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CONTENTS.

ILLUSTRATIONS.

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CONTENTS.

THE people of Rhode Island have had enough of their new lien law, to which reference has been made in these columns, and a bill is now before the Legislature to modify it. Under the present statute, material-men, as well as mechanics, have an almost unlimited privilege of lien against buildings, and the consequence is that the banks refuse to lend money for building purposes, unless they are secured by the pledge of other property, less liable to be dishonestly taken away from its owner than improved real estate; and, as the people who wish to build small houses can rarely give a large amount of collateral security to strengthen their mortgage-notes, they are obliged to go without their houses, or wait until they can pay for them in cash. The new bill proposes that the material-men shall be required to give three days' notice to the owner of their intention to hold him responsible, and that the owner may in that case refuse to receive the goods; but this does not go half far enough. The simple fact is that material-men have no just right or claim whatever to any kind of lien, and ought never to be allowed to have one, and that in the States where they have succeeded in getting the public authority to pull money by force out of the pockets of innocent persons, to make up losses due to their carelessness and unbusiness-like habits, the result has been to encourage all sorts of shiftlessness and rascality in matters connected with building, and to drive honest contractors out of business. Logically, all lien laws are wrong, as they give an unjust advantage to one class of men over another class; but those for the benefit of mechanics are supposed to be excused by the fact that if a journeyman does not get his wages from his employer, he must extort them by force from some one else, or starve. In practice, it would tend greatly to the cultivation of prudence and foresight in workingmen, and to the suppression of rascally contractors, to have journeymen in the building trades obliged to collect their pay from their debtors just as other people do, but wise Legislatures have decreed that, if they find any difficulty in getting their employers to pay them, they can help themselves to the value of their wages out of the property entrusted to them, and a good-natured public endures the injustice. With material-men the case is entirely different. There is no fear that their children will die of want if they trust a dishonest contractor occasionally, and there is no more reason for licensing them to fall upon an innocent owner, and extort the amount of their bad debts from him, than there would be for issuing letters-of-marque to doctors, authorizing them to chloroform their rich patients, and extract from their pocket-books the amount of all their claims against other persons which it was too much trouble to collect in the ordinary way.

MR. EDOUARD SIDEL, of Birmingham, Alabama, died in Paris recently, of consumption, at the early age of thirty-one. Mr. Sidel was born in Paris, and studied with distinction at the Ecole des Beaux-Arts. After leaving the school, he travelled for a year or more, sketching and accumulating useful observations, and, at the end of that time, decided to try his fortune in America, rather than at home. He came first to New York, where he easily found employment, and went thence to New Orleans, but finally settled in Birmingham, soon gaining a large business there. Nearly a year ago his health failed, and he returned to France for rest and change, but grew rapidly worse, and died in his own home in Paris, on Christmas day. Mr. Sidel was a thoroughly accomplished architect, as well as a man of great force of character, and possessed, to a degree very unusual among the French, the capacity for assimilating himself to circumstances about him. He was much interested in American architecture and architects, writing to us on several occasions on matters of professional importance; and, shortly before his departure from this country, he joined the American Institute of Architects as an Associate.

THE *Engineering and Building Record* tells a story about concrete which has the disadvantage of being true. The Brooklyn, Bath and West End Railway Company is, it appears, attempting to build a station in Brooklyn. Owing to the conformation of the ground, the foundation of a portion of the station serves also as a retaining-wall for a high bank, and was laid out seven feet thick at the bottom, two feet thick at the top, and thirty feet high. Earth was filled-in behind it as fast as the masonry was carried up. We do not learn whether the earth-filling extended to the top of the wall, but, if so, the wall, if a long one, was certainly too thin to hold a loose earth-filling. However, the wall was better than the foundation. This was ostensibly of concrete, but the "concrete," in practice, consisted of cement, sand and stone, dumped *dry* from a height into the trenches, the theory of the builder being that, as the earth around the trenches was damp, the moisture from it would gradually penetrate the mingled cement and other substances, and make them into concrete, in the same way, we suppose, that a cook steams raisins and dough into a plum-pudding. It is needless to say that the result did not confirm this convenient theory, and the wall, which seems to have had its choice whether to bulge from inherent weakness or settle from defective foundation, concluded to do both, and, on the occasion of a heavy rain, which came on after the masonry was completed, it settled in one place and bulged in another, and fell down completely in a third.

IT is astonishing to observe how ignorant and careless nearly all masons are with cement and concrete. Even the best masons hardly ever think of paying any attention to the quality of the cement they use. So long as it is dark-colored, and stains the mortar so as to satisfy the eye of the architect, it seems to make no difference with them whether it consists of inert loam or strong cement-stone, and it is almost invariably left to the architect to test and reject it. The consequence is that, where the brand of cement required is not specified by name, and, indeed, often where it is, some perfectly worthless cement is almost always first sent to the job, where it is industriously used until the architect sees the barrels, or tries a sample, and sends the whole lot off, whereupon it is transported to some other job, to be again detected and ordered off. We remember a batch of cement, consisting of fifteen or twenty barrels, which attended us, as the Old Man of the Sea did Sindbad, for about a year. It first appeared on some foundation work, and was immediately sent back to the dealers who furnished it. When the brickwork of the building was begun, under a new contractor, it was sent again, and was again promptly rejected. Its third appearance was on the ground at another building, from which it was forthwith ordered away.

Shortly afterward, the plasterer at the first building needed some cement, and the familiar, shabby barrels were delivered a fourth time for his use, to be a fourth time discarded by the architect's order. A few days elapsed, and, for the fifth time, the same miserable stuff, apparently in the same barrels, was delivered at a third building, to be used in some repairs. Now, we need not point out that such persistent attempts by dealers to palm off worthless cement greatly injures the business of the manufacturers of better cements. It is too much to expect architects to test new brands of cement, and, finding that they are sure to have trouble if they allow the builders any discretion, through the indisposition of the latter to take any pains to find out what they are getting, quite as much as through the dishonesty of the dealers, they are obliged to have recourse to the system of specifying that one of two or three brands with which they are familiar shall be used, and sending off all barrels marked with any other brand. They know that they may be doing a sort of injustice to a worthy manufacturer in rejecting barrels simply because the brand is not according to the specification, but after the work is begun it is usually too late to test the cement to be used in it, and, as experience has shown them that cement furnished by dealers which varies in name from the specified brand is almost always bad, they have no alternative but to presume the worst.

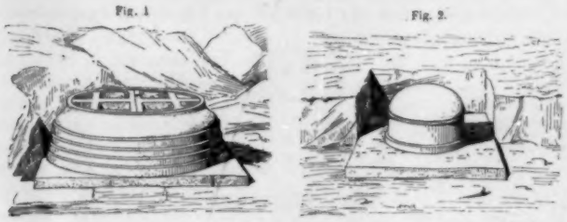
AFTER the cement is on the ground, it is seldom used by builders with any discretion, particularly in the case of concrete. We have heard of a contractor who made concrete by filling his trenches with sand and gravel, and then emptying the required number of barrels of Portland cement on top, and "washing it in" with a hose; and few masons make a much better mixture. The idea that the sand and pebbles, or broken stone, must be absolutely separated, the sand and cement first thoroughly mixed, dry, until no streaks can be detected in the smooth surface made by drawing a spade over it; and that, after carefully moistening this mixture, and turning it, the pebbles, washed, are to be finally added, never seems to occur to them, and, even if the proper method is precisely specified, the specification is generally disregarded as a architect's whim, and the cement is half-mixed with a pile of unscreened sand and gravel, and then "drowned" with a furious stream from a hose, and dumped into the trenches, forming ultimately a mass having hardly any of the properties of concrete. Wretched stuff as it is, however, when occasion arises it is clothed by the mason's imagination with qualities little short of magical. We once saw a building on piles, which had settled very badly, being "underpinned" with concrete. The masons had dug a trench beside the foundation wall to be underpinned, not extending down to the footing of the wall, and were putting in what they called concrete in the trench. To our inquiry how the so-called concrete was going to assist in holding up the wall, they replied that it was expected to "adhere" to the outside of the stonework, and prevent it from settling any further!

L'EMULATION contains a curious little piece of architectural history, relating to the erection of the Cathedral of Mons, one of the best pieces of late Gothic in Belgium. Several different architects have had the credit of designing it, but M. J. Hubert has collected a great number of items from the expense accounts in the archives of the Cathedral, showing conclusively that the original architect, under whom the work was begun, in 1450, and who continued in charge of it until his death, in 1457, when the choir was well advanced toward completion, was Jean Spiskin, probably a citizen of Mons, as he is not described as coming from outside, and is, moreover, mentioned later as having taken a journey, at the expense of the Cathedral Chapter, to examine the churches at Tournai, Lille, Louvain and other places. The canons of the Cathedral, which was probably originally a convent church, like the English cathedrals, were ladies, apparently of very high rank, and perfectly ignorant of practical affairs, but prudent enough to ask for plenty of the best advice, and liberal enough to pay for it. Their first step, after they had determined to replace their old Romanesque church by one in the style now at the height of its popularity, was to send to Brussels, and invite the canons of various other cathedrals, who happened to be visiting there, to come to Mons and assist in their deliberations; and, at the same time, a certain number of master-masons and carpenters, noted in the country for their skill, were called to meet the assembled ecclesiastics.

THE accounts show that Jean Huwellin, a master-mason, of Hainault, Michel De Rains, also a master-mason, of Valenciennes, Jean Le Fèvre, master-mason, of Mons, and probably others, were in attendance on Saturday, Sunday, Monday, Tuesday and Wednesday, March 1 to 5, 1449, "to give advice about commencing to lay out and put into form" the intended work; and each was paid twenty sols for his trouble, besides his expenses, and the cost of taking care of his horse; De Rains, who appears not to have owned a horse, being allowed twenty-five sols extra to cover the expense of hiring one, while a further sum of four livres Tournois was paid him for "having placed and compassed upon parchment two patterns of the manner of the work which, in his opinion, it would be best to carry out on the site of the said treasury and choir." What may have gone on subsequently between De Rains and other manufacturers of "patterns" does not appear, but on the thirty-first of January, 1450, Maître Jean Spiskin, placing his hands, in feudal style, between those of Jean Leleu, as the representative of the canonesses, took an oath as "master-workman, having the charge of the works which should be done on the said church." His salary was fixed at forty livres Tournois per year, with cloth for "grande livrée," and the use of a house belonging to the Chapter, and near the new building. What might have been the character of an architect's livery in those days, it would be curious to know. It appears, at least, to have been something a good deal better than that of a footman, and, in this particular case, the architect's new mistresses seem to have been very kind to him, for, in less than a week after his appointment, we find him starting off, with the carpenter, Jean Hulin, to accompany the lady canonesses to Bonne-Esperance, "to inspect the grandeur and the fashion" of the church of that place. On returning from this expedition, Spiskin, Hulin, and Henry de Jauche, who may have been the architect's assistant, were sent at the expense of the canonesses, who furnished them with hired horses for the journey, to Tournai, Lille, Grammont, Louvain and Malines, "to inspect the fashions of the churches of the said towns, and submit their observations in writing." This journey lasted nine days, and cost the ecclesiastical ladies a considerable sum.

IT may be imagined that Spiskin did not have much time, in the intervals of his travels, to finish his plans; but he had barely time to recover from the effects of his nine-days' ride on a hired horse when another council of experts was summoned, and Maître Gille Pole, a master-mason of Brabant, Maître Mathieu de Layens, a mason of Louvain, Piert Pole, Pierre des Moulins and Jean Le Fèvre, one of the original advisers, were sent for, lodged at the "ostel" of the Angel, and all their expenses paid, besides a liberal fee for their services, which consisted, this time, in examining the final drawings and specifications, and expressing their opinion about them. The canny experts, wiser than their successors of this generation, seem to have taken pains to find everything exactly as it should be, and the occasion was apparently one of great festivity; for we find that Spiskin drew a sum of money for his disbursements in "accompanying" them, and that he gave them a supper at the expense of the canonesses. On the 9th of March, 1450, the work on the ground was begun, and four days later the corner-stone of the new church was laid, with great solemnity, at twelve o'clock at "nuene," by the Demoiselles Katherine de Mastain and Jeanne de Bousies, canonesses of Cheens, assisted by two little boys, Ernoul de Trasegnies and Oste de Hoves. The rest of the day was spent in rejoicing: seventy-three sols were given to the workmen, to drink; twenty-one sols were spent in white bread, to be distributed to poor children; and Spiskin entertained, at the expense of the canonesses, "my Lord the Governor" and several others, who came to see the ceremony. A few months later, a rumor spread among the townspeople that the foundations were being badly laid, and Pole, Le Fèvre and de Layens were called in again to see if the rumor was correct. They examined the work, and reported that there was no ground for the story, and the work was then vigorously resumed. Everything then went on uninterruptedly for nearly seven years, when Spiskin died. The work continued for about a year without an architect, de Layens being only summoned from time to time from Louvain to give advice, as occasion arose. It then became evident that a more permanent arrangement was desirable, and de Layens was formally appointed architect of the church, at a salary of thirty-four livres Tournois per year, with twenty sols each way for travelling-expenses between Louvain and Mons.

FUNERARY ARCHITECTURE.[1]—II.

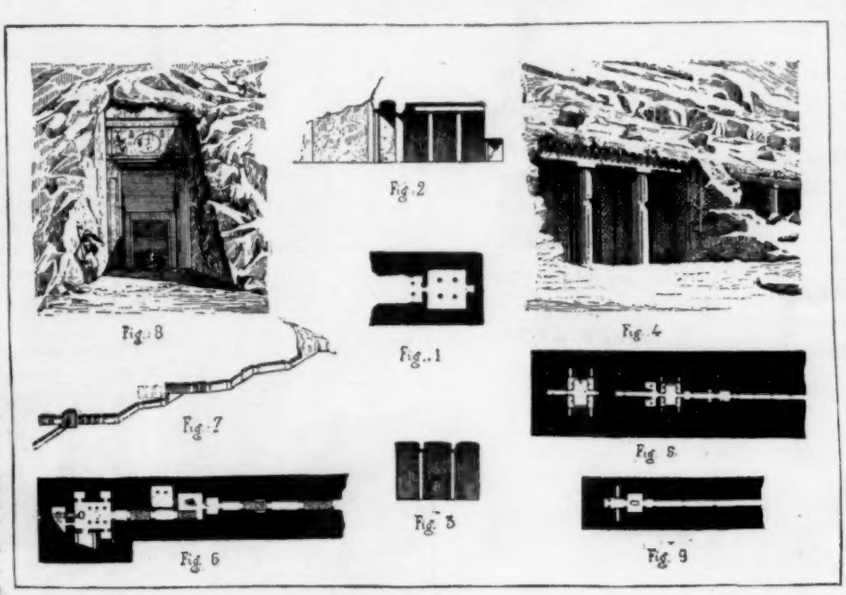


Mougheir Tombs.

THE *mastabas* and pyramids constituted the vast majority of the Egyptian tombs of the First Memphite Empire. The *hypogea*, of which we are about to treat, were at that period little more than the exception to the rule.

During the First Theban Empire [Middle Empire], the tombs underwent scarcely any modifications, except such as the nature of the soil necessitated. Thus, in certain portions of the necropolis of Abydos, tombs are found almost identical with those of Memphis, while in other parts, where the soil did not admit of the excavation of the shaft and burial-chamber, the former was suppressed and the latter was placed above the ground, inside a small pyramid, which was quite roughly constructed of crude brick. Often, also, the chapel was replaced by a simple enclosure, which was the only accessible part of the monument.

The *hypogeum*, or subterranean tomb excavated in the side of a mountain, which was of very rare occurrence under the First Empire, came into general use. We give a typical example of these sepulchres, which is very beautiful in its bold simplicity; it is found at Beni Hassan; the illustration is borrowed from the work of Gailhabaud [*Hypogea*, Figures 1, 2, 3, 4]. The external porch, like all the rest of the tomb, is cut into the limestone; it is composed of two columns, the character and proportions of which foreshadow in a singular fashion the Greek Doric column; a heavy architrave is surmounted by a sort of larmier supported on coarse dentils. Do this sepulchre and those near it furnish us the prototype of the Greek Doric order? We scarcely think so; but we do find here a proof that the primitive peoples of the globe were forced to adopt similar forms to satisfy identical needs. From the porch we enter a chamber whose ceiling is supported by four columns, and which is lighted only by the door. A statue of the occupant stands in a niche. Many tombs belonging to this period still exist; they vary but little in general design. Sometimes there are two or three chambers or chapels decorated with paintings. In one of them, a square shaft, starting at the surface, runs to a vault dug at a lower level. This shows how deep-rooted the primitive tradition was.



Hypogea.

Although the Theban kings of the Middle Empire continued to be buried in pyramids (yet never presenting the gigantic proportions of those of the First Empire), the *hypogeum* came into general use for private sepulture.

Under the New Theban Empire the *hypogea* were adopted by the kings themselves, and all tombs, without exception, were of that order; the royal tombs, however, alone attained the extraordinary dimensions of those known as *syringes*. There existed still a very marked distinction between private sepulchres, which continued to resemble more or less closely the type described above, and those of the monarchs, which, besides being of unusual size, possessed other striking peculiarities. In their various parts, which remained essentially the same, certain changes were wrought, necessitated at the same time by the demands of a new art and by the ever-persistent obligation to protect the body from all injury. The sepulchre proper did not change; as was the case in the pyramids, the burial-chamber was reached through an inclined passage traversing a series of halls, and not through a shaft. The long corridor was often strewn with obstructions designed to baffle intruders. The entrance to it was very narrow (Figure 8), and it was doubtless hidden as much as possible. Not the slightest trace is found, even at the entrance to the tombs, of chapels accessible for commemorative ceremonies. The Pharaohs of this period were not content with merely collecting in such underground rooms these marvellous paintings which we admire to-day, and which were endowed with a sort of magic virtue by the religious faith that they were designed to gratify; moreover, having renounced the pyramids, whose naïve simplicity no longer satisfied their artistic sense, these monarchs felt the necessity of impressing the imagination of their subjects by monuments worthy of the splendor of their reigns. We see, therefore, veritable temples taking the place of the primitive chapels at the entrance to the pyramids. As these structures must needs be of gigantic proportions, like everything else undertaken by the Pharaohs, they could not be built in the mountain-side, where tradition placed the royal tombs. They were, therefore, erected in the plain, some distance away from the real sepulchre. Separated from these, they became commemorative monuments, genuine cenotaphs, designed for the celebration of funeral rites, and containing colossal statues of the dead. The Rameseum and the Amenophium were doubtless funeral temples. It is noticeable that the paintings with which they are ornamented, unlike those of the *hypogea*, have a very marked biographical character. As for the tomb itself, it was still constructed in the flank of the mountain; and no matter what marvels of art were brought to its adornment, the entrance was concealed, so far as possible, for the purpose of protecting it from spoilers. The dimensions of the *hypogeum*, like those of the pyramid, were in proportion to the length of the king's reign. Figures 6, 7 and 8 [Hypogea] give the plan, section and the entrance to the tomb of Menephtah I.

This separation of chapel and tomb was peculiar to royal monuments. In private sepulchres the principles of the *mastaba* were always preserved.

It was only under the last Egyptian dynasties that the *hypogea* were constructed with a fore-court, the entrance to which was indicated by a pylon.

In the Delta, which was periodically inundated, the nature of the ground precluded the possibility of subterranean sepulture.

A great number of tombs are still found on Egyptian soil, notwithstanding the vicissitudes of the centuries; and one can fancy how vast the number must have been when he

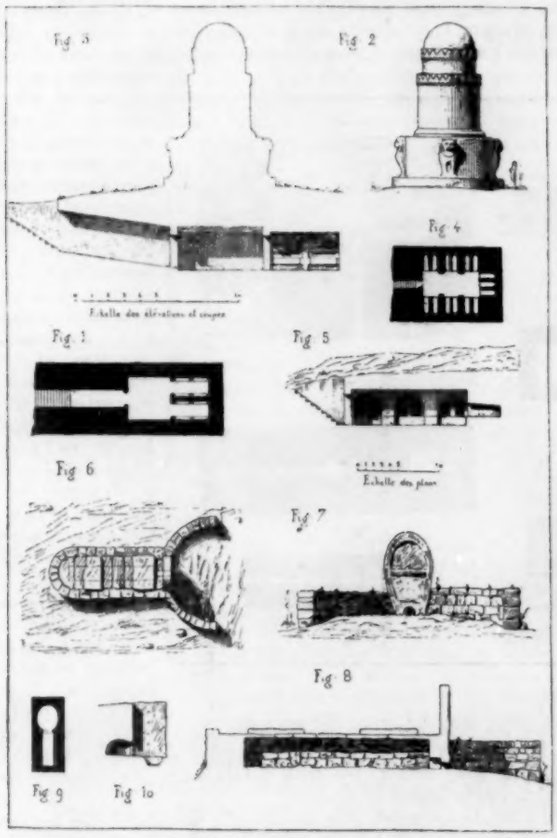
[1] From the French of Pierre Benouville in Planat's "*Encyclopédie l' Architecture et de la Construction.*" Continued from No. 738, page 101.

remembers that family tombs did not exist. Each individual desired to have a sepulchre for himself, his wife and his very young children.

ASSYRIANS AND CHALDEANS.

Assyria, for some scarcely explicable reason, shows no traces of ancient tombs. A few stelæ [Stelæ, Figures 1, 3], however,

Various Stelæ.



Phœnician Tombs.

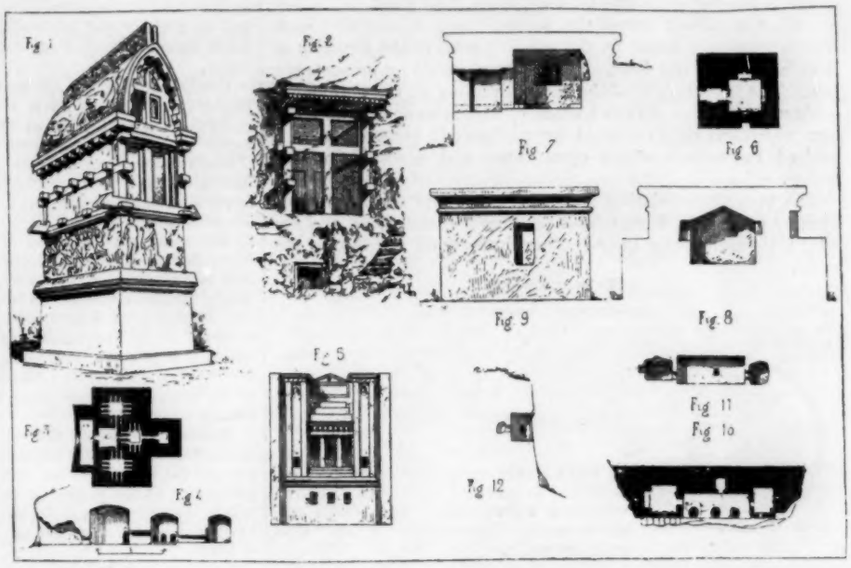
Absalom's Tomb.

Having given to the Egyptians the place of honor due to them as the greatest tomb-builders of the world, we will pass rapidly in review the funerary architecture of nearly all contemporary nations.

exist, which were designed for sepulchral monuments; we have good ground also for assuming that the Assyrians held very nearly the same beliefs as the Egyptians concerning the mystery of death. Certain authors have supposed that they sent their

dead to Chaldea for burial as that was their native country, their holy land. The hypothesis seems all the more plausible because the level soil of Assyria was but ill-adapted to sepulchral excavations, which, as we know, constituted the burial places *par excellence* of primitive races. Moreover, recent discoveries have disclosed an accumulation of tombs in Chaldea which cannot be accounted for except by some such supposition.

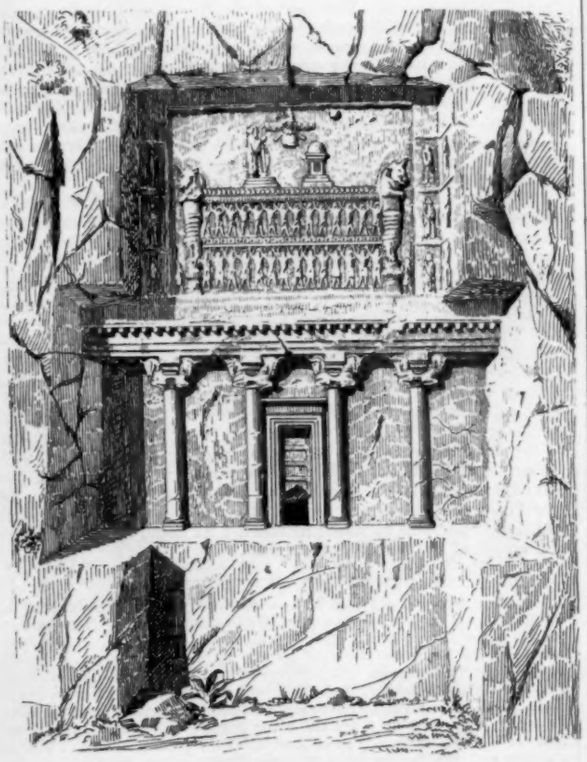
The Chaldean tombs are very peculiar, and exhibit but little architectonic character; sometimes they are mere vaults, the arch of which is formed by corbelled bricks; sometimes the bodies are simply deposited on a brick flooring and covered with a sort of lid, made of several pieces of terra-cotta joined together [Tombs of Mougheir, Figure 1]; the lid is sometimes dome-shaped and surmounts a cylindrical portion (Figure 2.) The terra-cotta was originally enamelled. These tombs, or rather graves, were piled upon each other in such fashion as to form high hillocks, the wind filling up the interstices with sand. Scarcely any examples of isolated tombs exist in Chaldea.



Tombs in Judea and Asia Minor.

PHŒNICIANS.

We give a few examples of tombs belonging to the civilization of Phœnicia, or to that of her colonies such as Malta



Tomb of Nakschi-Roustam.

[Phœnician tombs, Figures 4, 5] and Carthage (Figures 9, 10). Here again the rock excavated into a burial-chamber surmounted by an ædicula constitutes nearly all the constructional character of those monuments whose simplicity does not exclude all claim to character. The tombs found in Sardinia known as the Tombs of the Giants are more peculiar. (It appears to be clearly demonstrated now that the *nurhags* strewn all over Sardinia were not intended for sepulchres). These tombs [Phœnician tombs, Figures 6, 7, 8] contain a vault or burial-chamber built of stones without mortar and covered with slabs of stone; it is large enough to contain several bodies. In the anterior portion rises a rude stela; it occupies the centre of a hemicycle constructed like the vault. At the bottom of the stela an opening is pierced, doubtless designed for libations. In examining this singular monument one cannot but be struck with its similarity to the Celtic monuments.

JUDEA, ASIA MINOR AND SYRIA.

In these countries, likewise, it is the hewn rock that nearly always furnishes the place of entombment; whether the sepulchres be hollowed out of the rocky mass, with a more or less conspicuous façade [Tombs of Judea and Asia Minor, Figures 3, 4, 5], as in early times, or whether the detached rock is made to assume the appearance of a structure, as in the much later tomb known as the Tomb of Absalom, and in whose architecture the Greek influence is unmistakable, the same principles are always traceable in the conception and execution of the designs. The monolith of Siloam, which we reproduce from the learned work of MM. Perrot and Chipiez, is likewise a curious example. We also call attention, in the tomb excavated after the manner of a hypogeum (Figures 3, 4), to the disposition of the cells for the bodies, which are dug perpendicularly in the walls of the chambers. Our Figures 10, 11, 12, borrowed from the work of M. Guillaume, shows a Hethite tomb, which recalls, at least in the arrangement of the porch, the entrance to the Egyptian hypogea.

The Lycian sepulchral monuments (Figures 1, 2), although also cut into the rock, present a very different character. We find a curious attempt in them to reproduce the appearance of wooden constructions. One of them has the form of a genuine catafalque resting on a base which preserves the look of stone.

MEDES AND PERSIANS.

The few ancient tombs encountered in Persia are all without exception, cut into perpendicular rocks and situated at a high elevation above the ground. This manner of burial resulted from the religious beliefs of the ancient Persians, who, like the Ghebers of to-day, did not inhume their dead, but exposed them to birds of prey which soon devoured the flesh. Kings alone were entombed; but, fear of contamination from fire or earth forbade their incineration or interment. The custom was, therefore, adopted of excavating their tombs in the side of a rock, at a great height above the soil.

Tombs of this kind are to be seen at Nakschi Roustam, a

dozen leagues from Shiraz. They antedate Alexander's invasion. The illustration which we copy from Gailhabaud permits us to dispense with a long description of this strange, colossal monument. Suffice it to say that the figure on the three steps over the bas-relief is supposed to be the image of the King holding his bow in his right hand and facing the altar on which burns the sacred fire. A singular form above, seemingly afloat in the air, is probably the *ferouher* or familiar spirit of the dead. The globe at its side represents the sun. The total height of the three divisions of the monument is about 100 feet. At the bottom of the false door is an aperture which has been enlarged by spoilers; it gives access to a vaulted room, into which open three niches containing the bodies.

The monuments dating from the period of the Sassanides dynasty are very different from the above in character, and exhibit little more than bas-reliefs sculptured on the face of the rocks.

[To be continued.]

CHICAGO

THE HAVEN SCHOOL-HOUSE AT EVANSTON. — THE BUILDINGS OF THE NORTH-WESTERN UNIVERSITY; DEARBORN OBSERVATORY; MEMORIAL HALL AND SCIENCE HALL.

ALTHOUGH, of course, the largest and most extensive buildings are those erected in our city proper, still a great deal of excellent work is being done in its suburbs. Among others, Evanston, a suburb of about ten thousand inhabitants, situated on the northern shore of the Lake, is noticeable for its recent good work in this direction. One of the buildings to which its citizens point with especial pride is the new Haven School-house, which, in point of wise arrangement, if not beauty, seems to excel any other such construction in this part of the country, and has attracted wide and favorable comment from those interested in such matters. It is a two-story edifice, built of common buff brick, with white limestone trimmings, which produces a novel and not particularly artistic effect, with its entire lack of any attempt at ornamentation, excepting the cornice of brick in the shape of an arcade, surmounted by a stone coping. The ground-plan of the building, crudely expressed, is two Greek crosses with four large bays resting on the arms of each cross. Either side of these bays contains a large triple window, with a large single one on its side, these giving abundant light to each room. By this arrangement a much greater number of well-lighted rooms is attainable on each floor, and the necessity of more than two stories is avoided. The question of utility, and not beauty, is again consulted in the finishing of the grounds around the building. As no grass is ever known to grow successfully about a school-house, it has been decided best to avoid any attempt at such luxury, and the grounds are, therefore, graded to the street and covered with fine gravel. Trees in the yard are also tabooed, perhaps because they are usually so dismal a failure in such places.

Situated in Evanston, also, is the Northwestern University, a thriving institution of over seventeen hundred students. This institution has, during the last year or two, erected some very excellent buildings. The most northern of these, and one of the most successful, situated on the low bluff, where it has the Lake for a background, is the Dearborn Observatory. The treatment of this building is extremely successful and pleasing. The material is the common limestone, rock-faced, with red tile roof. The building is Romanesque in feeling and one-storied, with the exception of the observation-tower, which has two and a half stories, and which, with its red tile dome, is unusually well treated. The building is entirely without ornamental detail, with the exception of small stone finials in the shape of globes. However, the simple outline of the low, sloping roof, with the broad archway of the entrance, go to make up the outlines of a building which, taken as a whole, is unusually picturesque, as compared with other edifices of its kind.

The Garrett Memorial Hall is the next south on the campus. The building is Romanesque in style, built of red brick, with black slate roof, both brick and slate being, unfortunately, of exceedingly poor quality. The plan is a rectangle with a rounded end at its western extremity, in which is located the chapel, and on the south side, containing the entrance, rises a square tower with a loggia in the third story. The design is extremely good, and the ornamental details most carefully studied, up to the line where the roof commences. When one occasionally does see a piece of work where the style is faithfully carried out, it makes one regret that such things are not oftener done. The fault lies with the public, who often think as highly of bad work as good, and see no difference between the work of an educated architect and one who has drawn his chief inspiration from "*The Practical Joiner's and Carpenter's Assistant.*" It is considered proper to-day that a cultivated man and woman should know something of painting and sculpture, and why does not the time come when they should have an appreciative knowledge of the kindred art of architecture? If that were the case, we should have fewer of those monstrosities that raise their proud heads in the style of the Fifteenth-century Gothic till they reach the sill-course, and then with equal pride continue in a somewhat doubtful Romanesque manner, finished off, very likely, with "Queen Anne" pepper-boxes.

Partly because of its rarity, do we doubly appreciate a thoroughly good building when we see it.

At the end of the chapel of the Memorial Hall the arches for the small windows are carried on engaged columns of terra-cotta. These columns are extremely charming bits of design, and show knowledge and study. The cornice around the building is of the same material, and also very carefully worked up, having the true Romanesque spirit, but the terra-cotta finials are not at all worthy to be classed with the rest of the work, for above the cornice line, alas! the spirit seems to have departed from the designer, or, what was more probable, the work was handed over to a less skilful draughtsman, since we have here a confused mixture of Classical and Romanesque foliage, which has no style at all. The terra-cotta columns in the loggia, though of good design, are too light for the place, and give one the feeling of insecurity when the heavy weight above them is taken into consideration. The material does not seem to be suitable for this place, as the column has to be jointed, and cannot be in one piece.

As one steps across the threshold one sees the Romanesque idea is abandoned, and the mouldings, where the style might have been carried out in spite of the severe simplicity, lose all character. The only glory of the chapel is two very brilliantly-colored and harmoniously-arranged stained-glass windows. Here the Romanesque method is again felt in the use of the small, brilliantly-colored pieces of glass.

Another new building is the Science Hall. This, also, is of red brick with slate roof, the material being of much better quality, but the design much less satisfactory than the Memorial Hall. Here, where a large number of students congregate, where panics are liable to occur because of accidents in the laboratories, the heavy outside doors are carefully arranged so as to open inwards, as is often the case in our semi-public buildings, preventing any one from standing any reasonable chance of escape. This same criticism applies with equal force to the new Memorial Hall, as well as to all the old buildings of the institution. The walls of the laboratories are finished in common well-laid bricks, and whereas at first glance they give an unfinished aspect to the rooms, it must be a great advantage in the way of cleanliness. Next to the new Science Hall stands the old University Hall proper, and, although a pleasing structure in limestone of Fifteenth-century Gothic style, shows, when compared with the new buildings, how much has been gained in the matter of lower ceilings — a gain in beauty to the building on the exterior and interior, and how much gain in obviating the useless expenditure of muscular tissues the students could testify.

Many beautiful houses have been recently built in this town. Foremost among them stands one now nearing completion on the Lake shore, near the southern terminus of the Drive. Excepting in one feature, it is remarkably pure colonial in style, and from its general good taste is very agreeable. The foundation, which extends higher than the usual water-table, is of granitic boulders, which, with a large chimney of the same material, break the monotony of the light, yellow-painted wood, though there might be raised the objection that the effect is disquieting, and the rough-boulder appearance seems scarcely in harmony with the Classical feeling pervading colonial architecture. The gables are away from the street, fronting the Lake, giving the side of the gambrelled roof of dark shingles to the street, the monotony of the roof being broken by dormers. In the interior the colonial feeling is carefully preserved, although the principal rooms are finished in the natural woods. Many of the less expensive houses of this town are extremely good, as well as the new club-house, which has recently been erected, and, if they only had the granite hills of New England behind them, would have been photographed and spread far and wide.

The Resistless Power of Ice. — Some gentlemen were looking at the tons of ice piled upon the dike Wednesday, and the conversation turned upon the power of the ice during a shove. An interesting sample of ice force was recalled by one citizen — a house and family swept away "like a pack of cards brushed off a table," as he described it. The man and woman and their two or three children were in the house, which was an old French style affair. At that time there was a green bank sloping up from the river toward the house. The house had foundations and walls three feet thick in places. It was about 12 o'clock, and the family were at their dinner, when suddenly the ice commenced to move. The upper ice struck the sheet of shore ice and sent it like a huge knife up the bank, scraping all before it. Before the family had time to escape, the edge of the knife had struck the house. It cut it clean away and left not a soul alive of the entire family. Hardly one stone remained upon another, so heavy was the crash of the ice upon the house. One living thing alone escaped — the pet dog of the family. Two cakes of ice had fallen in such a manner as to form a sort of roof over the dog, and it was found unhurt. — *Montreal Witness.*

NOTES RELATING TO CONCENTRATED RESIDENCE IN VARIOUS COUNTRIES.[1] — II.

COMFORT: —

11. *Quiet.*

It furthers quiet by the absence of corridors or open stair-wells; and by the enclosing of entrance-ways.

This differentiates this System from: — All buildings which have longitudinal or other extended public corridors or passages on each floor, or have open stair-wells; and from buildings, the dwellings in which are approached through open courts, *cités*, alleys, or slums.

In the palaces, convents, and mansions Europe and, to a less extent, in the dwellings of the more wealthy in all countries, thick walls and partitions, outer rooms and gardens, are all used in careful planning to secure a degree of quiet proportionate, if possible, to the sums expended. Whatever methods, in the planning and construction of buildings, secure the least passage of sound, and especially those of these methods that take up least space, are being, and will be more and more sought for, and used as the advantages of concentrated residence are sought by ever increasing numbers. Floors, and thin partitions, which are sound-proof, as well as weather-proof, fire-proof and vermin-proof; double windows, not only for greater warmth in winter, but to shut out external sounds at all seasons when closed, and which can be easily and quietly opened and closed, and which occupy no unnecessary space for frames, etc.; doors which cannot be slammed; door frames with sound buffers rather than unnecessary and combustible trimmings, etc., will be more and more demanded. The plans of this System, while prepared for the ordinary and long-tested methods of construction, have also been prepared with a view to adaptability to an approximately fire-proof, vermin-proof, and sound-proof construction.

12. *Allows of Elevators.*

It allows of Elevators communicating on each story, like the stairs, with two (or sometimes three) dwellings; [also of using one general Elevator for mounting to an upper floor, and thence descending, by the stairs, to any dwelling].

This differentiates this System from: — All buildings where the use of an elevator necessitates having public corridors on each floor, whereby quiet and privacy are lessened, and having dwellings with rooms facing in opposite ways, so as to command thorough-draught, is prevented.

In the Hôtel du Louvre, Grand Hôtel, and other of the large hotels in Paris, one lift or elevator gives access to vast numbers of rooms placed on each side of long corridors which lead from the elevator and principal staircase; and the same method is used in most American and many English hotels. But in apartment-houses one elevator communicates frequently with but two dwellings on a floor. In a practically rectangular building, one elevator cannot on any floor level, communicate with more than two dwellings which have through-and-through, or direct private thorough-draught; and with not more than four dwellings which have angle thorough-draught. Where a greater number of dwellings are, on any floor, in communication with a single elevator, one, or more of them must be deprived of command of thorough-draught by the corridor giving access from the elevator to the dwelling beyond.

13. *Sea-Breeze* (in New York).

It allows, in New York, the Sea-Breeze to enter every Room.

This differentiates this System from: — All rooms in New York, whether in tenements, flats, apartments, or private houses, which do not have, or do not open into rooms which have, windows facing south, or southeast, or southwest.

Summers in which a land breeze is frequent, or of long duration, are the exception in New York. The torrid sudden heats of two or three days' duration, recurring at intervals throughout the American summer, would, were it not for the buildings, and especially their grouping and interior arrangement, be in New York scarcely felt with the discomfort experienced elsewhere, even a few miles to the north, east, or west, of the city. The night is cooler in a New York room from which thorough-draught is in no way impeded, than in most country-houses. The summer climate of New York, some generations ago rivalled — and some generations hence, when the planning of cities and city-buildings for the health, comfort, convenience, and recreation of all their inhabitants, is more fully understood and carried out than now, may again be found to rival the climates of the best American watering-places, whether inland or on the sea-coast, combining, as it does, the best qualities of both in its peculiarly exhilarating air.

RECREATION; —

14. *Play-Ground.*

It provides a Play-Ground in the open air with every house, for the use, in common, for the Children of all the families residing in it.

This differentiates this System from: — All tenements, flats, apartments, or houses which provide no playing-place for the children of their occupants except the dwellings themselves, or the public halls and corridors, and stairs of approach to them, or else the public streets, or nearest public square, or open spaces.

The number of parks, gardens, promenades, ramparts, and open spaces of all kinds, in and about the principal cities of all countries, are numerous and on the increase in number, size and beauty. Yet entire freedom for children to play as they like in them, is not so common; nor would it be possible to retain the beauty of the parks if all restraint as to the uses to be made of them were removed. Again, however free, extensive or numerous such public spaces are, they are generally too far away from some, or many homes, to be of service to all families as a recreation-ground at all hours of the day and evening. The play-grounds for children proposed and provided by this System have the further advantage of being at the top of the house where the air is purest, and the noise of the players is least heard.

15. *Garden-bed.*

It gives a private Garden-bed to every family.

It differentiates this System from: — All dwellings which lack this feature.

The surrounding of the children's play-grounds with a narrow garden-bed border next to the outside of the play-ground's enclosing high railing (which can be further protected, or closed, near the bottom by wire netting or sheet zinc, if desired), and the dividing of this border into lengths corresponding to, and accessible from, the private bleaching spaces of each family, are shown on a plan published in the *American Architect and Building News*, May 5, 1888.

In looking down from a balcony or window on to a roof, or a path, from which a glare of sunshine is reflected, the relief to the eye which would be experienced if such surface were covered with foliage, like an ivy-clad, or turf-clad surface, is easily imagined. Such a surface covering or blanket of low-growing, native hardy growths, especially such as also keep green in winter, like checkerberry, wintergreen, etc., with a simple mechanical appliance for irrigation added, is suggested to deaden sun-glare from the entrance-way roof, in the plan above named.

Discomfort to the eye is so important to be avoided that other discomforts or inconveniences are often patiently borne in order to secure for a time a pleasing change of scene, or secure constantly pleasing surroundings, or outlook. The pleasantest outlook is on green foliage. In a deep foliage-clothed ravine we can scarcely see the sky, and cannot see the sea or waving fields, or mountain outlines. Many most beautiful objects are absent, yet we are pleased. Often a convent cloister, a patio, or a vine-clothed court-yard are beautiful in proportion as they give, not varied details, but the absence of unpleasant details, in their narrow enclosure. An ivied or moss-clad, or even time-softened hued wall often soothes the eye, without other detail, and indeed by its absence of detail; for the detail is absent that calls for attention without greatly rewarding it, — distracts in a word — distracts not from contemplation of the wall, but distracts from the mental contemplation of subjects that the quiet hues of the wall leave us free to contemplate, or even have by some subtle sense of harmony, helped to bring to our minds. In crowded city courts or alleys we find a certain seclusion if others cannot overlook us in our apartment; a further seclusion if we cannot overlook others, or be distracted by a sight of them or their belongings; and a further gratification if a branch of a tree in a neighboring garden is seen over a roof or wall, or even encroaches on the narrow vista commanded by our point-of-view. In seeking for foliage, suited to the New York climate and occupying little lateral space, yet which, to the dwellings on every floor, would afford in summer a glimpse of green, or even screen or clothe somewhat the exterior of adjoining dwellings, but, in winter, would not shut out sunshine from any dwellings, — the wisteria is found to combine these most desirable, as well as other very pleasing, qualities; and points at which wisteria can be advantageously planted to climb vertically, on wires, to the tops of the buildings, are marked on the above-named plans.

APPEARANCE: —

16. *First-class Approach.*

It gives a first-class Approach to every Dwelling.

This differentiates this System from: — All dwellings the approach to which indicates by size or position, inferiority of means or social position in their occupants.

The method of laying out New York, with streets all of a nearly uniform width, together with practical uniformity in the paving, lighting and policing of the streets, has made one street about as desirable a place of residence as another so far as civic regulation goes. Again, the uniform size of the lots has, hitherto, so generally governed the width of house fronts that an entrance, such as there is space for in the various applications of this System, can be made as elegant or imposing as the entrances of the majority of the best private houses, or apartment-houses hitherto erected in New York.

PRACTICABILITY: —

17. *Separate Ownership.*

It allows of Separate Ownership of each Dwelling; and of securing of the same by small weekly payments.

This differentiates this System from: — All dwellings and plans for dwellings in which the character of the plan, or the approaches to the different rooms and suites of rooms or other circumstances prevent or do not lend themselves to, separate ownership of the separate dwellings.

Separate ownership of an upper-floor dwelling, large or small, has long existed in Venice, and to some extent, elsewhere. About 1882 was built, it is said, the first apartment-house in New York in which the apartments on the different floors belonged to separate owners, with power, under certain conditions, to sell them. The custom

[1] The portion of the table to which each note is an appendix is here repeated before the note. Continued from No. 737, page 90.

was soon widely followed in similar or smaller apartment and tenement houses throughout the city and opened a way for thrifty heads of families, of however small means, to become owners of homes in the city; a thing impossible to them so long as separate ownership of real estate in the city was confined by custom to owning, or renting on ground-rent, nothing less than a lot of some one hundred feet in depth, and owning all that stood on it. The admirable Building Associations of Philadelphia had gradually worked out the details of a method which put the possibility of acquiring, on most advantageous terms, separate ownership of homes, and other real estate, within the reach of all who paid rent, however small, for their houses or other dwellings. The details of such methods were readily made, with certain modifications, applicable to separate owning, in New York, and elsewhere, of apartments one over the other as well as adjoining. The incentive thus to economy, thrift, preservation of the safeguards of property, and to various forms of good citizenship, are apparent.

18. *Suits New York Lots.*

It can be used on New York Lots.

This differentiates this System from: — All dwellings, or plans for dwellings which, like the Peabody Houses in London, cannot be repeated on New York lots without waste of land, or else a radical change in the character of the plan.

Throughout England, a small country with a vast population, as soon as we get away from the heart of a large town or city, but while still within its limits, we find, in many directions, the ground covered with cottages and small houses, in rows, many of them but two stories high, with two rooms on a floor, one fronting on the street and the other fronting in the opposite direction on a small yard abutting on a similar yard, of a similar house fronting on the next street. A low one-story extension from the back of the house, for a scullery or out-house, takes off a portion of the yard-space on the ground-floor; but above this the space for light and air between the backs of the houses is seldom less than, say, about eighteen or twenty feet wide. Half this space, or the depth of one yard, say nine feet, added to the depth of the two rooms of the house, say thirteen feet each, would make, with the thickness of the walls, say, in all thirty-five feet for the depth of each lot. Allowing fourteen feet as the width of the house, a lot thirty-five feet by fourteen feet, which is inside of five hundred square feet, would be required for each such house and yard. In and about Philadelphia we find the ground covered with houses much smaller as well as others larger. In Philadelphia, in winter, the depth of frost in the ground makes a cellar or basement-room under each house almost indispensable. But farther south in the United States, and often, or most often, in England, we find the cellar or basement-room omitted; so that, small as is the cost of such a house in Philadelphia, it is still less in England. The demand for such houses is constant in England and the supply is constant, and such houses are even to be found in London notwithstanding the value of the land and the pressure of the population in a city many times larger than New York. And the demand for such houses is constant in Philadelphia and the supply is constant there though Philadelphia is only two hours distant from New York by rail. Yet no such houses are to be found in New York; because, in New York, all land is by law divided into lots twenty-five feet front by one hundred feet deep, which is five times as large as one of the lots just described. A regulation New York lot gives room for five such houses as just described, but gives no way to get to and from them. The land once laid out in regular New York lots is not re-divided so as to get smaller lots, and access to them, however much small houses like those in Philadelphia may be wanted, because the hope of increased value from causes wholly independent of itself — "the unearned increment," in a word — delays making use of the land in ways which may hinder or delay its sale at any future moment. Small houses on small lots like those of Philadelphia, and of English towns, are not built, nor any dwellings which would hinder the immediate sale at any moment of a single "lot." A speculative value takes the place of the value of immediate usefulness. The unit of exchange, the regulation-sized lot, established as a convenience for dealings in real estate and the fixing of the lines of streets, has now become an arbitrary factor forbidding the erection of houses on any method of land division not conforming to the twenty-five by one hundred feet lot. Small houses, however much needed, are not therefore built in New York, because small lots suitable for them are not procurable. Small capitalists who could compass the ownership of a small house and lot, but not of a large one, were thus forced to go out of the city or else relinquish the hope of ownership. Those who had capital enough to own a full-sized lot must further wait until they had capital enough to build not only such a house as they needed, but one many times larger, or else lose the full use of the lot as a building lot. Nor, when built, could the owner afford to live in the house with only his own private family, without further great addition to his means; without such addition he must fill the larger part of the house with tenants. Large capitalists were thus favored and small capitalists driven to the wall by the size of the lots, twenty-five feet front by one hundred feet deep, into which the vacant land in New York was, with the best intentions, thoughtlessly divided in 1807. This state of affairs continued for over two-thirds of a century, or until ownership of separate floors and parts of floors in a house was introduced. The large size of these lots has thus retarded the growth of New York by practically prohibiting that providing of small houses for families of small means which so largely contributed to the marvellous growth of London and of various other cities during the same period. It has kept away a vast population of respectable families of moderate means, discouraged marriage, and lowered the birth-rate of the city; while the want of proper ventilation in the tenements which were the only form of small dwelling for many years found practicable, on the New York lots, increased the death-rate, and especially the death-rate among children.

19. *Available Everywhere.*

It can, in some of its forms, be made Available Everywhere.

This differentiates this System from: — All plans suited only to corner lots, or to lots of certain dimensions; or to local, or national, customs or requirements.

The concentration of residence, coupled with great discomfort, that grew out of, and has been practically forced on by the New York uniform deep close-back lots, has made it further necessary that any system aiming to supplant it, should, in order to have even a hope of adoption, retain the same high rate of concentration, while getting rid of the discomfort. Hence a prize offered in New York, in 1879, was for the best method of housing four families on each floor on a space twenty-five feet front by ninety feet deep, shut in at the sides, but with a yard at the extreme rear of the ninety feet, ten feet deep, for light and air, as required by law, making the full depth of the lot one hundred feet. The same degree of concentration is maintained in an application of this System, printed in the *American Architect and Building News*, May 5, 1888; but, to secure comfort, all the factors named in the column of factors of this System are there combined with that high degree of concentration. By using the same factors with greater space, still greater desirability in the residences, in the number and size of rooms, etc., will be secured; but the higher the rate of concentration the more important it is not to deprive any of the dwellings of any of the features named as factors of this System.

A high degree of concentration of residence is likely, sooner or later, to be found wherever nearness to any single point becomes a matter of convenience and so of advantage and profit. Rarely, however, is such concentration foreseen when the buildings are built which afterward become divided up so as to form crowded dwellings; neither hitherto, has the giving to each of the dwellings in a highly concentrated congeries of dwellings the advantage of all the factors embodied in this System, been generally, or at all, looked for. In the crowded parts of most cities in all countries many, probably the majority of, dwellings never see the sun, or never see it in the winter season when sunshine in the dwelling is most welcome and beneficial. In Continental Europe many dwellings have no command of a through-and-through draught of air; and in New York and wherever deep close-back lots have long prevailed in closely built cities, many dwellings have neither thorough-draught nor adequate provision of air or light.

In new States and colonies and wherever virgin sites are laid out for buildings which may ultimately present any form of concentrated residence, a street and lot system like that of New York often is, and in the future often is likely to be adopted on account of its great simplicity. It is easily described and understood, and from being a rectangular system is easily applied. These merits, and the fact of its being largely in use, are patent and present; while a knowledge of the evils which have ultimately followed its adoption is absent; or, if known, the evils still seem remote. Further, it is quickly recognized that such a system, which divides up land, though only on paper, into small uniform-sized parcels, having, as nearly as possible, uniform natural and civic advantages, facilitates its immediate sale by putting it in a handy form for such purpose; and facilitates its future successive sales, at any time, by a form fixed and identical in shape and size with that of its fellows. A constant unit of value established in the land of a locality, which, like any other unit of value, wampum, cowrie shells, paper money, or coin, may change in value relatively to other commodities, but cannot readily change in value relatively to adjoining units, of the same kind. Whatever puts up the price of one lot generally puts up the price of adjoining lots. Profitable uses to which lots far distant have been put also adds to the value of like lots everywhere, so far as there is a chance of their ever being wanted for a like use. Land once laid out in "City Lots," and particularly in such city lots as those above considered are rarely likely to be redivided if any of them have been once sold. Each owner hopes from his one lot the profits from the greatest concentration of dwellers known on any similar lot anywhere. It is held, whether for sale or not, with these hopes attached.

Throughout the north and west of the United States, and in some of the British Colonies, land, in many places likely to become centres of population, has already been laid out, as in New York, in deep close-back lots. The evils which have accrued to concentrated residence on such lots, in New York and elsewhere, can be avoided by using this System; and, except the New York sea-breeze, every advantage of the System can be everywhere secured. For places south of the equator the arrangement has only to be reversed, using south for north. It is only when lots have been laid out with their longitudinal axes not in line with the meridan, or direction of a shadow thrown of an object, by the sun at noon (or nearly so, as in New York) that the System would lose the factor of command of

sunshine, while retaining its other factors, and only then if the buildings were placed with their axes in line with the axes of the lots as laid out, instead of in line with the meridian. So that the System is of value wherever a high degree of concentration of residence is desired to be combined with comfort. It is applicable both where land has been and where it has not been already laid out in lots. By its use may be anticipated the slow teaching of experience with all its attendant losses, discomfort and disease.

USEFULNESS: —

20. *Meets Pressing Needs.*

It meets pressing needs for Comfortable Housing for all Classes in New York, or wherever population is dense.

This differentiates this System from: — All plans for housing only certain classes (*e. g.* the "working classes"); or plans which (as in the laying out of the streets in Philadelphia) practically tend to separate as to streets and neighborhood those of different means, and so lack (however otherwise admirable) availability for future general use.

In the cities of all countries, a pressing need, not only of the future but of the present time, is of dwellings which, however small, however simple in adornment, or however economical in construction, are such that persons of the greatest refinement of taste and habits can live in them without discomfort, and even with satisfaction and pleasure.

21. *Provides a Way of Avoiding New York Tenement-house Evils.*

It provides a way of avoiding the tenement-house and apartment-house evils hitherto prevailing in New York, which are bred there and elsewhere, by the exclusive employment of an inflexible system of deep close-back lots.[1]

This differentiates this System from: — All plans of, or for, Improved Tenement-houses or Apartment-houses, in New York or elsewhere, which lack the features of this System named above as factors Nos. 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, and 16.

The report on the tenement-house evils in New York by the President of the Board of Health, December 1887, already quoted from, presents, not only a résumé of the history of the rise and progress of those evils, but a further history of the gradual lessening, or conquering, of many, perhaps most, of those evils, and affords a most hopeful outlook for the future. In time, doubtless, by the slow, but sure process of elimination of the undesirable features of successive buildings, an eradication of all possible removable objectionable features, and the additions of all possible desirable features will be arrived at. It is over eighty years since the street and lot system which has originated and bred the rapid growth of the worst of those evils, and presented the greatest obstacle in the way of overcoming them, was adopted; over fifty years since the existence of some of those evils was developed; between thirty and forty years since their existence was generally deplored, but efforts made to lessen or prevent them were hampered or discouraged by the general assigning of their cause to the small size of the island on which New York was built; over eleven years since the publication of a circular pointing out the deep close-back city lots as the source of the worst of those evils, an opinion founded on studies in the distribution of areas, on the vast space, more than half the area of the island, still unbuilt on, and on the presence of the same evils in Brooklyn, Jersey City and even remoter and smaller places, where the New York street and lot system had been followed; over nine years since a very general philanthropic movement resulted in the offering of a prize for the best method of overcoming those evils within the limits of one of the lots which are the cause of the evils. Thus, for years there has been a constant effort for improvement, the success of which has gradually increased, and has of late been especially marked. Many houses have been erected entirely or partly from philanthropic motives with a view to providing better dwellings for such as otherwise must dwell in the old and faulty tenement houses; while, at the same time, the latter houses have been improved very generally, some in a few, and others in many ways. The introduction of apartment-houses, or flats, about 1865 with every appliance for convenience of the best dwellings, combined with spacious suites of expensively fitted rooms, has been followed by similar houses with smaller suites but embodying like conveniences; until now the line of demarcation between many apartment-houses and the best tenement-houses is practically lost.

But these advantages are still detracted from by the lack of direct light and means of adequate ventilation in many of the rooms, and especially the sleeping-rooms, in by far the larger number of these buildings. Such rooms, however otherwise convenient, are neither cheerful, comfortable, nor wholesome. Their existence in such numbers proves either indifference to these discomforts or else that no way has hitherto been presented and made widely known of altogether avoiding them while yet securing such a high degree of concentration of residence in a given space as in all cities is always more and more being sought for. But the tone of complaint on this subject, constantly being voiced by the press, forbids the idea that people who suffer from these discomforts are indifferent to them. And, in all probability, for one who speaks, multitudes who sympathize keep silent. Few are inclined to speak of, or dwell on, discomforts which their lack of means obliges them to put up with, however glad they would be to avoid them. Certainly increased public education and refinement, however they may help men to bear losses which do not involve self-respect, do not render them more indifferent to these peculiar discomforts, nor to many others the avoidance of which most completely, and with least loss, makes up the problem of concentrated residence.

The table to which these notes apply shows what the author deems would be further improvements in any plan for concentrated residence which did not already unite all the factors here named and combined in a System; and gives the reason for thinking that such a System provides a way of avoiding New York tenement-house evils.[2]

E. T. POTTER.

[1] See Circular by the author: To whom it may concern, December 20, 1876.

[2] In an intermittent, but almost constant, study, in several countries, of this subject, since circumstances, over thirty years since, called his attention to the mortality, suffering, and discomfort consequent on the lack of thorough-draught, or even proper air or light in the bed-rooms of New York tenement-houses, the author has found no buildings, or plans for buildings, uniting the factors which he has tabulated and combined in a System.

SAFE BUILDING.[3] — XXXVII.

Example III.

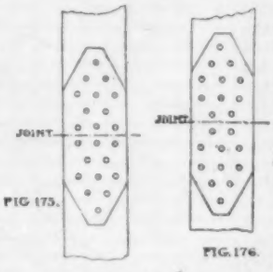


FIG. 175. FIG. 176.

Butt-joint Two Cover-plates. *Same problem as before, but two cover-plates to be used, one above and one below the joint.*

We will again decide to stagger the rivets and losing only one rivet-hole will again require a 1″ thick plate.

Required number of rivets. Now, for bearing we will have the same result as before, *viz*: 9 rivets required, but in shearing it is evident that now each rivet has two resisting areas or is in double shear, so that we will need only one-half of the previous quantity or $\frac{17,2}{2} = 8,6$ or say, nine rivets. Had we used Formula (111) we should have obtained this result, for:

$$x = \frac{135000}{1,5714.\ 1^2.\ 10000} = 8,6$$

For the bending-moment we use Formula (113) and have

$$x = \frac{135000.\ 1}{0,7857.\ 1^3.\ 18000} = 9,5$$

or say ten rivets required to resist cross-breaking. This shows how much better proportioned the different strains (shearing, bending and bearing) are to each other, where we use two cover-plates. Had we calculated directly without use of formula we should have obtained the same results. We have already calculated net area of plate and bearing value of rivets in *Example II*, also the single shearing value, which was 7854 pounds per rivet; as we now have two areas this would be doubled or the resistance of each rivet to shearing would be 15708 pounds and the number required $\frac{135000}{15708} = 8,6$ as before.

Advantage of Two Covers.

For bending-moment we should have a 1″ circular beam with a clear span of 1″, uniformly loaded with 135000 pounds.

From Formula (21) we have the bending-moment

$$m = \frac{135000.\ 1}{8} = 16875 \text{ pounds-inch}$$

Moment of resistance will be as before

$$r = 0,0982$$

Therefore the total strain on all the rivets

$$s = \frac{16875}{0,0982} = 171843$$

This divided by $\left(\frac{k}{f}\right) = 18000$ gives the required number of rivets as before

$$x = \frac{171843}{18000} = 9,5$$

We now design the joint, as before, remembering to stagger the rivets and to place the required number each side of joint. The greatest number required was to resist cross-breaking, *viz.*, ten.

Designing the joint.

We can design as shown in Figure 175 or as shown in Figure 176; both require eleven rivets each side of joint, but cover-plates in Figure 176 need only aggregate $1\frac{1}{8}$″ in thickness, that is be $\frac{9}{16}$″ thick each; while those in Figure 175 would have to aggregate $1\frac{5}{16}$″ in thickness, or be, say, $\frac{11}{16}$″ thick each.

Joint shown in Figure 175 looks a little better, but otherwise there is no preference.

If cover-plates are not equal in thickness each side of plate, it would require very many more rivets. Each rivet would become a double lever, with its central part built-in and a projecting free arm each side, the length of arms being equal to their respective thicknesses of cover-plates. The load on each arm would be the proportion of whole strain, that the thickness of its respective cover-plate would be of the whole required (aggregate) thicknesses of cover-plates.

Covers of same thickness.

[3] Continued from No. 722, page 197.

There would be no sense in such an arrangement however. It would produce all sorts of unequal stresses, in shearing, bearing, cross-breaking, etc., and should be avoided. Riveted work at best is very theoretical, as the calculations depend entirely upon the accuracy and fit of each rivet. If a single rivet fails to do its share, it will at once disarrange all the strains and produce unequal stresses in different parts. Still if the above rules are followed, riveted work can be used with perfect safety. Where the result gives a fraction, a whole rivet should as a rule be used in place of the fraction. If the necessary spacing requires still more rivets, they can either be used, or, all the rivets can be reduced in size enough to bring them nearer to the allowable stresses.

No account has been taken of the loss due to punching, for this will affect the plate in tension mainly, and the safe stresses allowed for tension are very low. In compression the metal would not be strained as heavily as in tension, for the rivets will not weaken the plate so much if they entirely fill the holes, thus giving full bearing on the entire plate. Then, too, the butt joint if planed and carefully made and joined, will transfer directly more or less of the compression.

No reliance on butt.

But in all good work it is customary to place no reliance whatever on the butt, and to calculate in compression the same as for tension, namely, sufficient *net* area in each plate, at its weakest section, to resist the whole compression strain.

Explanation of Tables.

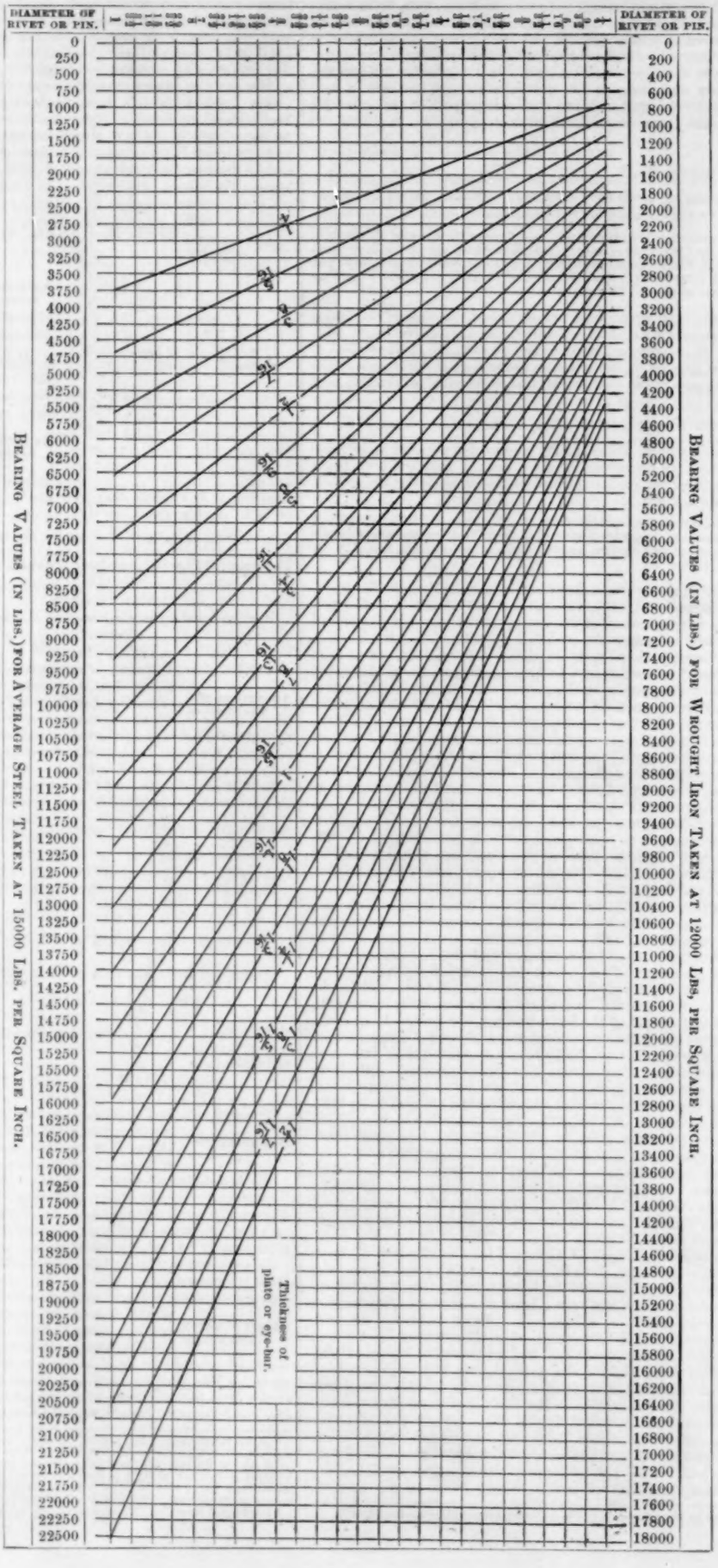
Tables XXXV to XL inclusive, have been calculated and laid out to save most of the wearisome figuring necessary in riveted work and in connection with pins. The first three give the bearing value of pins and rivets against eye-bars or plates, and the latter three the values in tension, single and double shearing and in cross-breaking of pins and rivets. All the tables are laid out for both steel and wrought-iron.

Tables XXXV, XXXVI, XXXVII.

The full heavy straight lines in Tables XXXV, XXXVI and XXXVII represent the thicknesses of plates or eye-bars against which the different sizes of rivets or pins bear. The thicknesses given are from ¼″ to 1½″ in Table

TABLE XXXV.

BEARING VALUES FOR IRON AND STEEL RIVETS AND PINS.

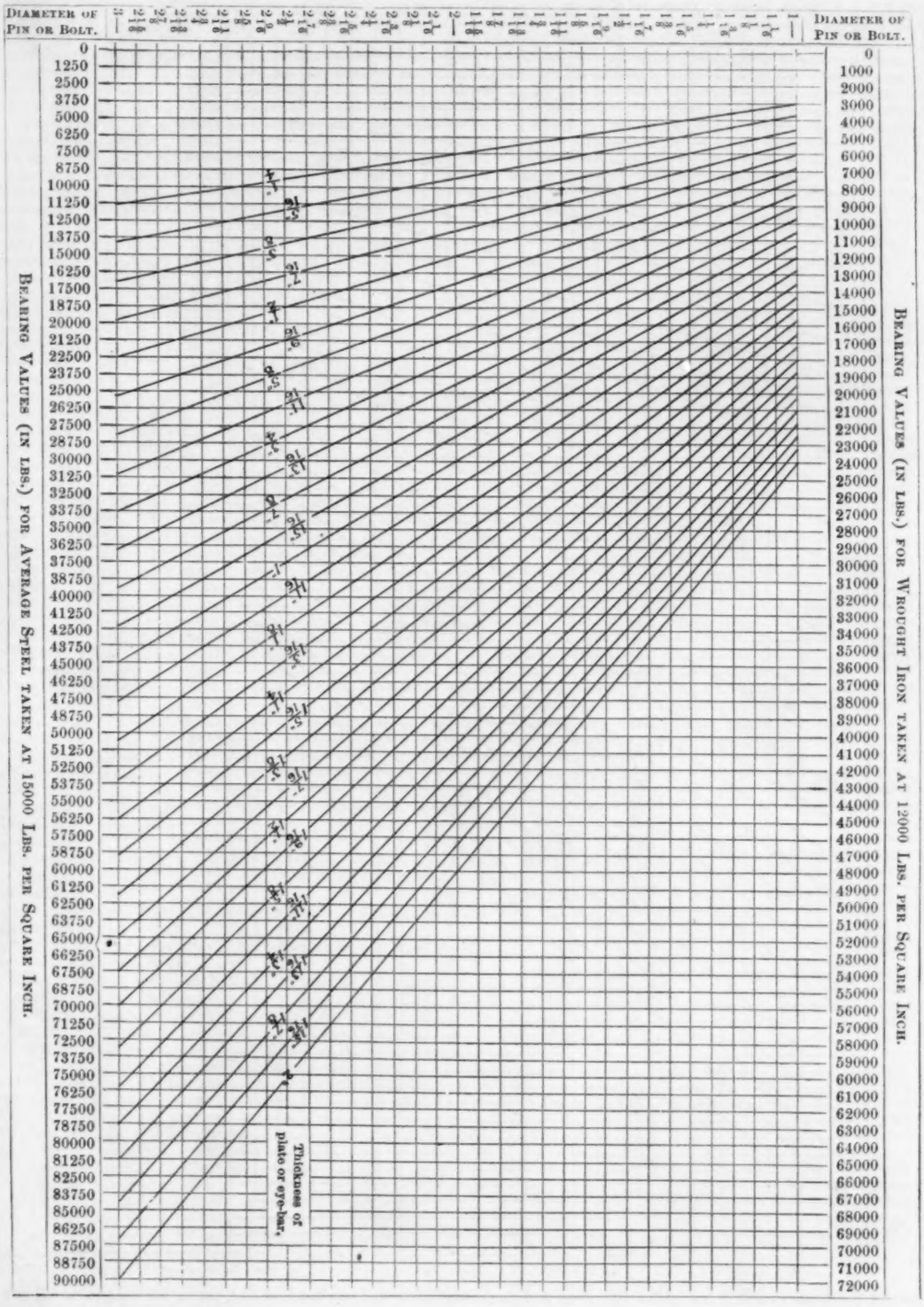


XXXV and from $\frac{1}{4}''$ to 2″ in Tables XXXVI and XXXVII; all by $\frac{1}{16}''$. For thicker plates or eye-bars it will only be necessary to increase the bearing value found, in proportion to extra thickness.

The columns to the left give the diameters of pins and rivets, running in Table XXXV from $\frac{1}{4}$ inch diameter (by $\frac{1}{16}$ inch) to 1 inch diameter; in Table XXXVI from 1 inch diameter (by $\frac{1}{8}$ inch) to 3 inches diameter; and in Table XXXVII from 3 inches diameter (by $\frac{1}{8}$ inch) to 6 inches diameter. The figures at the *tops* of these

TABLE XXXVI.

BEARING VALUES FOR IRON AND STEEL PINS AND BOLTS.



tables give the bearing values in pounds for wrought-iron, and those along the *bottoms*, the bearing values in pounds for average steel.

LOUIS DECOPPET BERG.

(To be continued.)

COHESIVE CONSTRUCTION.[1]

APPLICATIONS. — INDUSTRIAL SECTIONS.

IN Barcelona we have a family called Muntadas, which we can say is a genuine representative of the aristocracy of the manufacturers of Catalonia. All of the members of this family are, or have been, manufacturers, and together they employ in the towns of Barcelona, St. Martin, Sans, Gerona and Ripoll, more than six thousand people in their bleacheries, manufactories, dyeing and printing buildings.

One of the members of this family owns in the Department of Zaragoza a rich and extensive property, that for centuries was

[1] Lecture delivered by R. Guastavino before the Thursday Club, January 2, 1890.

possessed by the monks and is called "The Monasterio de Piedra" (the Stone Monastery); this tract contains about 50,000 acres, and the buildings thereon, which consist of churches, convents, and the Palace of the Abbot, all of different epochs, Romanesque, Byzantine, Renaissance and modern, cover about 100,000 square feet of ground.

The owner Don Frederico Muntadas (who is a great litterateur, and pisciculturist) lives there with his family a large part of the year.

nary works of nature. Imagine Trinity Church covered by an immense natural vault, supported by walls of the same nature, with gigantic stalactites of all kinds of forms and dimensions like great chandeliers hanging from above; the floor a lake; receiving the whole light through an immense vent, or opening like a rose-window in a cathedral, covered by the fall of the full mass of water of the river Jalon, *its builder*, that passes over the vault and is pre-

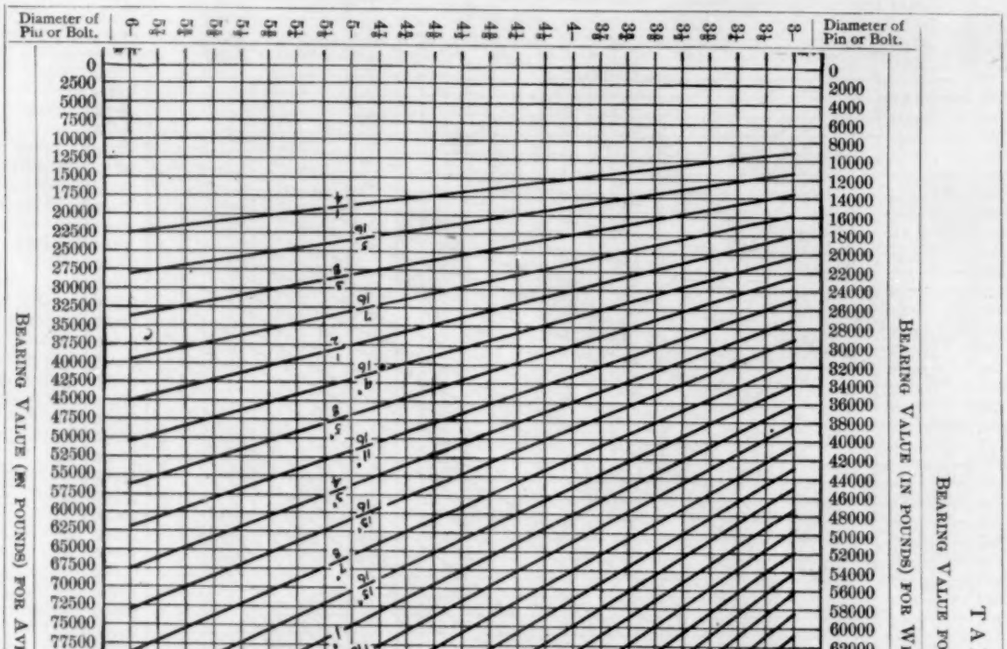


TABLE XXXVII.

Bearing Value for Iron and Steel Pins and Bolts.

cipitated more than two hundred feet, taking the form in its fall of a horse's tail, which is the source of its name, "Cola de Caballo."

I was invited by this gentleman, through his uncles Don José and Don Ignicio Muntadas, to visit this property, as they intended to convert the immense convent into a summer resort. It was in October, 1871, when I made my acquaintance with this estate, which is four miles from the railroad station of Alhama, a noted hot-spring resort. It was here in this "Monasterio de Piedra" that I saw a grotto of immense grandeur, one of the most sublime and extraordi-

I had just left Barcelona after completing some buildings, among them the large manufactories of Batllo' Bros., and was under the impression that I had done something in these buildings in the Cohesive System, but within this grand specimen of Nature's Architecture, I realized how small and insignificant my work had been.

The thought came to my mind in this immense room, viewing this fall of water, that all this colossal space was covered by a single piece, forming a solid mass of walls, foundation and roof, and was constructed with no centres nor scaffolding, and especially without the necessity of carrying pieces of heavy stone, and heavy iron girders; all being made of particles set one over the other as nature laid them. From this time, gentlemen, I was convinced that we can learn everything in this immense book called Nature, never enough studied, and that our ordinary system of constructing was very poor, notwithstanding we possessed the material for this kind of building, in imitation of Nature. I understood why my distinguished Professor of construction in the Academy of Architecture in Barcelona, D. Juan Torras, said, "*The Architect of the future will construct imitating Nature, because it is the most rational, durable and economical method.*" This grotto is really a colossal specimen of cohesive construction. Why have we not built on this system? This is not the time to answer that question. To those who are interested I would refer my lecture before the Society of Arts of the Massachusetts Institute of Technology, October 24 last.

In the South of Europe and in Asia there exist to-day many buildings in the Cohesive System, built, centuries ago, much as I am now building, except that their processes were too slow for this age. We better appreciate the worth of time and our method must be more rapid.

The types are: cupola of Saint Sophia, cupola of Cathedral of Zamora, Moorish constructions in Spain, and others in Asia.

Under these impressions I commenced work in Barcelona, beginning with my own private house, corner of Aragon and Lauria Streets, where I tried on myself, as a physician who first tries his own medicine, the effect of my ideas, building a construction four stories in height, practically with no beams.

Afterwards I built the bleacheries of Muntadas Aparicio & Co., a manufactory of merino and woollen goods for Carreras & Sons, another in Villa Franca for Michans & Co., the glass manufactory of Modesto Cassademunt, the Theatre of Villesar, the manufactory of porcelain for Florens & Co., silk manufactory of Saladriguez, some applications in the private house of the bankers D. Victor Blajot and D. Andres Anglada and others.

Some of the plans of these buildings were represented and rewarded at the Centennial in 1876. This together with the Chicago fire, which made a great impression on the European mind, persuaded me that this country was the place for the system; but I did not succeed in getting here until 1881, and then I spent several years studying American methods and material.

After a severe experience in this country, I began with the construction of a private house on Seventy-eighth Street, New York, owned by Bernard S. Levy, four stories high, built on this system. In the same year I began the building of the interior of the Arion Club, New York. The building-committee accepted my proposition when they ascertained that in the arches they could make a saving of over $5,000, in two floors, over the ordinary system of fireproofing. From this time I have been building in New York, having erected all kinds of constructions; but the first opportunity of putting this system into a manufactory in this country was given by Mr. T. M. Clark, the distinguished architect of this city, in the Coolidge Building and Organ Factory on Irvington Street, Boston.

As the object of this short lecture is to show the application of this system to mills and factory-buildings, and workmen's homes, colleges, etc., we will now begin with some facts that may prove interesting.

The Cohesive System is the most adaptable and economical for this kind of structures for the following reasons, which we will divide into two forms:

First: Economy in the qualities or mechanical conditions of the construction.

Second: Economy derived from comparison with the general systems in use, price by price.

Economy coming from the qualities or mechanical conditions of the construction is as follows:

1. Rigidity in the floors, representing an economy in coal. It is evident that all oscillating movement in the floor is a loss of power that represents at the end of the year a sum of coal consumed in excess. In the walls and floors of our system the rigidity is absolute, and in a building of great surface, that represents, as I have found by experiments with the old and new factories of Muntadas in San Martin, before referred to, a net saving of between five and six per cent.

2. It is common to see in wooden floors a warping of the wood, caused by the change of temperature or humidity, or by currents of air or the proximity of heated bodies, thus changing the level; consequently, the machinery is thrown out of level; then ensues a loss of power if the machinery is not re-levelled, or, when this is done, there is no certainty as to its stability, as another change is imminent. The same is true when, in consequence of the bad setting of the beam in cases where no ventilation is provided for the ends, dry-rot is precipitated more, if care has not been taken in the use of the lime. It is very frequently the case that such beams have to be replaced. In our system all the material is permanent, like solid walls.

3. We know the necessity for the use of grease and oil in factories, and the dangers attendant thereto, especially in cotton-mills, because of its extreme inflammability, and as all manufacturers require great room-surface, and as many parts of the room are far from the exit, there is a constant menace to safety.

In factories constructed on the Cohesive System, the floor being laid with tiles, nothing is affected by the oil; the cotton, if it takes fire, has nothing to burn; no iron-work is exposed; all is clay, like the samples shown.

Second: The second reason, or the economy derived from comparison with the general system in use, price by price, is as follows:

It is evident that light materials of equal strength, and the use of each material in the way required by its nature, is the base of building economy: that is our constant view. If we put the wood or iron to work under deflection, or submit them to transversal pressure, surely we shall need more material than in using the same wood or iron under tension. Both iron and wood have the greatest coëfficient when working under a single tension, and ought always to be so worked. If we place them in this position, designed for them by nature, we will here have an economy. The same is true when we put clay and cement to work by pressure; they then have their greatest coëfficient, and can replace the iron and work with economy. In a floor in the ordinary system we find wooden or iron beams, and, between, wooden planks or brick arches. What are the wood and brick arches doing? Only bridging between the girders or beams; all this material between is not working at all, the total weights are supported only by the beams or girders, and these bridges contribute only to the weight. But in the Cohesive System, if well applied, every piece of material is working directly and just as is necessary; the clay works to support itself, working by pressure, and the iron works as a rod. That is the great economy, and you, gentlemen, as practical financial men, will admit that, with these conditions, it is not strange that this system, although the material in itself is dearer, can compete with the "Slow-burning Construction," as I show by plans and estimates that you can compare. Here are the plans, but first permit me an explanation. [See Illustrations].

These plans are merely for the purpose of showing the application of this, our system, to factories, bleacheries and operatives' houses. I do not pretend that they cannot be improved, though they are the result of twenty years' experience in all sorts of buildings, especially in factories. All human work is susceptible of improvement, especially my own; consequently, the architects and the owners will have the services of the Guastavino Fireproof Construction Company only as contractors disposed to execute their ideas inside of this system. That is our business; but we cannot, we will not, act as architects, but only as builders.

The plans are: First, a Fireproof Factory. As these buildings have only a utilitarian object, it is not necessary to give them any artistic effect; the outside and inside walls will be left rough, except the inside walls of the workmen's houses, which will be left in plain plaster. The solidity of the structure is only taken into consideration, and on these conditions prices are based. The artistic part of the plans is only to show that any ornamentation or artistic finish can be done in this system if desired. The effect will be a rough surface, solid and substantial, and as the principal element in this system of construction is the cement and the tiles are but a mixture for rigidity, to give thickness of section, and as the cement afterwards is harder than the tiles, the joints will be irregular, as the clay comes, without any cutting or symmetrical pointing: this gives its own characteristic good effect.

DESCRIPTION OF THE BUILDING AND ITS CONSTRUCTION.

The walls are constructed of clay tiles, the piers being built hollow and utilized as ventilating-flues. The beams are all covered in the arches and are working under tension.

Hard-burned clay tile floors etc., fireproof columns, no iron exposed.

It contains on each floor in addition to space appropriated for manufacturing purposes, offices, store or sample rooms, and toilet-rooms and fireproof stairs. The building is well lighted and ventilated and is adapted for almost any kind of manufacture. The stories are 14′ 0″, 13′ 0″, 12′ 0″ x 14′ 0″ respectively with bays 25′ x 10′ 6″.

The safe load is 350 pounds per square foot, six months after being built and 150 pounds one month after being built.

The building is four stories high, 238′ 0″ deep and 134′ 0″ wide making 26,000 square feet, and price is based on nothing smaller.

The cost is 89 cents per square foot for each floor, including walls, floor and iron construction against 75 or 80 cents per square foot of wood floor and girders and walls.

SECOND. BLEACHERIES.

All the conditions given for the factory building will be applied in this, but the plans are the fac-simile of one already built in Spain. Price for bleachery of 12,000 square feet, 80 cents per square foot. If less than 6,000 square feet, the walls will be 6 inches, with piers of 6 inches additional.

THIRD. HOUSE FOR WORKMEN. BRIEF DESCRIPTION OF THE BUILDING AND ITS CONSTRUCTION.

This building is in the form of a double tenement 35′ 0″ x 35′ 0″.

The entrance hall is 4′ 5″ x 11′ 0″ and is used by both tenants. Each tenant has on the ground-floor a kitchen 11′ 6″ x 11′ 0″ which can be used as a living-room, a parlor or sitting-room, 9′ 6″ x 11′ 6″, also pantry 4′ 10″ x 5′ 3″ and closet or store-room 4′ 10″ x 5′ 3″, with private hall between kitchen and parlor, also separate water-closet, and separate door and yard. These stairs are used jointly by both tenants and are entirely fireproof (no iron). On the second story each tenant has three bedrooms with private hall connecting the front and rear rooms. The front bedrooms have each a closet. The stairway hall is lighted by a skylight. This arrangement gives each tenant five rooms, pantry-closets and water-closet. Each story is 10′ 0″ in the clear.

This building is exclusive of the foundations and cellar.

Price $3,000 to $3,500, building ten double houses at a time.

The rent at 6 per cent for both tenants, would be $210, or but $9.15 per month for each tenant without taxes, etc.

The outside walls are built of blocks of tile, each block containing six tiles with air-spaces between them as shown by detail-drawings.

COLLEGES AND SCHOOLS.

The plans for colleges and academic buildings are not yet drawn but in the matter of economy there would be the same saving as in all other buildings devoted to a special object, with the difference that the exterior must be more expensive, corresponding to the higher moral order of the building, but in the interior we would have the same mechanical conditions.

I must here remark that the constructive lines corresponding to the cohesive system, derived from the mechanical line of pressure is just the continuous curve or round form required by the laws of hygiene for good ventilation, avoiding corners that confine the impure air. Another condition of hygiene is that each room is absolutely isolated from those adjoining, thus making it cooler in summer, and warmer in winter, because the floors are absolutely tight.

Still another condition is the hollow wall which as well in manufactories as in dwelling houses secures absolute absence of dampness in the walls and of condensation. These hollow walls permit the building to be ventilated in the corners of the rooms where the impure air collects, and permits a greater section of ventilation than can be had in any other system without affecting the solidity of the building. This is a source of great annoyance to architects when a building requires a great number of flues, as they have difficulty to find places on which to lay the beams, having to make header after header, sometimes resting half a floor against the head of a single beam, thus constantly torturing the brain of the architect to make suitable framing-plans. But in our system this trouble is entirely avoided, all our walls and floors are tubular and every part of the room can be well ventilated in every direction.

Although this is outside of our subject, permit me to remark that these tubular walls, and tubular ceilings also facilitate the establishing of a system of pipes, to connect every corner of the room with the fire-box or grate of the boiler-fire, range or furnace in order to burn the air, passing it through the flame, which is the best way to transform impure air; such an appliance as this can be used for the ventilation of college buildings, and to any who are further interested in this matter, I would refer them to plans and treatise sent by me to the Centennial, on "Improving the Healthfulness of Industrial towns," for which I was granted a certificate of award, signed by your distinguished fellow-citizen here present, General Walker, as Chief of the Bureau of Award.

MATERIALS.

My intention is not to uphold the use of concrete in construction where cohesive strength is required, because it is a slow process; it works only by pressure, and there is no shearing strength in the joints, neither chance for perfect setting. It makes a heavy load, especially on the centres during construction, producing a great load of dampness in the building, and is ruinous for patching or alteration. After several years' experience in concrete construction with no satisfactory results, I have come to the conclusion that the tubular system as applied in constructing walls and ceilings with light and well-burned clay, and good Portland cement is the best, safest, most substantial, economical and rapid method of construction in the cohesive system, for our dwellings or in any kind of buildings. By light and well-burned clay, I mean such as was used by the ancients, which although as strong as the others (from 1,500 to 2,500 pounds per square inch), has a specific gravity less than water.

The mortars used must be of the quality called hydraulic — *i. e.*, mortars that do not need exposure to the air for setting — which for our especial work is Portland cement.

The bricks must be of as large dimensions as a man can easily handle, and of such weight that a man can work with them all day. The result of these conditions is a brick of about four pounds weight (for the clay commonly used); about an inch thick, and of seventy-two square inches surface, or 6″ x 12″. These tiles must be a little porous, in order to absorb some of the excess of water in the cement; the breaking load for a square inch of tile is between two and three thousand pounds.

I must remark that we have yet a great deal by way of improvement to do, and it is necessary that I call for assistance in perfecting our knowledge of the art of building, especially from manufacturers of materials and architects.

There are three things to be improved.

1. The technical part ought to be put in a treatise, in order that it may be used in the technological schools for the benefit of the constructive art.

I have the satisfaction of saying that this matter is in the hands of one of the eminent professors of the Institute of Technology, I refer to Prof. Gaetano Lanza, who has given some figures and ideas which show that these important matters could not be in better hands.

2. To the manufacturers: Our tiles, as well as our bricks, are too heavy. The cupola of St. Sophia has some rings that were built with *lava* (pumice stone), some with brick that was so light that it would float in water; we have some of this kind of clay in Spain, north of Valencia; Alcora says that perhaps the people working in the old mines between Pensacola and Valencia used this kind of clay, but investigations on my part have failed to discover it. The idea of looking for it in the mining districts, led me to make a search for it in Colorado, with flattering prospects: I have here a specimen from Colorado — heavy, for floors, but we are having them lighter for ceilings.

The far West is much advanced in the preparation of fire-clay, as much as we are in Spain; and in some parts of Mexico they are better prepared than here in the East for ceramic-work applied to architectural purposes, and have given some attention to the lighter brick.

It is an error to believe that the heavy brick is the best; the light brick, which I mentioned, has a breaking strain of 2,200 pounds and will float in water; this is the help that we need from the manufacturers.

ECONOMY IN THE FUTURE.

The clay in our tile is about the same as that in the common brick, and the volume is about the same, *i. e.*, from 4, 4½ to 5 pounds. Our tile is 1 x 6 x 12 inches or 72 cubic inches, and the brick is 2¼ x 4¼ x 8 or 72 cubic inches, but we have to pay from $18 to $20 per thousand for the tile, while the brick costs from $7 to $9 per thousand.

When we consider that the tiles are made in blocks of six tiles each, and thus are more easily handled than brick at the factory, that they are thinner, thus drying more quickly and being easier burned with less fire, it would seem that they ought to be made more cheaply than brick, and such is the case in Spain where brick costs from $6 to $7 per thousand, and tiles from $4 to $5 per thousand.

This anomaly is perhaps due to the fact that as yet there has not been sufficient demand for these tiles here to cheapen their manufacture by producing them in large quantities.

In regard to the cement, we now have to pay to English manufacturers a large contribution on the Portland cement we use; when it can be safely made in this country, I suppose it ought to be about 20 per cent cheaper. We ought from these two sources alone to be able to cheapen construction from 20 per cent to 30 per cent.

3. To the architects: In concluding, permit me to put before you the following thoughts that are not of my own, but of one of the eminent English authors of the first part of the century.

What is the best type of structure, that which for equal periods of duration has more per cent of its full-covered area occupied by solid walls, or that which has less of its surface so occupied by walls?

In the contemplation of buildings which show their strength by their age, the comparative science displayed may be partly estimated by an inverse ratio of mass of materials, to the space covered.

The following list of notable buildings, with the per cent between the areas covered and the wall-surface, may be interesting:

Of the superficial feet of walls of the Church of the Invalides, at Paris, two-sevenths of the whole is solid.

St. Peter's, Rome, one-fourth.
St. Paul's, London, two-ninths.
Pantheon, Rome, one-fourth.
St. Geneviève, Paris, one-seventh.
Salisbury Cathedral, one-fifth.
Temple of Peace, one-seventh.
Parthenon, two-elevenths.
St. Sophia, *cohesive* system, one-eighth.

A great building with few materials, besides the periodical approbation that it will receive from the age, will have an indisputable superiority as a rule.

ILLUSTRATIONS

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

HOUSE OF W. A. BURNHAM, ESQ., BEACON ST., BOSTON, MASS.

[Helio-chrome, issued only with the Imperial and International Editions.]

FIRST BAPTIST CHURCH, ELMIRA, N. Y. MESSRS. PIERCE & DOCKSTADER, ARCHITECTS, ELMIRA, N. Y.

THE church is to be built of common red brick, with red mortar, and Hummelstown sandstone trimmings and slate roof. The interior is to be of oak, finished on the grain; to be heated and ventilated by the Smead-Rutan system. The cost of the church proper is $50,000. Organ, seating, stained-glass, heating, ventilating, plumbing and all other fixtures, $15,000.

FACTORY BUILDING, ON THE COHESIVE SYSTEM.

For description see elsewhere in this issue.

A WORKMAN'S DWELLING-HOUSE, ON THE COHESIVE SYSTEM.

For description see elsewhere in this issue.

HOUSES FOR DR. A. WHARTON, ST. PAUL, MINN. MR. A. H. STEM, ARCHITECT, ST. PAUL, MINN.

[Additional Illustrations in the International Edition.]

A PIER OF THE PORTICO OF THE CATHEDRAL, LUCCA, ITALY.

[Gelatine Print.]

A PIER OF THE PORTICO OF THE CATHEDRAL, LUCCA, ITALY.

[Gelatine Print.]

THE HALL, CASTLE CAMPBELL, CLACKMANNAN, SCOTLAND.[1]

"EVERYBODY admires Castle Campbell. It would be difficult, indeed, to discover a more complete representative of the mountain chieftain's stronghold, as the romancists have described it in the Abruzzi or the Vosges, and Salvator and Vernet have painted it. A high and abrupt range of mountains, a precipitous rock covered with a vast and varied mass of buildings, on either side roaring torrents, seen through mysterious gulfs of frightful depth, while far off on either side stretches 'a sable, silent, solemn forest'; scarcely any of the attributes which can give interest to such a scene are wanting. The Ochils, on the slope of which the Castle stands, are at a distance, shapeless and uniform, with long table-lands and rounded summits; but their sides are in many places scooped out into precipices and gulfs. Of the wild, inaccessible spots thus created, the very best has been selected for Castle Campbell. On the front, facing the valley of the Devon, and the sides, there is, perhaps, no other Scottish fortalice so well defended by nature; and even on the rear, only approachable by crossing a high range of mountains, the access is narrow and well defendable. On approaching the Castle rock, we reach the streams which on either side tumble through the chasms at its base and meet in one, thus making the rock a peninsula. The adventurous tourist sometimes endeavors to clamber up by the channel of the more southerly stream, but the attempt is a perilous one. If not carried beyond the bounds of prudence, however, it brings him into magnificent scenery of precipice and waterfall, with the sweet overhanging trees, which give freshness and beauty to the dark fissure. Right in the face of the rock, and reaching from the bottom of the defile to the Castle wall, there is an eccentric narrow cleft, smooth as if it had been cut with a sharp knife in a soft substance. It is called Kemp's Score. Tradition ascribes it, with other geological eccentricities, to art, and also asserts that it once afforded a hiding-place for John Knox — a most unlikely service, since it is a place where a fugitive would be exposed to multitudinous dangers.

"We reach the Castle from the lower part of the torrent by a steep ascent on the surface of the smooth grass, and then we find what a lordly eagle's nest, commanding a matchless stretch of country, the great mountain chief had raised for himself. Besides the attributes of great strength and security, the fortress is not without its amenities. The mixture of symmetry with solidity in the arched roof of the hall will be noticed in the accompanying engraving. A gallery facing the rock, as well as the top of the great square tower, have been places of open-air enjoyment, and a small garden still shows an occasional crop of apples hanging from venerable, mossy trees. Some of the lower parts of the building are, or till a late period were, occupied by a shepherd and his family; and there was something to be respected in the nerves of those who could live in the these deep, dusky vaults, with the torrents roaring in the rocks beneath, and the broken, shattered and occasionally falling masses of masonry swaying in the winds above.

"It does not appear to be distinctly known at what time this mountain territory, so far separated from the others in the far West, came into the hands of the Argyle family. It was of old called the Gloume, or Gloom, and there has been much jocularity about the Castle of Gloom, in the parish of the Dollar, or Dolour, and beside the stream of Griff, or Grief. Colin, first Earl of Argyle, did not like the name, and procured an Act of Parliament in 1849 to change it to Castle Campbell. It may be given as a specimen of a species of document which, at that period, pretty frequently occurs in the statute-book:

"'Oure sourane Lorde of his Riale autorite at the desire and supplicacioun of his cousing and traist consalor Coline Erle of Ergile Lord Campbele and Lerne his Chancellare has chengeit the name of the Castell and place quhilk was callit the Gloume pertenyng to his said cousing, and in this his present Parliament makes mutacioun and changeing of the said name, and ordaynes the samen Castell to be callit in tyme to come Campbele.'

"It is not likely that the great Macallum Mhor resided so often in a place where his power was bounded by an ordinary estate, as in his island fortalice at Loch Awe, or at Inverary, where he was monarch of the surrounding territory. There are traces, however, of the occasional residence of the family here. The author of the statistical account of the parish mentions, among the seignorial obligations of the feudatories of the domain, that 'in some of the charters the vassals are taken bound to cary the wine used in the Castle from the port of Aloa, and in others to furnish horses to bring their superior and his family from Stirling.' He mentions, apparently from acquaintance with the tenures themselves, that some buildings in the neighboring village of Dollar are held by owners who, if they had to fulfil the original obligations in their titles, would have to be the hereditary bakers and butchers of the owners of the Castle, and supply coal for its fires, beer for its table, and oats for the horses of the men-at-arms.[2]

"There is one curious piece of historical evidence of the occupation of the Castle. In 1556, John Knox had lifted his ecclesiastical banner against the Queen Regent and the Pope, had gathered around him a body of followers, and held, though not yet without considerable danger, open disputations. It was then that he was desired to minister to the English Church at Geneva, and, having sent his female relations on before him, he determined to leave his friends in Scotland and accomplish the perilous journey. In the meantime, in the words of the history generally attributed to his own pen, he 'passed to the old Erle of Argyle who then was in the Castle of Campbell where he taught certain dayis. The laird of Glenurquhare being one of his auditouris, witted the said Earle of Argyle to retaine him still; but he, purposed upon his journey, wold not att that tyme stay for no requeast, adding "That if God so blessed thei small beginnings that they continued in godlyness, whensoever they pleased to command him they should find him obedient"; but said "That ones he must neadis visit that lytill flock which the wickedness of men had compelled him to leave"; and so in the month of July he left this realm and passed to France, and so to Geneva.'[3]

"We pass over to another historical epoch, nearly a century later. Cromwell had swept the King's army before him at Naseby, and the Royalist cause was doomed in England. Montrose, who proposed to bring his Highland army to England, was still beyond the Grampians, and he had to pass the well-organized forces of Baillie. In his way along the side of the Ochils to the memorable field of Kilsyth, he passed the gate of one of the stateliest of the fortresses of his hated adversary, Argyll. The opportunity was too tempting to be overcome, and, indeed, he only pursued the system of warfare adopted by both sides when he sacked and burned Castle Campbell."

THE COURT-YARD, CASTLE CAMPBELL, CLACKMANNAN, SCOTLAND.[1]

STABLES, HOLCOMBE, CHATHAM, ENG. MR. JOHN BELCHER, ARCHITECT.

ENTRANCE, HOLCOMBE, CHATHAM, ENG. MR. JOHN BELCHER, ARCHITECT.

SKETCHES IN NORMANDY.

THE sketches we reproduce were made a few months ago by Mr. Railton during a short visit to Normandy, and will suggest his style of obtaining data from which finished drawings can be made.

DESIGN FOR BOARD SCHOOL, BROMLEY, KENT, ENG. MESSRS. VACHER & HELLICAR, ARCHITECTS.

THESE schools, to hold 600 children, were competed for by the local architects. The design was sent in with others illustrated under the motto "Bromley," but the professional assessor excluded it and placed another design first. A protest was made, and disputes having arisen — raised by one of the other competitors, who considered he had not been fairly treated — the Board were induced to consult the Council of the Royal Institute of British Architects, who ruled that the consulting architect was as much bound, in making his award, by the instruction issued with his concurrence as were the competing architects, and, therefore, the design placed first should not have been thus placed. The Board, following further advice, submitted the designs to Mr. Norman Shaw, R. A. There was a clause restricting any buildings behind line *A A* to a maximum height of twenty feet to the highest feature. Messrs. Vacher & Hellicar, the authors of the design "Bromley," have been appointed the Board's architects for these schools.

PARISH ROOM AND SCHOOL, CHARLETON, DEVON, ENG. MR. F. T. COMMIN, ARCHITECT, EXETER, ENG.

THIS building was recently completed, and has been erected from the designs.

COMMUNICATIONS

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

THE POPULAR IDEA OF ARCHITECTS' INCOMES.

BOSTON, MASS., February 17, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:

Dear Sirs, — As a commentary upon some recent remarks in your journal about mistaken notions regarding the incomes of architects, the following paragraph from an article in the Boston *Transcript* of

[1] It should always be kept in mind that these illustrations from the "*Baronial and Ecclesiastical Antiquities of Scotland*," [1845] by R. W. Billings, are republished very largely for the sake of giving instruction in one manner of the rendering of architectural drawings.

[2] New Stat. Account, Clackmannan, 108.

[3] The Works of John Knox, i, 254.

February 15 may be of interest. The author kindly gives the profession double the fee which custom allows, and three or four times what is often forthcoming. This and the unkind criticism of the architect's performance of duties, some of which are imposed upon him in entire disregard of wise foreign regulations which the writer extols, must, it would seem, proceed only from ignorance or the desire to make a point by misrepresentation.

"Four years of technical study and the possession of a diploma must precede any constructive work by a French architect; he is held responsible for twenty years for accidents occurring in buildings he has erected. He or his representative is on the ground during the entire period of construction. With us, he alone is the judge of his qualification, and his responsibility usually ends with the payment of ten per cent for *not* superintending the work."

Yours, respectfully, A. Clinton Brackett.

ABATTOIRS.

Philadelphia, Pa., February 10, 1890.

To the Editors of the American Architect:

Dear Sirs, — Will you please, in your next issue, direct me to any source of information in regard to abattoirs as erected in Cincinnati, Chicago and other cities of the West.

Respectfully yours, A Subscriber.

[We cannot give any information as to Western abattoirs, but the pamphlet describing the Brighton, Mass., abattoir, published by the Massachusetts State Board of Health in 1878, may be of assistance. — Eds. American Architect.]

NOTES & CLIPPINGS

The Prison-Ship Martyrs' Monument. — Representative Spinola has been instructed by the House Committee on Military Affairs to report favorably to the House his bill appropriating $100,000 for the erection of a monument to the prison-ship martyrs, in Brooklyn. — *New York Tribune.*

Church Restoring by Lottery. — It is not often that so interesting a lottery is announced as one which is to be drawn in Munich on the 25th of this month. The money that will be raised is to be applied to the restoration of the Church of St. Sebaldus, in Nuremberg, which is one of the most interesting buildings in Germany. Among its treasures is Peter Vischer's masterpiece, the "Tomb of St. Sebald." — *New York Commercial Advertiser.*

Decision Against the "Trolley" System. — On February 12, Judge Taft, of the Superior Court sitting in Cincinnati, decided the case of the Telephone Company against the Mount Auburn Electric Street Railroad Company. The Telephone Company asked for an injunction restraining the defendants from using the single trolley system, on the ground that it interfered with the operation of telephone wires. The court decided in favor of the Telephone Company, granting the injunction, but allowing the Street Railroad Company six months in which to make the necessary changes. It seems to us that a similar decision in Boston must be made sooner or later.

The Queen of Greece and an Electric Wire. — Electric wires are no respectors of persons, and it was only by a piece of dumb luck that the Queen of Greece recently escaped instant death when one became detached from its fastenings and fell upon her as she was walking in the palace grounds. By great good fortune the current was at the time shut off, but the wire encircled her in such a way that it took her attendants several minutes to release her from it, and hardly had it been cast loose when the high tension current was turned on and made itself manifest in the form of long sparks. The sensations of the manager of the plant when he learned of the occurrence may be imagined. — *Fire and Water.*

The Tunnel Under the St. Clair. — Six hundred men are now digging the railroad tunnel under the St. Clair River, at Port Huron, at the rate of fifteen feet each day. More than 1,200 feet of the tunnel proper is now ready for trains on the Michigan side and 900 on the Canadian. The remaining 4,000 feet will be finished at a wonderfully rapid rate, considering the nature of the work. The tunnel is over 6,000 feet long. The approaches are equally long, so that the entire length will be more than two miles. Of this distance 2,310 feet are under the river, 2,390 feet on the Michigan land side and 2,100 on the Canadian. The grade is one foot to every fifty, except under the river bottom, where it is substantially level. It is an iron-cylinder tunnel — the only one of the kind in the country. There is neither brick nor stone used in this construction. Neither are there any stays or supports — simply a mammoth iron tube built in sections underground. It is designed for a single track. Electric-lights make it as light as day, air-engines keep the atmosphere as healthy inside as above, and steam-pipes hold the temperature at the proper point. It is as dry as a street in summer, and the disagreeable features common to subaqueous work are entirely absent. Work is pushed from both ends. The method of construction is simple. A great cylinder, weighing more than sixty tons, twenty feet in diameter and sixteen feet long, is driven into the blue clay, which constitutes the entire bottom of the river, by the use of hydraulic power, with as much ease as cakes of soap can be carved out of a general mass. Inside this cylinder, which is called a shield, twenty-two men are at work removing the dirt. As fast as the shield is pushed forward, which is about two feet at a time, the clay thus brought inside the shield is dug out to the edge of the great cylinder. Then the hydraulic jacks are again started, and slowly, but irresistibly the immense iron tube moves another two feet into the solid earth ahead of it. Each jack has a power of 3,000 tons, and the combined power behind the shield is more than 400,000 tons. Another ring of iron-lining is put into place, and each foot of tunnel is ready for track-laying as fast as the work progresses. There is no mason-work, as already stated, and when done the tunnel will practically be a continuous iron tube twenty feet in diameter and nearly 7,000 feet long. The iron plates that form the lining are of such curvature and length that any thirteen of them, with a small key piece, will make a circle of twenty feet in diameter. The edges and ends are turned up, each piece being bolted by a dozen large bolts to its neighbor. Each one is eighteen inches wide and weighs as near 1,000 pounds as the foundries can make them. — *Boston Transcript.*

TRADE SURVEYS

It is now about twenty years since the great agitation in favor of internal water-way improvements upon a large scale. The senatorial committee which at that time listened to the popular demand recommended that as much as $150,000,000 could be judiciously expended in the construction of canals, the improvement of rivers and the general utilization of the water-ways of the country for the purposes of commerce. Railroad influences were credited with destroying the budding scheme to divert this large amount of public money in this direction. Then followed the granger movement, with results which have never yet been satisfactory to the agricultural or commercial interests of the interior. On the heels of this agitation came the Interstate Commerce Law, with which railroad managers, railroad boards and legislatures have been wrestling ever since. Despite the obstacles encountered, a great deal of progress has been made in the removal of difficulties and injustice. Moderate improvements have been made from time to time, and now a large number of schemes are about to be pushed. The shipment of 5,000 tons of pig-iron from Sheffield, Ala., to Pittsburgh by water, is one of the first results growing out of this long agitation. Engineers are now at work mapping out the course of a canal to connect the Ohio River and Lake Erie. The water-ways of the Northwest are to be greatly improved as soon as the proper agencies, political and otherwise, can be organized for their prosecution. The Hennepin Canal scheme is on its feet; Chicago expects to soon have freer intercourse with the Northwest. The River Freight Line Navigation Company is another one of these schemes growing out of this long agitation; its object is to run 60 steamships between Omaha and Pittsburgh. This is not a fairy tale, although it reads like one. The capital stock of the company is $5,000,000, divided into 50,000 shares. It is proposed to carry freight at a minimum rate of 15 cents per 100 pounds for all consignments of 1,000 pounds or more. It is intended to reach the entire Southwest, in time, by other lines, and minerals, iron, lumber and other Southern products will be carried up the Ohio Valley and the valley of the Missouri. The time has come when such a scheme as this can be successfully carried out. The necessity of rushing heavy freights fifteen to twenty miles an hour is not so urgent as it was formerly. Less speed will now answer; shippers will only have to start a little sooner. Three ship-yards are now being built along the Lakes, one of them at Chicago, with a capacity of twelve large lake vessels at one time. Seven large boats are under contract at Pittsburgh for the South American trade, and there are facilities there to meet the heavy demands likely soon to be made for river craft. In fact, a new departure is in order; it means that the people are gradually edging themselves into a position where they will be able to free themselves from their almost exclusive dependence upon railroad transportation. Looking at the subject from a reasonable and business-like standpoint, there is no reason why a large proportion of the heavy freights now moved at great expense and risk by rail could not as well, and much more cheaply, be moved by water. The development in this direction will not interfere with the prosperity of the railroads, will not decrease the value of their properties, nor, in reality, deprive them of a ton of freight. The growth of the country and the necessities for increased commercial intercourse demand this departure. As railroad construction led to the building of towns along the lines of road and the development of contiguous territory, so will the development and utilization of our interior water-ways influence the country's growth. It is well to note the weekly and monthly ups and downs of trade and commerce, to catch the meaning of the movements that are in progress. Much of the future development of the United States will be along the larger rivers, and the smaller ones which are to be made navigable. New towns will spring up and grow to be cities, owing to the abundant and cheap transportation facilities which the contemplated improvements will establish. There will be a fresh decentralization of industries; a development of industrial activity in new lines, opening up fresh opportunities for labor, enterprise and capital which now remain inactive, largely owing to the entanglements of our railway managements, and the deleterious influences which these difficulties exert, directly and indirectly, upon the little industries which require special and careful fostering. The general business interests of the country are gathering strength; in the opinion of financiers, railway managers and heavy manufacturers, we are entering the most active business year we have ever enjoyed. Money, while equal to the requirements which exist on the broad commercial highways, is not in sufficient supply to meet the demands of the by-paths and remote places. There are tens of thousands of little business men suffering for want of money, which a wise and beneficent financial system would and should provide. The cries of these diminutive business interests are not heard. The influences controlling legislation and directing the great energies of the country are opposed to what might be regarded as schemes of benevolence so far as providing sufficient currency to meet the demands of far-off, isolated districts are concerned. Even the best business men and moneyed men of the East do not properly appreciate the force of public opinion in the West, demanding that more attention be given to the business and commercial requirements of that section. The question of farm mortgages is now attracting the attention of Congress. When that subject is thoroughly investigated, it is probable that the public sentiment resulting will lead to some remedial measures. The business men of the West have as much to gain by an abundant supply of money, well distributed, as they have to gain by the irrigation of their prairies through the economic distribution of the rainfall of the Rocky Mountain region.

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

Two Residences for Dr. T. Wharton

St. Paul Minn

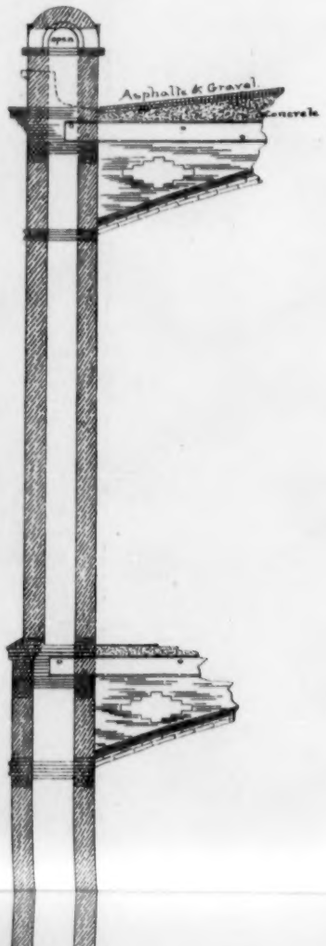
A. H. Stem Archt.

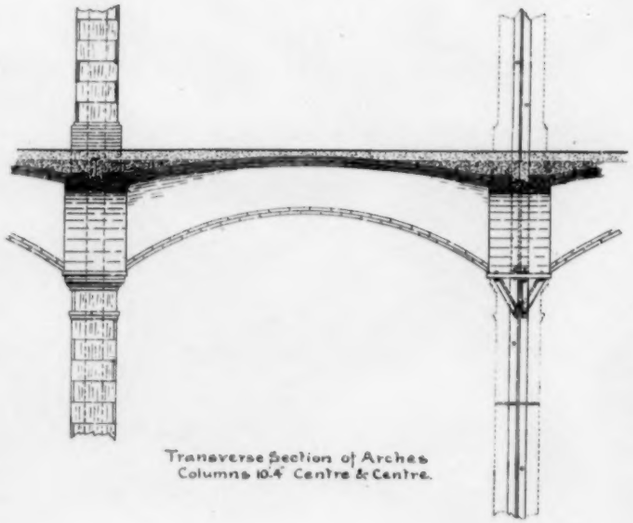
BY TUTTLE & CO

HELIOTYPE PRINTING CO. BOSTON

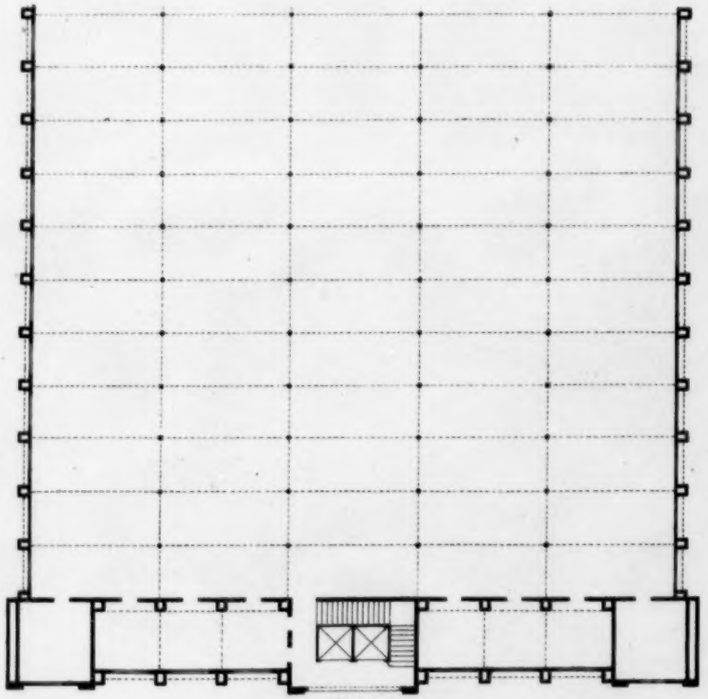
Longitudinal Section of Arches
Columns 25'-0" Centre & Centre.

Fire-proof Factory.



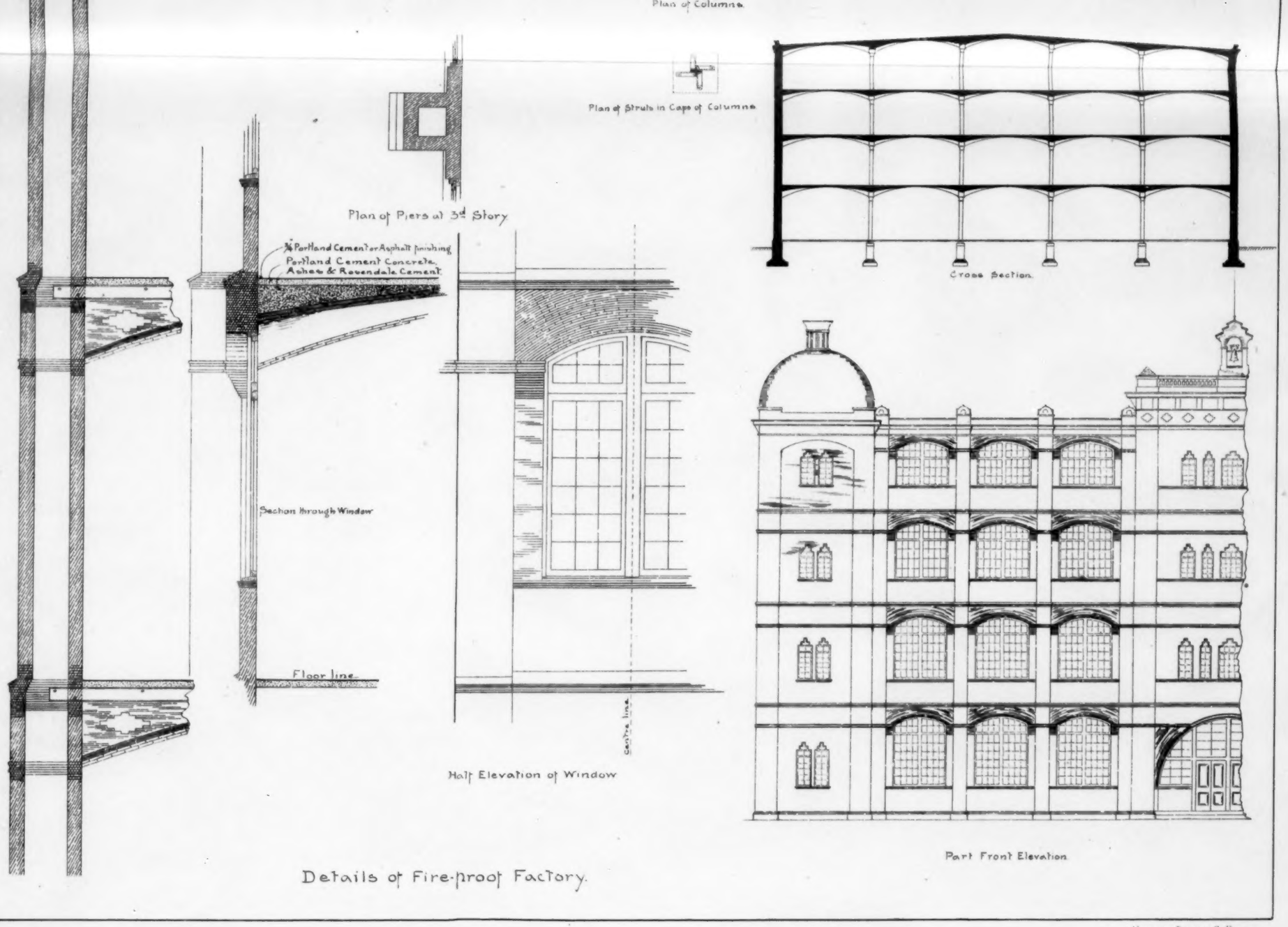


Transverse Section of Arches
Columns 10.4' Centre & Centre.



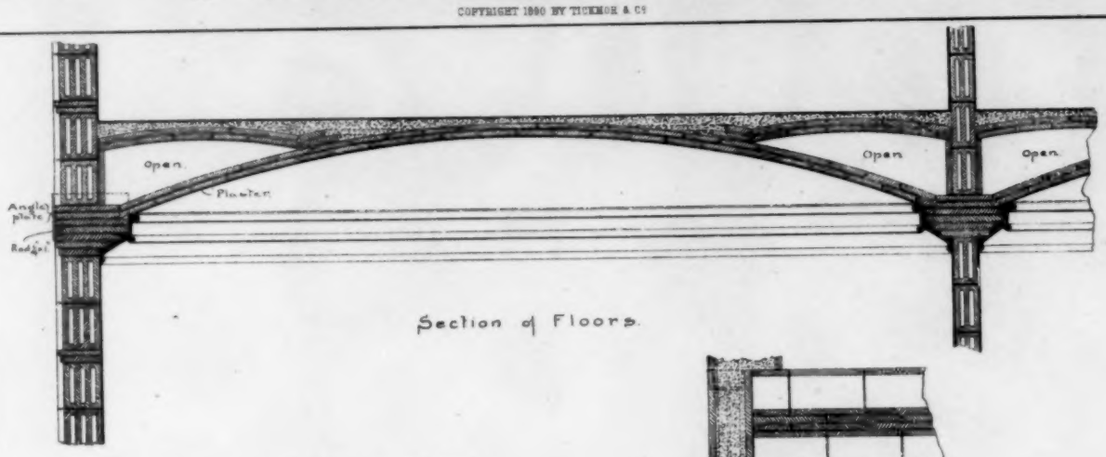
Plan.

Plan of Columns.

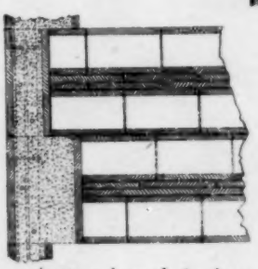


Details of Fire-proof Factory.

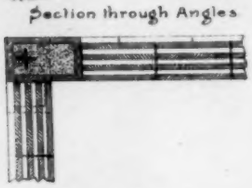
Heliotype Printing Co. Boston.



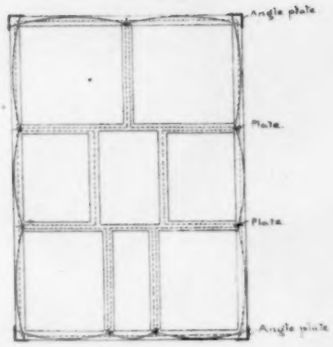
Section of Floors.



Section through Angles.

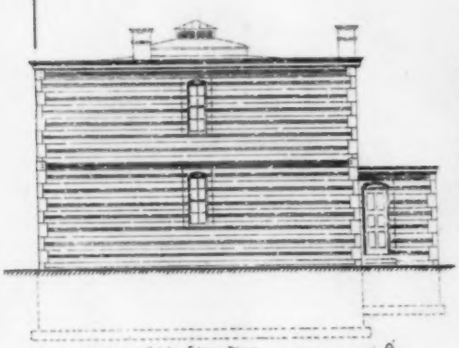


Plan at Angles.

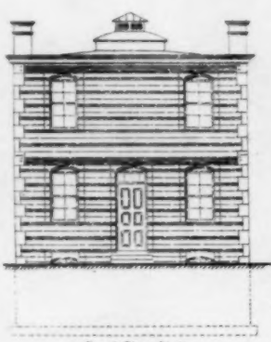


Plan
showing skewbacks & tie rods
Scale ½" = 1 Foot

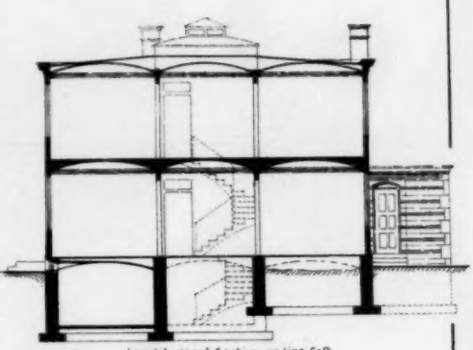
Details of
Fire-proof House for Workmen
on the Cohesive System



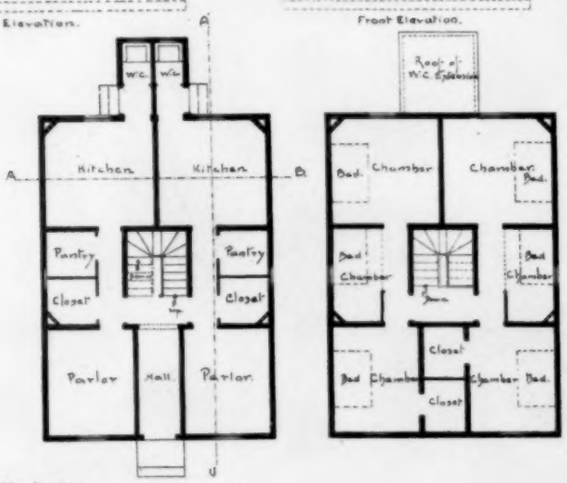
Side Elevation.



Front Elevation.



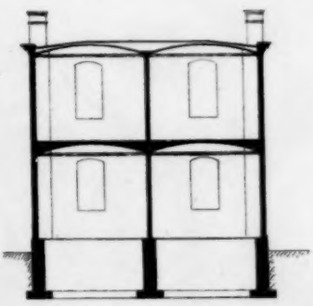
Longitudinal Section on line C-D.



House for Workmen

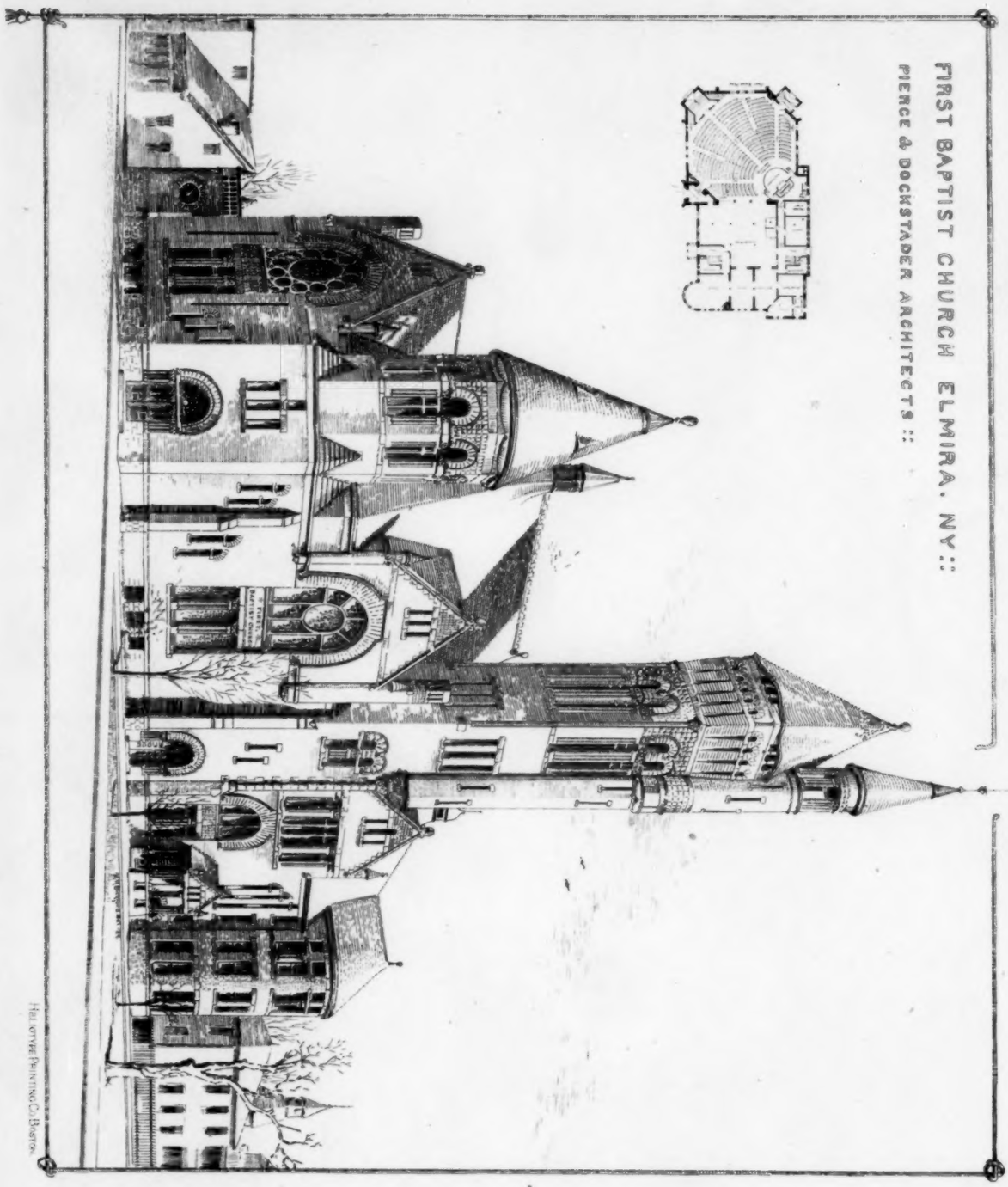
First Story Plan.

Second Story Plan.



Cross Section on line A-B.

Heliotype Printing Co. Boston.



FIRST BAPTIST CHURCH ELMIRA, NY ::

:: PIERCE & DOCKSTADER ARCHITECTS ::

Heliotype Printing Co. Boston.