voted to demand that architectural designs should be enumerated among the artistic works taken under the protection of the Convention of Berne, and assimilated to works of painting, sculpture and engraving; and it was obviously useless now to return to the discussion of what the Congress had implicitly admitted, or better, earnestly demanded.

Thus, in consequence of such deliberations, M. Harmand should have withdrawn from discussion his resolutions, which, in substance, amounted to a demand for what had been already asked for and voted the day before, with the decision that works of architecture should be equalized with works of sculpture, painting and engraving.

The resolution, I do not deny, is extremely important, inasmuch as it goes even beyond the principle from which it is derived. In fact, through the jurists, the artists and men of letters of the International Congress of Milan, it signifies that the architect is an artist, who needs, however, to clothe his thoughts, the forms which science offers him, and it does not mean that, by this circumstance, he is not, and does not remain, an artist.

If, therefore, the resolutions of M. Harmand were not adopted one by one, the general substance of them — that is, the spirit which inspired them — was, as you have seen, admitted. Moreover, the report could not have been more filled with facts, nor the oral explanation more rich in arguments.

Among other things, M. Harmand, noting that in France the law adopts an irrational system, by which the artist, in selling his work without reserve, transfers to the purchaser the full and absolute ownership of the thing sold, with all accessories, rights and advantages, observed that this rule had been adopted recently in connection with the Eiffel Tower, and cited a decision given by the civil tribunal of the Seine, April 18, 1889, and confirmed by the Court of Paris, August 7, 1889. The decision is as follows: "Considering," said the tribunal, "that the architect is at liberty to convey all the rights that the law of 1793 concedes to the authors of artistic and literary works, and particularly the right of reproduction, it is certain that the conveyance of a work of this kind (the Eiffel Tower) transfers to the purchaser the entire property in the work, and, in consequence, the right of reproduction."

This decision appears to me quite unjust, as it did to M. Harmand, for a distinction ought to be made between material and artistic proprietorship; that is, between the right to possess the marble or the canvas, and the right to reproduce the idea or the composition represented in this canvas or this marble. Such a difference, to my mind, is equally applicable to architecture, and it may be hoped that it will come to be admitted by the tribunals as being founded in logic and justice.

But, on the present question, ideas in Europe are very various. In England, for example, the legislation, as M. Harmand observed, has not considered the rights of the architect. In 1875, an English commission rejected the resolution of protection presented, in the name of the architects, by Mr. Barry, President of the Royal Institute of British Architects, and so, also, among you, in the United States, the law does not recognize the rights of architects. In Russia, on the other hand, it does, provided the author registers his design. In Germany it does not, but in Sweden the architect's work is protected, so far as reproduction is concerned, by means of a stamp; and so on. The remainder of the list shows great diversity in the treatment of the rights of architects, a diversity which the resolutions of the International Congress of Milan are intended to cause to disappear, assimilating the architectural legislation of the two worlds to the principles of equity which reason indicates, and which the law of nations will finally make prevail.[2]

ALFREDO MELANI.

THE LIFE OF IRON BRIDGES. — The life of iron railway bridges is reported not to exceed 75 years. In many instances a shorter period of use renders them unsafe. This conclusion is the result of special investigation instituted by European Governments to determine the durability of railway bridges. Nothing has ever been discovered which, in point of durability, is superior to good, solid masonry for bridges. — *Invention.*

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[1] It may be mentioned, for the benefit of those who are unacquainted with it, that in the Convention of Berne, Article 4, the expression, works "literary and artistic," comprises: 1. Books or all other writings; 2. Dramatic or dramatic-musical works, and musical compositions without words; 3. Works of design, of painting, sculpture and engraving; 4. Lithographs, illustrations, geographical maps; 5. Designs, sketches, and works in relief relating to geography, topography, architecture and the sciences in general; 6. Finally, every reproduction of any literary, scientific or artistic work whatever, which may have been published by any mode of printing or other process of reproduction.

[2] Our colleague in Paris, the architect, Charles Lucas, not being able to be present at the Congress of Milan, sent an excellent historical study about the "Signature of Works of Architecture," from which it is evident that this right, so far as architecture is concerned, is very ancient, extending from the time of the building of the palaces of Chaldea to that of the new Hôtel de Ville of Paris; that is, through a period of about five thousand years.

THE ARCHITECTURAL EXHIBIT AT THE WORLD'S FAIR.

IT is much desired that the Architectural Exhibit from Massachusetts at the World's Columbian Exhibition should be fully representative and of the best character. For that reason it is urged by the Committee that architects contribute fully, and that they send their best work.

It is suggested that drawings or photographs shall be framed in ivory-white, and with mats; and that small drawings shall be grouped in large frames.

Photographs shall be of actual work.

No blue-prints will be accepted.

All contributions must be sent to the Mechanics' Building, Huntington Avenue, Boston, during the week from January 2 to January 7, 1893, inclusive.

A collection of drawings in Boston will be made from January 2 to January 7, 1893, upon notification being sent to Mr. Frederic P. Vinton, Secretary, 309 Sears Building.

All drawings are at the risk of the contributors.

Edward C. Cabot,
Edmund M. Wheelwright,
C. Howard Walker.

Committee upon Architectural Exhibit for Massachusetts.

WORLD'S COLUMBIAN EXPOSITION.

Office of the Advisory Committee on Fine Arts for the State of Massachusetts.
Frederic P. Vinton, *Secretary.*

Office of the Massachusetts Board of Managers,
World's Columbian Exposition,
309 Sears Building, Boston.

The Department of Fine Arts of the World's Columbian Exposition will open in Chicago, May 1, and will close October 30, 1893.

The Advisory Committee for the State of Massachusetts will receive all works of art intended for the Exposition, at the Massachusetts Charitable Mechanics' Association Building, on Huntington Avenue, Boston, from January 2 to January 7, 1893, inclusive, after which time no works will be admitted.

Lists must be sent to the Secretary, Frederic P. Vinton, office of the Massachusetts Commission, World's Columbian Exposition, 309 Sears Building, Boston, before December 20.

The Committee will collect exhibits, within the limits of the City of Boston, from January 2 to 7, inclusive. These will be received without packing-cases. Works sent in from outside the city limits must be forwarded in boxes direct to the Mechanics' Association Building, and the freight or express charges prepaid by the exhibitor.

The retrospective group will be collected and placed in the Museum of Fine Arts.

The paintings and all art work, of whatever nature, will be insured while in charge of the Advisory Committee; but the Committee will assume no other risks.

The Committee has received the guaranty that the expenses connected with the reception, selection, transportation and insurance of all accepted works of art will be covered by adequate State appropriation.

Rejected works not removed from the Mechanics' Association Building within one week after the decision of the jury — of which due notice will be given to exhibitors — will be stored at the risk and cost of the owners.

Those who have already sent lists to the Secretary, and in duplicate to the Department in Chicago, need send no other, but forward their works as above directed.

Exhibitors will please note on blanks amount of insurance desired.

TO AMERICAN ARTISTS.

"The position held in this Exposition by our artists, as compared with the artists of other nationalities, will have much to do with determining the general estimation of our art by our own countrymen as well as by our foreign visitors, for many years to come. It is, therefore, of the highest importance to every American engaged in artistic pursuits that the exhibit of American art work be of the highest quality obtainable; that each example shown represent the highest achievement of the artist, and that the collection, as a whole, present in a dignified manner the best productions of our native art."

J. J. Enneking, *Chairman.*
Frederic P. Vinton, *Secretary.*
Edmund C. Tarbell.
Thomas Allen.
I. M. Gaugengigl.
Daniel C. French.

Advisory Committee.

EXTRACTS FROM THE GENERAL REGULATIONS OF THE ART DEPARTMENT.

Works of art approved by the Jury of Selection will be admitted for exhibition, whether previously exhibited or not.

No charge will be made for space.

The installation of Works of Art admitted to the Exposition will be under the supervision of the Chief of the Department of Fine Arts, and such assistants as he may appoint.

On the back of each picture-frame should be attached a label, giving the name of the artist, his address, the title of the work, the price, if for sale, and the name and address of the exhibitor.

All round or oval pictures should be placed in square frames. Excessive breadths in frames or projecting mouldings should be avoided. Shadow boxes must not project more than one inch beyond the frame. Glass over oil paintings will be allowed only by permission.

Works of art intended for sale will be so designated in the Official Catalogue.

Works intended for competition must be so designated by the exhibitor, or they will be excluded from examination by the jury.

Artists will not be privileged to send works direct to the Exposition.

No works by American artists intended for the Department of Fine Arts will be admitted to the Exposition grounds except such as bear the stamp of approval of the jury of that section to which the artist belongs, except works by American artists owned in this country, which may be submitted to the jury located nearest the place of residence of such owner — in such case, they must bear the stamp of the approval of this latter jury.

Works owned by individuals will not be received for exhibition in the Art Department should the artists who have produced them object to their exhibition.

There must be attached to the outside and inside of each package a label, giving the name and address of the exhibitor, and the title and number of articles in the package. Cases containing pictures should have the name and address of the exhibitor on the outside and inside of the cover; also, on the inside of the case should be marked the number of pictures, and title of each. On the stretcher-frame of each picture and also on the back of the picture-frame there should be attached a label, giving the name of the artist, the title, the price, if for sale, and the name and address of the exhibitor.

N. B. — These blanks are sent in duplicate. Artists residing in New York, Pennsylvania or Massachusetts will please fill out and send one copy to the Secretary of the Advisory Committee at New York, Philadelphia or Boston, and one copy to the Chief of the Department of Fine Arts, World's Columbian Exposition, Chicago.

Artists living in other States will please fill out and send both copies to the Chief of the Department of Fine Arts, World's Columbian Exposition, Chicago.

American artists residing in Europe should fill out and send one copy of this blank to their nearest Advisory Committee and the other copy to the Chief of the Department of Fine Arts, World's Columbian Exposition, Chicago.

LIBRARY ARCHITECTURE.

The American Library Association is preparing an exhibit for the World's Columbian Exposition at Chicago, under the auspices of the United States Bureau of Education. A prominent position in the exhibit is to be assigned to Library Architecture. The purpose of this department will be twofold. On the popular side, it will serve to call public attention to the architectural importance and significance of libraries; and to suggest to communities and to individuals the erection of library buildings. For this purpose large and effective exterior views or models are particularly desired. On the professional and technical side, it is intended to show the development and present state of library science, as regards the adaptation of the building and its equipment to the practical purposes of a library. In this direction more importance attaches to floor plans, sections and interior details than to exteriors.

Trustees, librarians and architects are invited to send for exhibition drawings or photographs of existing or proposed library buildings or rooms, whether built for the purpose or altered from premises intended for other use. While it is earnestly desired that the large modern libraries should send full sets of plans, it is equally to be hoped that the older and smaller libraries will contribute; for most of the libraries of the future which will derive benefit from this exhibit will be of moderate size and means.

Librarians and trustees are asked to send, with their plans, suggestions as to merits or defects which have been developed in use.

Architects who are preparing plans for library buildings, or who have submitted plans in recent competitions, are invited and urged to send them for exhibition, inasmuch as any carefully matured plan, even if not adopted, may contain features of practical interest to librarians.

If plans are prepared expressly for this exhibition, it is recommended that they be made on a scale of one-eighth inch to the foot, and rendered with India ink. The largest frames on which the plans are to be displayed will be twenty-eight inches high by forty inches wide, so that plans should not exceed that size. Many of the frames will be only twenty-two by twenty-eight inches, and this size of plan is preferred by the Bureau of Education.

The plans and models contributed will be arranged and displayed as effectively as the available space will permit. After the Exposition, they are to form part of a permanent library exhibit. If the contributors are unwilling to part with their drawings for this purpose, it is hoped that photographic copies may be permitted.

The Library Association of the United Kingdom has promised thirty or more representative plans of English and Scotch library buildings, and if the American collection can be made thorough and representative, the combined exhibit will not only be very useful to those interested in library administration, but it may also serve to stimulate and encourage the building of libraries in all parts of the United States.

Notification of willingness to send plans should be sent at once, and the plans should be forwarded (flat) as early as possible, to C. C. SOULE, 15½ Beacon Street, Boston, Mass.

For the Exposition Committee of the American Library Association.

CHARLES C. SOULE,
Trustee, Brookline Public Library,
SAMUEL S. GREEN,
Librarian, Worcester Public Library,
GEORGE W. HARRIS,
Librarian, Cornell University,
Sub-Committee on Architecture.

PHILADELPHIA'S WATER-SUPPLY.

Designed by Daniel Marot. From *Der Formenschatz.*

FIRE AND WATER reprints from the recently issued report of chief of Bureau of Water, J. L. Ogden, for 1891, the following:

The total number of gallons consumed was 54,678,916,408, a daily average of 149,805,250, which is a per capita consumption of 140 gallons on an estimated population of 1,071,672. This is an increase of nine gallons over the year before, and of 40 gallons since 1888.

Some experiments have been made for the purpose of accounting for this increase, one in the centre of the city and two in manufacturing districts.

The first selected was the square between Broad and Thirteenth and Walnut and Spruce Streets, which was isolated by closing the necessary stops at Juniper and Walnut Streets, where the water passed through a 6-inch meter.

A house-to-house inspection was first made for leaks. Three spigots were found wasting some water, and they were repaired. No other leaks could be detected. All of the houses were supplied with curb stops to shut off the water.

This district contained 131 buildings, as follows:

Dwellings	104	Library	1
Dwellings and stores	3	College	1
Dwellings and stables	2	Theatres	2
Stables	12	School	1
Stores	3	Club-house	1
Historical society	1	Total	131

Population 794

There were no manufacturing establishments, and the appliances for the use of water were as follows:

Hydrants	96	Water-closets, with handle	41
Wash-paves	71	Water-closets, in yard	16
Spigots, kitchen	384	Water-closets, flush tank	134
Spigots, bath-tubs	244	Urinals	13
Spigots, wash-tubs	12	Urinals, stalls	5
Spigots, wash-stands	255	Motor	1
Spigots, in cellars	38	Beer-pump	1
Spigots, in bar-room	3	Ice-cooler	1
Spigots, fire-hose	19	Steam-boilers	2
Spigots, pantry	74		

The water rents amount to $2,335.55.

Readings of the meter made every hour from November 4 to 18, inclusive, showed an average daily consumption of 89,760 gallons, equal to 113 per capita.

Forty-one and four-tenths per cent were used between 6 P. M., and 6 A. M., and 48.6 per cent, between 6 A. M. and 6 P. M., or

Between 6 P. M and 12 P. M.	28.1	gallons per capita.
Between 12 P. M. and 6 A. M.	18.7	" " "
Between 6 A. M. and 12 M.	33	" " "
Between 12 M. and 6 P. M.	33.2	" " "
Total	113.	" " "

It was at first supposed that on account of the large amount of water passing through the meter between 12 P. M. and 6 A. M., there were some leaky pipes, but none could be discovered.

Three urinals and five urinal-stalls were found to be constantly running. It was not practicable to measure the water used by them, but by metering similar appliances, under similar conditions, an approximation was made. It is certain that they use not less than 42,450 gallons daily, one-fourth of which is within 3,926 gallons of the total used between 12 P. M. and 6 A. M.

In addition to the above there were eight siphon-urinals running constantly, but the amount of water they use has not yet been ascertained.

		Gallons.
Average consumption, 794 people, 24 hours		89,760
Three urinals	3,450 gallons.	
Five stalls	40,000 gallons	43,450
		46,310

This amount represents a consumption per capita of 58 gallons, exclusive of the water used by the urinals. By the constant running of these appliances nearly 50 per cent of the water used passes through them.

By experiment it was found that the least amount of water that can be used to effectually wash urinals with the water running constantly, is 1,150 gallons daily, or 419,750 gallons yearly, which at meter rate amounts to $33.58. The rent now charged is $2.

Running at full capacity, as some do, they would each use annually about $179.85 worth of water at meter rates.

The examination of this locality will be continued with the assistance of a Deacon waste-water meter.

Similar examinations should be made over the entire city. Much waste could be prevented, but this experiment shows that the largest proportion of the waste is legalized through appliances that of necessity use a large amount of water. The only check that can be put on them is a meter, which will either make payment for the water used, or compel the shutting off of the water when the use of the appliance is not required.

The second experiment was made by placing meters on the mains supplying a large manufacturing establishment in the Twenty-eighth Ward. During the first eight days the water passed through the meters at the rate of 600,000 gallons per day, or 219,000,000 per annum. The water was delivered under 140 pounds pressure from the Roxborough reservoir.

The water pumped at Roxborough supplies Manayunk, Falls Village, Chestnut Hill, Germantown and Tioga, the total for the entire year being 3,745,192,134 gallons.

It will thus be seen that one-seventeenth of all of the water pumped at this station was used by this one establishment, which should pay by meter rate the sum of $17,520 annually. The amount charged by assessments is but $1,792.

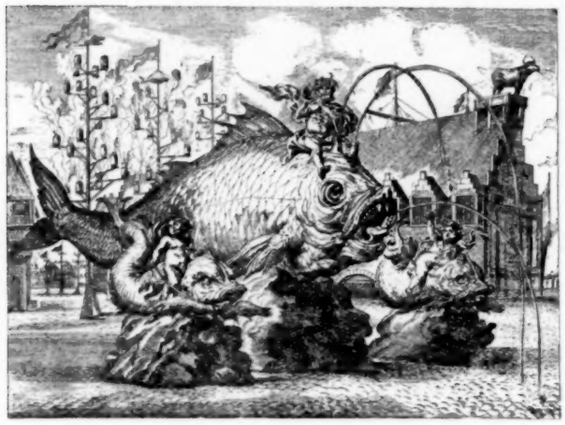
The third experiment was made in a manufacturing district in the Thirty-first Ward, which contained:

Dwelling-houses	200	Church	1
Manufacturing establishments	13	Slaughter-house	1
Dye-houses	7	Offices	2
Stables	5	Saloon	1
Stores	2		

The resident population was 849, and the transient population employed in the mills and dye-houses numbered 1,723.

The water consumed amounts to 1,292,544 gallons daily, or 1,422 gallons per capita of resident population. These investigations were only preliminary, and to obtain experimentally some idea of the best manner of conducting further examinations throughout the entire city for the purpose of stopping waste and reducing the per capita consumption and for increasing the revenue of the city from water-rents.

ABOLITION OF LONDON FOGS.



Decoration for a Triumphal Entry: designed by Gaspard de Crayer. From *Der Formenschatz.*

IN the *Contemporary Review* for November is an important paper by Mr. B. H. Thwaite which merits investigation by the London County Council and other authorities, as well as by inhabitants of the metropolis. The title is "London Fog: a scheme to abolish it." Mr. Thwaite suggests that the example of Pittsburgh should be followed and fuel-gas substituted for coal. He says:

In the thriving States of Pennsylvania and Ohio nature has illustrated the ideal method of obtaining heat for the benefit of mankind. There the gaseous hydrocarbon is distilled by the internal heat of the earth from bituminous coal or from naphtha deposits in enormous volumes and at high pressures, and is led for distances of seventy miles and upwards to cities and villages, where it is used for household and industrial purposes. The distributing mains are already nearly 3,000 miles in length. The use of this natural combustible gas in Pittsburgh, once a town with a smoke cloud, has resulted in the clearing of the atmosphere, and has brightened the conditions of life. On the exhaustion of the natural supply artificial fuel-gas will be used. Pittsburgh realizes the household economy which gaseous fuel makes possible.

If we are to follow the example of Pittsburgh, gas must be the fuel used in all London fire-grates. Establishing the system would involve the erection of plant for the conversion of a great part of the 9,000,000 tons of coal into a gaseous condition. The present plant of the London gas-companies is capable, at high pressure, of converting some 15,000,000 tons. With the extension of the electric light, a great part of this plant would be available for the production of heating-gas. Writing in the *Standard*, Mr. James Knowles proposed that the additional gas-producing plant should be set down outside the boundaries of London. Lecturing at Manchester, at Sheffield and at Halifax, I have suggested that the gas-generating stations should be established in the centre of the coal-fields of South Yorkshire, Staffordshire and South Wales. The gas generated there would be conducted to the metropolis through high-pressure mains. The plan, I think, is sound. If it were adopted the double journey of the coal-trucks would be rendered unnecessary, there would be no cartage, no middlemen's or merchant's profits, no loss of coal in transit, no reduction of the value of the coal by exposure to various atmospheres.

Let us examine the items of the cost that would be avoided by carrying out the suggestion I have made. I deal with 9,000,000 tons of coal already spoken of.

The cost of transmitting by rail 9,000,000 tons of coal an average distance of 100 miles, at .838*d.* a mile....	£3,142,500
The profit of middlemen and carters is estimated at 2*s.* a ton.....	900,000
The profit of merchants at 1*s.* a ton.....	450,000
	£4,492,500

These figures explain the heavy cost of coal in the metropolis. The value of the 9,000,000 tons of fuel at the mouth of the pit would be not more than 2,250,000*l.*; but the price in London increases the value to nearly 7,000,000*l.*

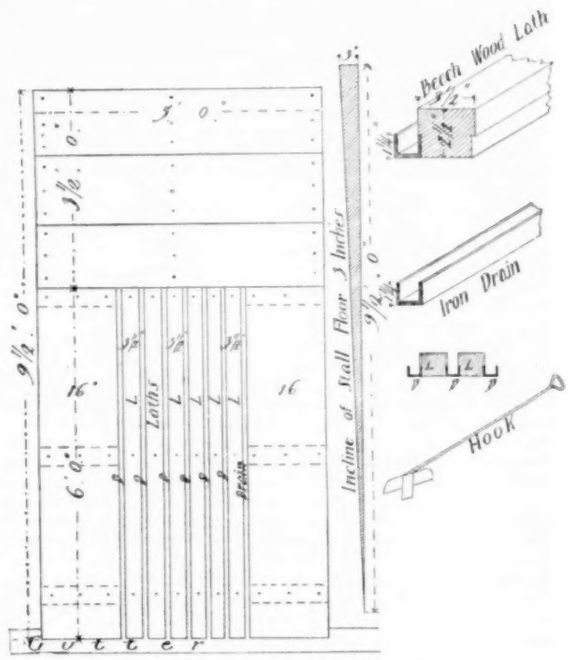
If my plan were adopted, all the proved arrangements in use in Pennsylvania for regulating the pressure and supply would be utilized. Near the metropolitan area, and at carefully-selected positions, containers, from which the local distributing mains would be fed, would be provided.

The cost, including that of the generating-plant and the distributing-mains, would probably not exceed 11,000,000*l.* The monetary value of the clear saving to the citizens of London may be summarized as follows:

By residuals and hydrocarbons.....	£495,000
By railway freight, portage and intermediate profits..	3,548,950
Total saving....	£4,043,950

This saving would enable fuel-gas to be delivered to metropolitan and suburban consumers at a price less than that of coal; and, after providing for a reasonable dividend on the cost of the plant and the mains, and for maintenance, it would leave a very large surplus for sanitary improvements, besides liquidating, in time, the cost of the London water-works. — *The Architect.*

STABLE-DRAINAGE.



IN the interest of horse-owners, as also to promote the health and well-being of our most useful and willing servants — our horses — and to keep away sickness from stables, I submit the following suggestions for the laying of stable floors:

A stall five feet wide and nine and a half feet long should be built as shown in the cut above.

Give 3½′ for front boards laid crossways and 6′ for the drains; if the under flooring is cemented, lay in three cross-beams of hardwood for the laths to be screwed to; put on both sides of the stall a plank 2″ thick, 16″ wide and 6′ long; the middle of the stall is left for the drainage. The laths ought to be of hardwood (beech-wood is best) and rabetted $\frac{3}{16}$″ for the iron drains to fit exactly under the laths, thereby preventing any escape of urine; these laths are 3½″ wide, 2½″ deep and 6′ long, screwed down to the under floor, with heads of screws sunk in. Between laths and drains put a layer of white lead.

The cast-iron drains are 1¼″ high, 1″ wide inside, about ⅛″ thick and 6′ long and are closed at upper end. Laths, drains and boards overreach the gutter behind the stalls by 1″.

The urine flows off through the iron drains into the general gutter behind the stalls and from these through the conduits to the sewer and are easily flushed out with water or cleaned with a hook.

This method of laying stable floors is not uncommon in Europe and has of late been introduced in the new stables built by the Lion Brewery, 9th Avenue and 108th Street, New York City, where it gives complete satisfaction.

It is a fact that about two-thirds of our horses are condemned to inhale during the whole night the health-destroying vapors of a rotting floor and bedding saturated with ammonia, in stables badly lighted, badly ventilated and worst of all badly drained, and this nuisance could be easily removed by simply breaking with the old custom of laying stall-floors.

The incline of the upper floor from head of stall to gutter should in no case be more than 3″, as standing on an inclined plane for hours and days hurts the loins and joints of the horse considerably.

Any improvement in this direction would be an act of mercy and

justice to our faithful servants, a saving to their owners by preserving the horses' health and usefulness, a saving in straw and harness and a benefit to the inhabitants living in the neighborhood of stables.

The cost for this kind of drainage is very little: for drains 6′ long about 50 cents apiece; for laths 6′ long about 10 cents apiece.

Any iron foundry will furnish such drains. EX-CAPTAIN.

SOCIETIES

THE SKETCH-CLUB OF NEW YORK. — MONTHLY MEETING AND EXHIBITION.

THE regular monthly meeting of the sketch-club was held at the rooms of the club, 47 West 42d Street, Saturday evening, December 3, 1892.

About fifty members were present, also several guests.

Mr. George De Forrest Brush, the well-known artist was the critic of the evening.

The drawings to be criticised were made to illustrate two verses of Scott's Cordon Castle. Mr. Brush, being an artist, confined himself to the composition and rendering of the drawings, going over each one carefully, pointing out their deficiencies and praising their good qualities. In awarding the places, he departed from the usual way of giving first, second, and so on, by giving three men first place, giving as his reason for so doing, that he had always noticed that a drawing marked first generally received all of the attention, while those marked less were pretty apt to be slighted, when perhaps they would have some qualities that were better than some in the one marked first.

The successful men were Messrs. Charles H. Israels, Edgar A. Jocelyn and J. Addison Johnson.

Mr. Brush's criticism was very much enjoyed by all present.

Drawings were handed in at this meeting for the Park Vase competition.

The first exhibition of the club was opened on Monday evening, December 5, with a reception to their friends.

The exhibition bids fair to be very successful. It deserves to be, as it is a very good one. Besides the Architectural Exhibit there are a great many sketches from nature, made by the members on summer sketching trips.

The club entertained the Kit Kat Klub Saturday evening, December 10, 1892. J. N. HUTCHINS,

Recording Secretary.

THE SOUTHERN CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS.

THE second annual convention of the Southern Chapter of the American Institute of Architects will convene at Birmingham, Alabama, January 10, 1893. All Southern architects are cordially invited to be present and any Fellows of the A. I. A. that may desire to attend. A. C. BRUCE, *President.*

THE ILLUSTRATIONS

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

HOUSES OF MRS. McCARTHY AND DR. WM. JARRACH, LEHMAN STREET, GERMANTOWN, PA. MR. LINDLEY JOHNSON, ARCHITECT, PHILADELPHIA, PA.

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

HOUSE OF GEORGE LOWTHER, ESQ., RIVERSIDE, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

HOUSE AT SCRANTON, PA. MR. E. G. W. DIETRICH, ARCHITECT, NEW YORK, N. Y.

HOUSES FOR THE NATIONAL HOME BUILDING COMPANY, BROOKLINE, MASS. MR. J. WILLIAMS BEAL, ARCHITECT, BOSTON, MASS.

HOUSE FOR MR. RATHBUN, BETHLEHEM, PA. MR. G. T. PEARSON, ARCHITECT, PHILADELPHIA, PA.

HOUSE OF LOUIS BERNERO, ESQ., ST. LOUIS, MO. MESSRS. BARNETT & HAYNES, ARCHITECTS, ST. LOUIS, MO.

HOUSE FOR W. S. QUIGLEY, ESQ., NEWPORT, DEL. MR. FRANK R. CARSWELL, ARCHITECT, WILMINGTON, DEL.

ROW OF HOUSES FOR ALFRED S. MOORE, ESQ., SAN FRANCISCO, CAL. MESSRS. POLK, POLK & POLK, ARCHITECTS, SAN FRANCISCO, CAL.

[Additional Illustrations in the International Edition.]

ARABIC DOORWAY AT ALGIERS, ALGERIA. AFTER A DRAWING BY M. BONCTON, ARCHITECT.

[Copper-plate Photogravure.]

PLAN OF THE PALAIS DU SENAT, BUCHAREST, ROUMANIA. M. MARCEL, ARCHITECT.

[Copper-plate Photogravure.]

TRANSVERSE SECTION OF THE PALAIS DU SENAT, BUCHAREST, ROUMANIA. M. MARCEL, ARCHITECT.

[Copper-plate Photogravure.]

DESIGN FOR TOP-LIGHTED CHURCH NEAR VICTORIA STREET, WESTMINSTER, ENG. MR. J. BELCHER, ARCHITECT.

BARRET-BROWNING MEMORIAL, LEDBURY, ENG. MESSRS. JOHN E. NEWBURY AND C. W. BAKER, ARCHITECTS, WESTMINSTER, ENG.

THIS design was submitted in competition last May. The site is rectangular and has a frontage of thirty feet in the Homend and thirty-six feet in Bye Street. The conditions required the clock-tower to be placed at the angle of the two streets, and the height to centre and diameter of clock face were given. The accommodation asked for and provided was: A public reading-room and small library on ground floor, two class-rooms, water-closet, and lavatory on first floor, rooms on upper floor for care-taker and cellar for fuel, etc. Stone stairs are arranged in the tower. The authors endeavored to design a building that should be in harmony with the picturesque old town which contains many interesting examples of timber houses. The tower and stonework of ground story were to be of a reddish sandstone, fifty tons of which could be quarried free. The remainder of facings under gables was to be of thin red bricks, to give scale to the building. The first floor, upper part of tower and gables were to be in timber framing, either fir treated with Stockholm tar, or if possible of oak, which would be merely left to bleach by exposure to the weather, the spaces between the timbers being filled in with "rough cast." The overhanging stories were expressly permitted in the conditions. The roofs, including those of the tower, were to be covered with hand-made tiles of a rich dark color. The stipulated cost, exclusive of clock and fittings, was 1,600*l.* After making a careful estimate, the prices being based on those given in the conditions, it was found that the work could be completed for this sum.

ANDERNACH-ON-THE-RHINE.

COMMUNICATIONS

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

A MATTER OF SLOW BURNING.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — What would be on an ordinary joist construction, the more "slow-burning" ceiling, two-inch matched pine plank, or three-coat work on metallic lath? Would like your own opinion, also that of Mr. Edw. Atkinson. Yours truly, M. H. H.

[MUCH would depend on circumstances. If fire could get readily to the spaces between the beams, above the plastering, the metal lathing would be worse than none, as it would serve only to prevent getting water on the fire. If, however, the building were constructed with face brick walls, or protected in some other way, so that fire could not get from the sides into the hollows of the floor, but must burn up through from underneath, we think that three coats of plastering on good wire or metal lath would shut out fire from below much longer than a flooring of two-inch plank, on wooden joists, all exposed on the underside. Mr. Atkinson will answer the question as may suit himself, but we believe he has already expressed a somewhat similar opinion. — EDS. AMERICAN ARCHITECT.]

A CORRECTION.

BALTIMORE, MD., December 12, 1892.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I am reminded by my former partner to-day, who is in Europe, that the illustration of Mr. Fergus Reid's house which you published on the 28th of May, last, had my name alone, as the architect, whereas it should have had that of the firm, "J. A. & W. T. Wilson." If you would kindly correct this I should esteem it a favor. Very truly yours, J. APPLETON WILSON.

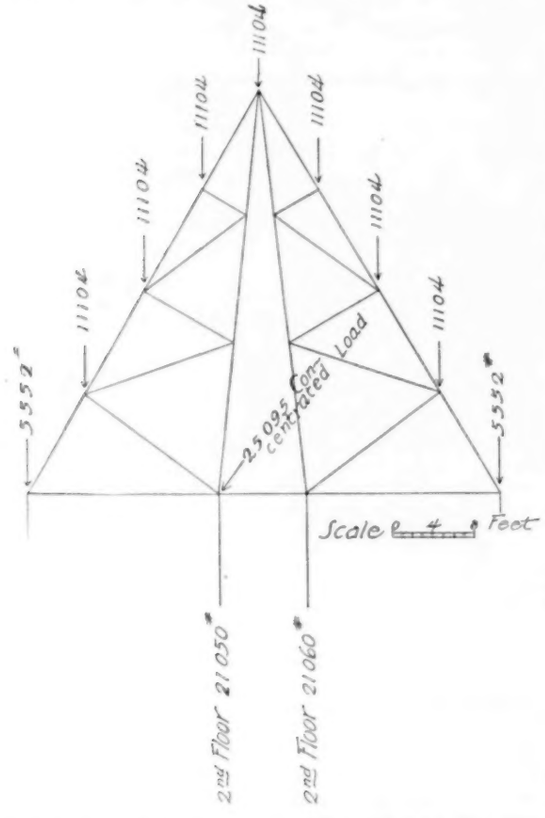
A SOLUTION WANTED.

St. Louis, Mo., November 22, 1892.

To the Editors of the American Architect: —

Dear Sirs, — I enclose you a drawing of an iron truss that I have had under consideration, with the loads in pounds as they are distributed. I would like to have a graphic solution of the same. I have never found anything that enables me to find all of the strains.

A Reader.



[As our correspondent does not appear to be in pressing need of his solution, we refer his problem to those of our readers who may feel an interest in working it out. — Eds. American Architect.]

NOTES AND CLIPPINGS

Malmaison. — A far from pleasing bit of news for those who still care for remembrances of "Auld Lang Syne" is the announcement that the historical Château de Malmaison will shortly be sold at auction. It was the favorite residence of Napoleon I and of Josephine during the Consulate, and it surely seems a piece of useless vandalism to deliver the poetical old house, with its quaint and lovely gardens, to the tender mercies of some "fin du siècle" contractor, who will demolish it in the same ruthless manner as the neighboring Palace of St. Cloud, and raise on its site rows of the horrible "jerry-built" suburban villas, with green shutters and flat roofs, which are the ideal of the retired Parisan shop-keeper. The old château, it is true, is now in a rather dilapidated condition, but it might easily, at a comparatively small cost, be restored to its former glory, and ought by right to be preserved from destruction. It was purchased in 1798 by Josephine for the sum of $40,000. At her death she left it to her son, Prince Eugène de Beauharnais, whose heirs sold it in 1829 to a wealthy Swedish banker. In 1841 Queen Maria-Christina of Spain bought it for $150,000, and subsequently sold it to Emperor Napoleon III for $220,000. The latter presented it to the State, and to-day it is valued at $500,000. Great efforts are being made by several enthusiastic Bonapartists to save the old palace and to convert it into a Napoleonic Museum, which might be added to the collection of "Historic Monuments of France"; but it is scarcely likely that this will be done. — *N. Y. Tribune.*

Effect of Wooden Pavements on Eyes. — Opticians have recently discovered that in certain quarters of London ophthalmia is increasing, and they attribute it to the fumes which arise from wood pavements after rain. It appears, from subsequent investigation, that wood-pavement fumes are responsible for even greater optical changes than mere ophthalmia or decrease of visional powers — they change the color of the eyes. It is not yet exactly known whether it reduces blue, green, gray, and pink to the uniform color of London wood pavement or causes a change from one hue to another indiscriminately, the observations made not yet being sufficiently extensive to warrant conclusions. If the former theory be correct, the inference would be that those who desire to have blue eyes should select a quarter where granite blocks are used for pavement, those wishing black ones would naturally choose asphalt-paved streets, while people who like old mahogany-colored eyes should get as near wood pavement as possible. But, to avoid confusion and perhaps disappointments, it will be advisable not to make any change of residence until the opticians have completed their observations and formulated results. — *London Telegraph.*

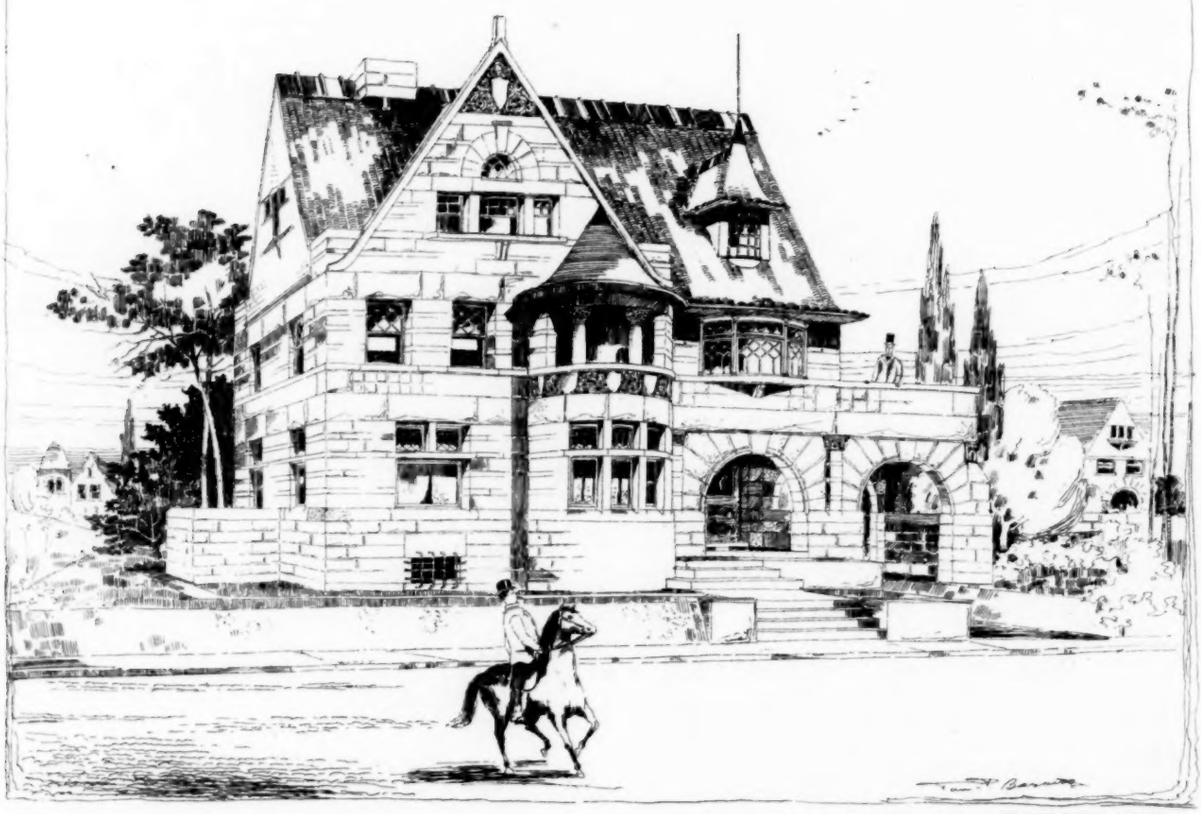
Mr. Tate's Gallery of Modern Paintings accepted. — The British Government has accepted Mr. Tate's offer to present to the nation his gallery of paintings by modern artists. The offer would have been accepted some time ago had it not been for the fact that the authorities were at a loss to decide upon a location of a building to contain the collection. The site of the Millbank Prison has now been allotted for the building.

TRADE SURVEYS

It is worth while to again call attention to the increasing probability of an expansion of railway construction throughout the Northwest and Southwest. If work is prosecuted on a large scale, the effect will be to strengthen prices in several industries, and give an impulse which will be felt in nearly all branches of trade. The comparative dulness of the past few years has been due, in a very great measure, to the absence of any great activity in railway construction. It is a matter of doubt whether there is, at this time, an urgent need for much additional mileage; but the signs of the times at present point to an expansion of construction, which, in the opinion of a great many authorities, will be sufficient to increase activity in several industries. The tendency of prices is and has been downward for two or three years, but a number of influences have prevented any serious break. Among them are trade combinations and associations of various kinds, the difficulty of any but well-grounded concerns obtaining credit, the multitude of opportunities for profitable investment, etc. Railroad managers have all along thrown their influence against an expansion of mileage, and it is understood that most of them are still in a position of antagonism to any general increase. This is, no doubt, wise, but will not interfere with the construction of the projected mileage when the conditions warrant its construction. At the present time, the railroads — or, at least, the trunk lines — are crowded with traffic, for which reasonable, and, in some instances, high rates are obtained. The Interstate Commerce Law will probably be amended, and recent decisions of high courts go to sustain the movement for the proposed amendment. The railway companies are gradually getting into more harmonious working shape, and this fact in itself is sufficient to encourage the railway companies to extend mileage and engage in new enterprises. The new mileage will be built at much less cost than that constructed five to twenty years ago. Everything is cheaper; economies of various kinds have been established, and the risks of construction have been greatly reduced. The possibilities of remunerative investment in this direction are now very accurately determined. It is not only in the Western, but also in some of the Eastern States, that a considerable increase in mileage may be looked for. The good cotton crop has helped very much in the direction of railroad building in the South, but, as previously stated, most of the lines there will be short ones. Profitable lumbering operations have led to the projection of a good deal of mileage in the Lake region; the development of Lake ore properties has also helped. The increased demand for coal has stimulated a good deal of activity in railroad projection in Pennsylvania, Ohio and West Virginia. The object in calling attention to these indications is to draw safe conclusions as to the possibilities of the future in this direction. It is not asserted here that a new era in railroad building is at hand, but there are several signs which go to show the probability of a greater than usual activity next year and the year following. A restriction has been put upon wild expansion of capacity not only in iron and steel making, but in lumber production and the mills, shops and factories of the country. On this account, the manufacturing interests are now in far better condition than ever before. Up to three or four years ago production was hap-hazard; now, in almost all directions, it is upon what might be called a mathematical basis. Requirements are closely watched, and the probabilities as to what can be sold next year are very carefully figured out. In addition to this, the anticipation of requirements for material is discountenanced by all conservative interests; producers are not now obliged to contract far ahead for supplies, as in years past, when they frequently paid more for material than it was worth at the actual time of using. Another point is that bank loans can now be obtained in most States upon more favorable terms than three or five years ago. Larger borrowings, and at lower rates, can be had. This is a very important consideration. Added to all this, is the regular and certain growth of demand from nearly all of the newer sections of the country. The advantages growing out of the trans-continental railway construction of ten to twelve years ago are only now being fully realized. All of the conditions seem to indicate a general improvement in business, if not in prices. The obstacle to any advance in prices is the enormous producing-capacity everywhere established. The manufacturing interests will be satisfied if they can hold prices where they are. The agricultural interests are prospering, and, considering cost of production and cost of traffic, better margins are being realized — a fact established by the agricultural reports of the Government. The prosperous condition of the farming interests is at the basis of all real prosperity. In the heavier industries and in the general markets there is nothing of an unsettling nature. The mills and furnaces are busily engaged, and prices are not weakening. The prospects for heavy building operations next year are very bright. Capitalists and persons of small means are anxious to invest in industrial stocks, in building operations and in the various safe avenues being opened up for small as well as large investors. The reports of the savings-banks show that the accumulations there are declining through the action of depositors, who are slowly finding opportunities for more remunerative use of their money than through banks. This tendency, should it continue, is one that should be watched. The disposition to invest will probably grow apace if not checked by unsettling influences in the financial world. A great deal of confidence is also shown by investors in real estate in cities and towns, and also in remote rural sections. A vast amount of land has changed hands in this way during the past year, investors recognizing the fact that cheap Western lands, especially, will within a comparatively short time become much more valuable.

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

LOUIS BERNERO'S
RESIDENCE.
ST LOUIS. MO.
BARNETT. AND MAYNES.



RESIDENCE AT PEBBLE BEACH, NEWPORT, R.I.

AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 17, 1892. No. 886.

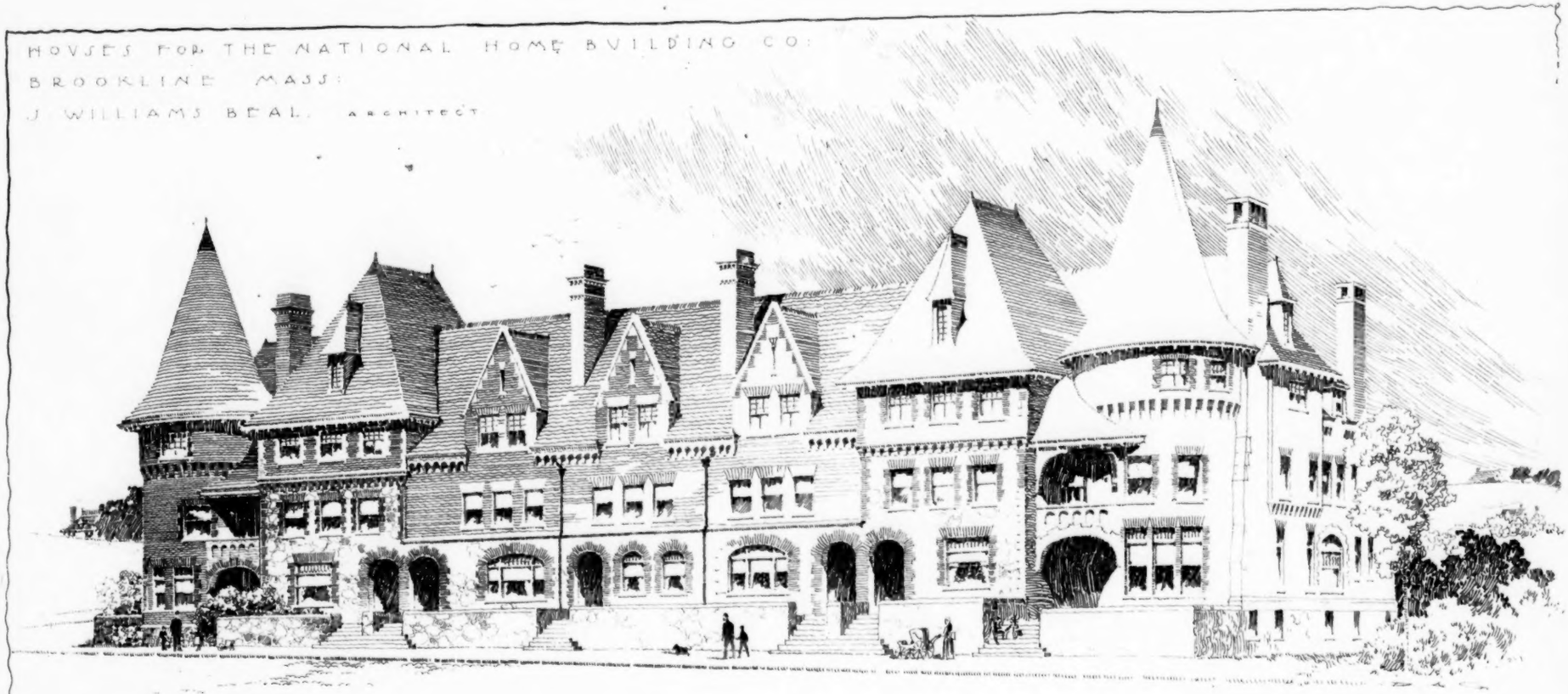
HOUSE AT SCRANTON, PA.

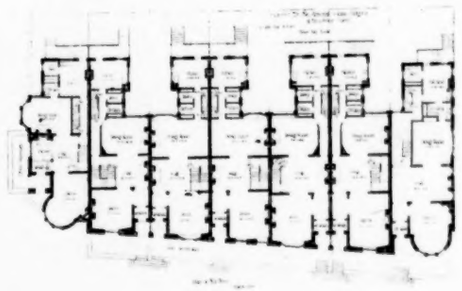
F. C. W. DIETRICH, ARCHITECT, 10 BROADWAY, NEW YORK.

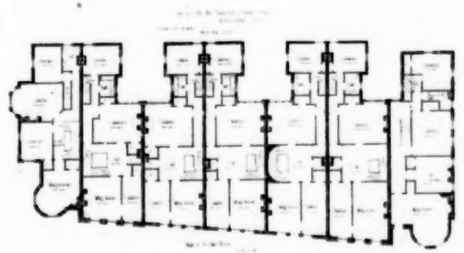
HELIOTYPE PRINTING CO. BOSTON

AMERICAN ARCHITECT AND BUILDING NEWS. DEC. 17, 1892. No. 886.

HOUSES FOR THE NATIONAL HOME BUILDING CO:
BROOKLINE MASS:
J. WILLIAMS BEAL. ARCHITECT







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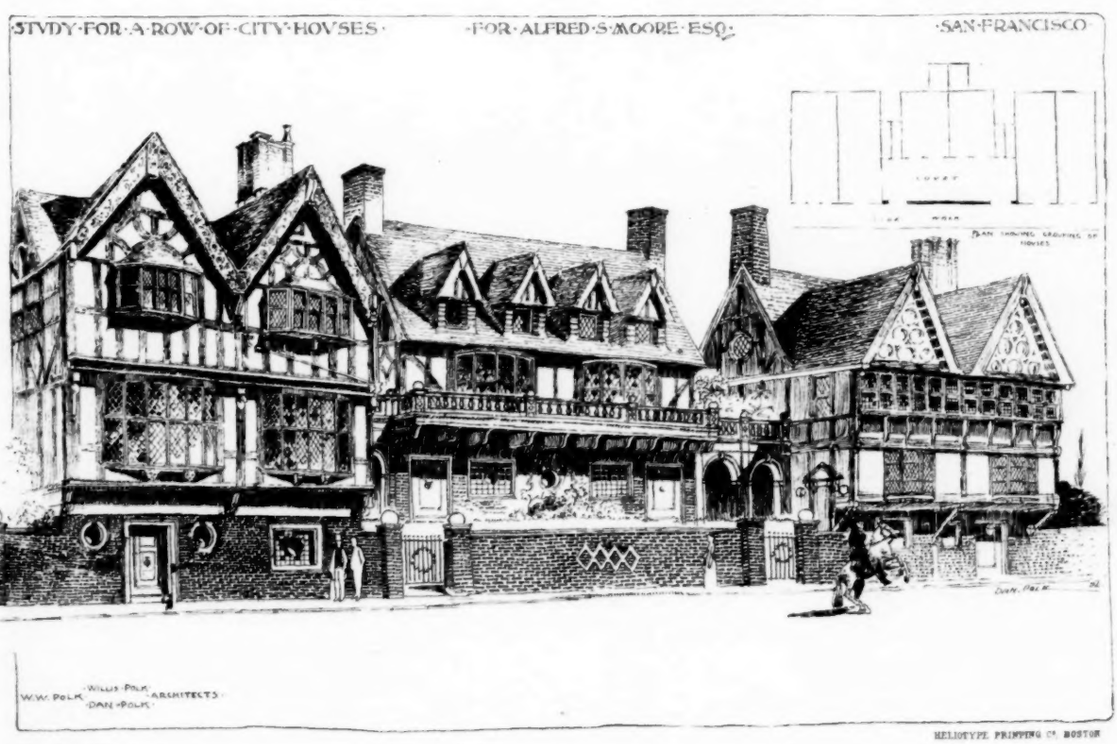

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