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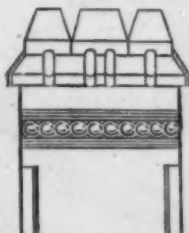
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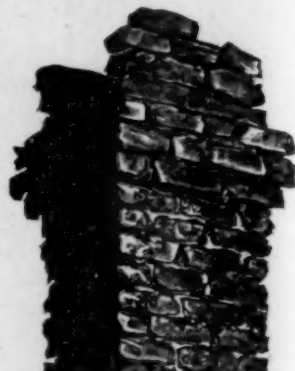
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MARCH 7, 1891.



SUMMARY:—

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ONE of the great labor unions is threatened with a dose of the union medicine which is usually reserved for outsiders. Bricklayers' Union No. 7, comprising about one-third of the union bricklayers in New York, Brooklyn and Jersey City, has had the good sense to keep out of a few of the squabbles concocted by designing persons to stimulate contributions of union money, and has not felt the need of being represented in the famous Board of Walking Delegates. Not long ago, an international convention of bricklayers' unions was held in Toronto, Canada, and Union No. 7 was ordered to pay a strike assessment. The Union, believing the assessment unfair, refused to pay it; and steps were immediately taken by the other unions to apply the familiar means of coercion, by notifying the twenty-five hundred members of Union No. 7 that, unless their assessment was paid by a certain day, without any more parleying, they would be regarded as non-union men, and the members of the other unions would refuse to work with them. What will be the result of this proposition we have yet to see, but the members of Union No. 7 have now an excellent chance to observe how absolute is the tyranny to which their system subjects them. A few men, in a caucus of walking delegates, decide upon a certain measure, and their decision binds the caucus. The decision of the caucus binds the party in the convention which has held the caucus, and, if that party is in the majority, binds the convention. The action of the convention binds all the unions represented in it; and, if any member of any union ventures to question a decree issued by half-a-dozen men of whom he never heard, and whose interests are totally at variance with his, an army of ten or fifteen thousand men stands, not only ready, but pledged, to hound and persecute him into his grave, if need be, to carry out the orders of the tyrants.

THE report of the Chief of the Massachusetts District Police mentions a little circumstance, which throws some light on the absurdity and uselessness of much of the so-called "labor legislation," which politicians, in response to what some one tells them is a popular demand, take so much pains to inflict upon the public. There is a statute in Massachusetts, which provides that wages shall be paid by corporations weekly, apparently without regard to the nature of the employment in which the wages are earned, or the wishes of any of the parties to the employment. The enactment of this statute gave a good deal of trouble to some manufacturers, who had to raise additional working capital, in order to meet the weekly payments, and added a complication, of considerable interest to architects,

to the lien law, inasmuch as it made a lien by a workman, for more than the amount of one week's wages, evidence that the contractor, in certain cases, had violated the statute, and was therefore liable to criminal prosecution; but, like other unnecessary laws, it seems to have been quietly neglected. However, the officials of the labor organizations, in deference to whom the statute was passed, seem to have felt bound to do all they could to galvanize it into life, and, during the year, a complaint was brought to the District Police by some of these gentlemen, to the effect that the Old Colony Railroad was violating the law. Two inspectors were thereupon sent out, who travelled over the whole extent of the offending railroad, and questioned more than four hundred men, but without finding a single person who would complain or testify against the company. Believing that there must be some foundation for the complaint, the grand jury was appealed to, to find indictments against the road, and compel the victims of the alleged grievance to make public their woes. The indictment was, however, thrown out by the court, on the ground that the proceedings should, under the statute, begin by complaint, instead of indictment. The matter being thus left just where it was before, a fresh attempt was made to secure a complaint, but without success. It was, however, ascertained that certain of the employés of the road, preferring to receive their wages monthly, instead of weekly, had made application to that effect to the officers of the road, and that their request had been complied with; that one of these men, having changed his mind on the subject, had asked to have weekly payments resumed in his case, and had been gratified; and that no one had any doubt that all the men who were paid monthly could get their money weekly if they preferred.

THE *Wiener Bauindustrie Zeitung* makes some sensible remarks about warming by means of hot air. It is hardly necessary to say that the Germans give great attention to everything relating to the hygiene of school-rooms, in particular, and their observations on such subjects are well worth remembering. The author, apparently the editor of the journal, mentions that the principle on which systems of hot-air warming are based is, usually, that the warm, fresh air will ascend immediately to the top of the room, and, as the supply continues, will gradually push downward the cooler foul air which has accumulated in the lower portion, and, if openings for escape are provided near the floor, will drive the foul air entirely out through them, particularly if the exit through the floor openings is hastened by connecting them with a flue in which a current is induced in some way. This theory is familiar enough to us; in fact, nearly all our commercial ventilating systems are founded upon it, and the pictures by which their proprietors illustrate them to the unscientific mind show, in the most satisfactory manner, the space just above the floor in the apartments to which it is applied filled with black, rolling clouds of carbonic acid and organic miasm, constantly replenished by currents sent downward from the breathing apparatus of the figures which animate the scene, while the whole upper part of the room shines like a sunset sky with the pink which represents fresh air, and which is shown entering in beneficent abundance half-way up the wall, while the black miasm hurries out through registers in the floor. The truthfulness of this representation is enforced upon the mind of the public by the observation that carbonic acid is heavier than air, and must naturally sink to the bottom of the room, and that it is better to draw it off from that point, without letting it mix with the pure air coming in above; and even those who know that the carbonic acid in a school-room rapidly diffuses itself through the entire atmosphere of the room are likely to think that the noxious animal exhalations can best be removed at the floor, keeping the upper part of the body immersed in the inverted lake of fresh, warm air which constantly descends from above. The writer of the article, however, says that, in practice, as soon as a room ventilated on this system has been occupied a little while, complaint invariably begins to be made that the air is "too dry." To remedy this defect, pans for evaporating water are placed in the fresh-air-supply ducts, but without much success; and, as the complaints still continue, the teacher is usually obliged, even in the coldest weather, to open a window, to relieve the headaches, lassitude, and difficulty of breathing, which prevail through the room.

THE explanation of this phenomenon, which, we venture to say, is very familiar to teachers in our city schools, is given by our German authority as follows: It is perfectly true that the warm, fresh air, supplied in any part of the room, but, more particularly, if it is supplied through registers six feet or so from the ground, as is now the usual rule in school-rooms, to prevent the current from being felt by the children as a cool draught, rises immediately to the ceiling, and, as more is supplied, fills the room, from above downward, with fresh air, at a temperature which is probably about 80° Fahrenheit at the ceiling, and diminishes to 70° at the level of the children's heads, the mass working downward, in the middle of the room, where it is not influenced by the chilling effect of the walls and windows, at the rate of perhaps four inches a minute, supposing that the size of the inlets is in the usual proportion to the dimensions of the room, and that a free escape is provided at the floor for the foul air. Meanwhile, however, all the people in the room are sending from their lungs currents of warm air, exhausted of oxygen, and loaded with carbonic acid and organic exhalations, which, instead of descending at once to the floor, as the pictures would have us believe, insist upon taking the course which specific gravity, instead of hygienic propriety, dictates to them. The temperature of the exhaled breath is about 90°, and, although its greater proportion of carbonic acid would make it heavier than pure air, at the same temperature, the difference in temperature of about 20° between it and the surrounding fresh air makes it enough lighter to ascend, until it reaches a stratum of exactly the same specific gravity as itself. As the surrounding air is warmer near the top of the room, while the exhaled breath cools in rising, it may be roughly estimated that the latter comes to rest somewhere about three feet above its starting point, and, as it cools, and consequently descends, with the stratum of fresh air to which it has attached itself, it comes back, in eight or nine minutes, to be breathed over again by the people who had just respired it. The same operation goes on constantly, so that the unfortunate scholars, in practice, get nothing to breathe but their own breath, about eight minutes old, mixed, by diffusion, with a certain quantity of fresh air. Of course, this is, hygienically, very objectionable. Our author does not point out any method for arranging a more satisfactory system, but most architects, with this suggestion as to the demerits of the common system, could devise some improvement.

IT seems to us that something might, with great advantage to architects, builders, lawyers, judges, jurymen and the public, be done to simplify the building cases which come before the courts. Under the present system, it is not too much to say that injustice is constantly done, while suitors in such cases are involved in enormous expenses, to the advantage of no one except the lawyers. We will suppose that a contractor, having completed his work, asks to be paid the balance due him on the contract price. The owner, who is, fortunately, one of a small class, puts him off with promises, until the builder is compelled to sue for his pay. A man of any profession not connected with building would get his judgment, with costs, in half an hour, and at an expense of ten dollars; but it is very different with our contractor. No sooner is his claim filed in court than a counter-suit is entered by his debtor, who has engaged astute counsel, alleging that the contractor owes him a large sum, on account of monstrous imperfections in the building, which he had not noticed before, but which now cause him dreadful losses. The court appoints an auditor, to hear the two cases together, and from one to three months is spent by all the parties, with the auditor, two or three or more lawyers, and one or two stenographers, in listening to what is called "expert testimony," which is, in nearly all cases, a continuous exhibition of gross ignorance, deliberate perjury, and drivelling idiocy, with, at rare intervals, a little of common-sense. All the rubbish that an endless crowd of muddle-headed or malicious people, whose only claim to be heard consists in the fact that they once wielded a trowel or a jack-plane, can invent on the subject of building is spread at length before the court, at the expense of the suitors, is recorded by the stenographers, at the expense of the same persons, is discussed by the able and numerous counsel, also at the suitors' expense, and considered by the auditor, on the same terms; and the contractor is fortunate if the auditor does not find himself hopelessly bewildered, and cut the knot by dividing the bone of contention equally between the claimants, giving each nothing, and sharing the costs equally between them.

NO one, who has not attended such trials, would believe how ludicrous is the testimony admitted, or, rather, concocted, to injure one party or the other. We once heard of an "expert" witness who swore that it was usual for wooden beams, in shrinking, to move downward, leaving the floor-boards in place, so that, after shrinkage, a space intervened between the top of the beams and the boarding! This testimony was advanced, we believe, to prove that some beams, which showed, by the marks of the flooring on the baseboard, that they had shrunk a certain small amount, had really gone on surreptitiously shrinking under the boards, leaving these stranded at some distance above. To us, such testimony seems perfectly absurd, but it is not so to judges, or auditors, most of whom would regard it as a statement of an interesting and important fact; and so with scores of other points. We have heard an "expert" builder explain at great length to an auditor that if a straight-sided wooden beam of a given strength should have the upper portion adzed off at each end, it would be stronger after this operation than it was before; and this was intended to be an important piece of testimony. There is, in our courts, no limit to the number of witnesses of this kind who can be called by either party, and the other side must rebut everything that they say, or their testimony must stand as established, no matter how ridiculous it may be to persons who know anything about the subject. It is no wonder that judges, jurymen, auditors and lawyers detest all building cases, and are very apt to terminate them by what they imagine to be a compromise, without much regard to the hopeless muddle of the testimony; while builders, architects and owners, knowing that the trial of such a case means many hundreds or thousands of dollars in expenses, submit to the grossest robbery, in preference to losing still more by a resort to the "courts of justice."

THERE is a remedy for the worst of these evils, which has long been in use in France, and might, with great advantage, be adopted here, perhaps in a modified form. In that country, superannuated bricklayers are not invited to expatiate before courts, at the suitors' expense, on the laws of mechanics, but the filing of papers in a case where building work is concerned is followed by the sending of an expert, by authority of the court, to examine the building in question, with reference, particularly, to the points alleged by the parties to the suit in their declarations and answers. In important cases, two may be sent. The reports of the experts furnish all the technical information needed by the court, and, if the case turns on technical points, the verdict appears to be generally in accordance with their opinion. The experts are usually architects distinguished for skill and fairness, who receive the appointment of "expert to the courts" for life, and regard it as a high honor. They are paid reasonable fees, which are charged in the court costs, and the mass of conflicting folly and rubbish which suitors have to pay for here, under the name of "expert testimony," is dispensed with. Whether the traditions of our courts would permit the exclusion of any testimony, however absurd, that either party chose to offer, we cannot say, although the advantage to justice of having nothing but intelligent and unbiassed information admitted is obvious enough; but it would certainly be lawful for the parties to agree that the court should appoint an expert, on behalf of both, and that neither side should present any other testimony on technical points; and this course would be not only the most honest, but the cheapest, for both.

AN important method of joining glass or porcelain to metal has been devised by M. Cailletet, which will find many applications in the best plumbing work, as well as in the manufacture of lamps, and of philosophical and chemical apparatus. The portion of the tube or other article to be joined to the metal is first coated with platinum, by warming it slightly, and covering it, by means of a brush, with neutral chloride of platinum, mixed with essential oil of camomile. The heat is raised slightly, until the vapors of the volatile oil have ceased to rise, and is then carried to redness. On cooling, the tube is found to be covered with a shining coating of metallic platinum, which adheres firmly. The metallized end of the tube is then made the negative pole of a plating battery of suitable strength, and placed in a bath of sulphate of copper, where it is left long enough to accumulate a thick ring of copper, which adheres strongly, and can be threaded, or otherwise adapted for connecting with other work.

ENGLISH ARCHITECTURE.¹—III.



Fig. 41a. St. Paul's, London.

A NEW revolution (1689) drove out the Stuarts, but this peaceful overthrow of the ruling house did not affect the development of architecture in England. The Classic architecture which came in with Wren remained, until about fifty years ago, the architecture *par excellence* of lordly manors and

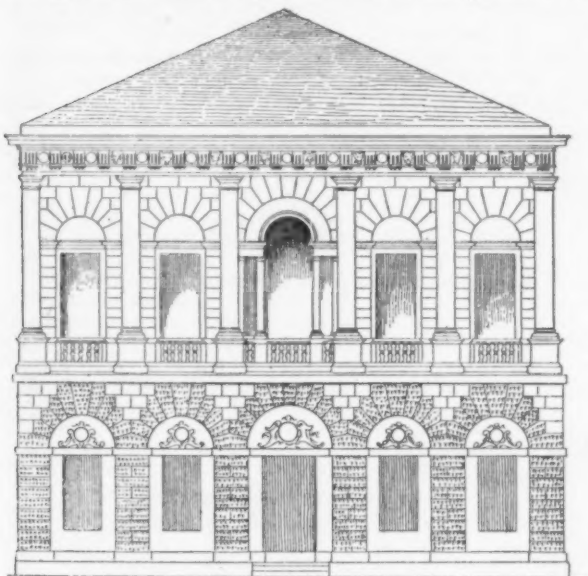


Fig. 42. General Wade's Mansion.

public edifices. In general, it may be said that the architects who succeeded one another during this time were, to a greater or less degree, amateurs of the Wren type. One of the most distinguished was Lord Burlington (1695–1753), who displayed more talent in his façades than in his plans (Figure 42). Another less erudite amateur, though endowed with real genius, was



Fig. 43. Blenheim Palace.

Vanbrugh (1572–1726). Born of wealthy parents, Vanbrugh at first embraced a military career, then won fame as a writer of witty comedies, and died at last the foremost architect of his

day. To Vanbrugh, architecture was merely a means for constructing vast decorations, and out of this conception grew masterly productions, notwithstanding his dense ignorance of the rules and details of his art. Vanbrugh's great work is the Palace of Blenheim (1705–1725), built for the Duke of Marlborough, and which is at the same time a private residence

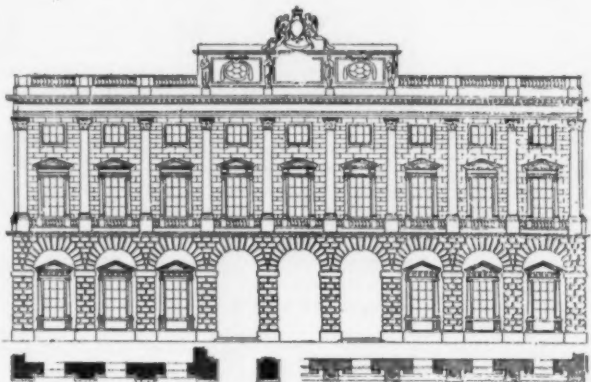


Fig. 44. Somerset House.

and a monument commemorative of national triumphs (Figure 43). Among professional architects, Sir William Chambers (1726–1796) may be cited as the most distinguished of the past century. His productions bear the impress of knowledge and study; in fact, Chambers had studied profoundly. The son of rich parents, he had travelled as far as China, and had brought back numerous plans and descriptions; on reaching England, he, also, had the good fortune to receive an appointment as teacher of architecture to his Majesty, King George III. If his pupil profited little by the lessons, on the other hand, the young professor was compelled to study to fit himself for his duties, and the results of these studies are apparent in the edifices designed by him and in his treatise on architecture, a work which has been accepted as the English Vignola. Chambers's masterpiece, Somerset House (1776), is an immense

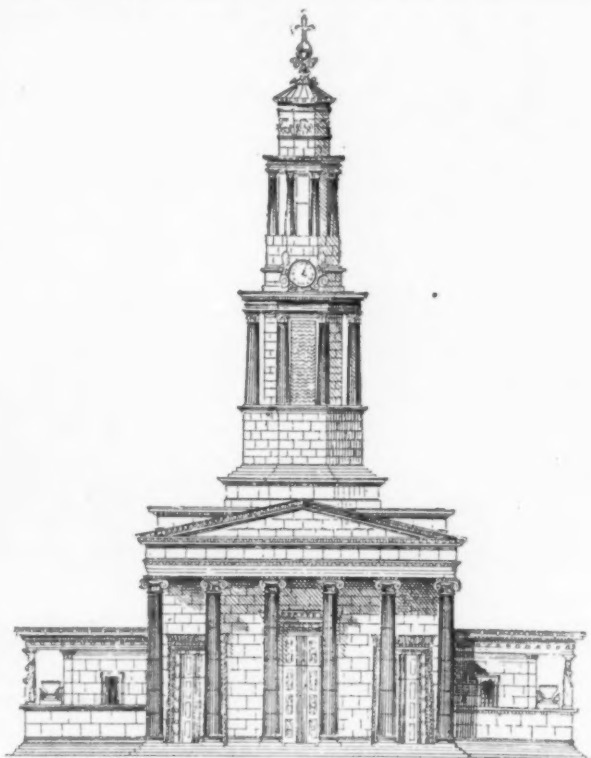


Fig. 45. St. Pancras Church, London.

structure enclosing a great court of honor, with one façade on the Thames and one on the street (Figure 44).

Through Chambers's influence, Classic architecture might have formed a school of distinguished architects in England if order had not been disturbed and chaos once more ushered in

¹ From the French of Lawrence Harvey, in Planat's "Encyclopédie de l'Architecture et de la Construction." Continued from page 133, No. 792.

by the discoveries which were made in Greek architecture at about the same period. In 1762, two English archaeologists, James Stuart and Nicholas Revett, published a magnificent work on the antiquities of Athens. The nourishment that invigorates a man will kill an infant. In France, under



Fig. 46. Dunrobin Castle.

Labrousse, Duc and Duban, Greek architecture was fruitful in happy results; but in England, in the hands of ignorant amateurs, it produced nothing but bungling compositions. Instead of appreciating the harmony of Greek proportions, the logic of Greek dispositions, the decorative spirit of the Greek conception, instead of striving to reproduce these characteristics in modern edifices, the English of the last century adopted the Greek structure pure and simple, without questioning whether it was suited to our climate and to the customs of the day. They manufactured churches, theatres, prisons, warehouses and villas out of fragments of Greek temples, pieced together no matter how. The Church of St. Pancras (Figure 45), constructed in 1820, gives a good idea of the most successful of these so-called Greek monstrosities. The rage for the Greek lasted three-quarters of a century. This is what hypocrisy in art leads to! Such things do not occur in a country where the

ing out, architecture could not be neglected. The Continent, which had been bound round with bands of iron for more than twenty years, reached out toward our insular inhabitants and bestowed upon them all the honors due to the might of the pound sterling and the prestige of the conqueror. And so the routes of Europe were furrowed by the heavy travelling coaches of My Lord and My Lady, and Italy, Greece and the East were invaded by the cream of English society.

Reassured by their triumph and confident in the future, the English nobility began to reconstruct or enlarge their old manor houses after the model of palaces which they had admired in Italy. They had the good fortune to be seconded in their efforts by a young man of genius, Charles Barry (1795-1860), the future architect of the Parliament Houses, who had spent years in studying the monuments of Italy and the ruins of Greece and Egypt. Barry introduced into England the Italian palace without columns or pilasters, on the plan of the Pandolfini at Florence and the Farnese at Rome; he afterwards made modifications in his style, so as to adapt it to the climatic conditions of the country. In the castle of Dunrobin (Figure 46), it appears that he connected his windows vertically, as is the custom in Paris on the façades of *maisons de rapport*. Captivated by the old manor-houses of the days of Elizabeth, he adopted this style and designed a masterpiece of the kind in Highclere House. In his old age he made use of the engaged column, which he had rejected in his youth as an illogical ornament; the Treasury Buildings, by Barry, have a greater number of engaged columns than any other edifice in England. Finally, in the Houses of Parliament (Figure 47), for the plans of which the Gothic style was stipulated to the competitors, Barry has given us the most extensive Gothic edifice in the world. He employed the Tudor Gothic, the genuinely national style of England. It will be observed that though Barry was free from prejudices he nevertheless followed principles to which he was faithful all his life. These may be summed up in a few words, namely: Never remove the central motive from a façade for that cuts the composition in two; define



Fig. 47. Parliament Houses, London.

artistic pulse really beats, nor in a country where the people have the honesty to admit that they understand nothing about art, and care nothing about it.

After the battle of Waterloo, the national genius, aroused by struggle and fostered by victory, gave birth to a galaxy of eminent men. It was at this time that Byron appeared, and a throng of other poets and writers worthy to dispute the palm with him. Turner, Constable, Landseer and other painters opened up new horizons to English art. In this general flower-

sharply the extremities of the buildings by lofty pavilions or towers. Two architects, contemporary with Barry, who clung to the Greek style, treated it with sufficient intelligence to render it acceptable; these were Smirke (1780-1867) and Cockerell (1788-1862.) The British Museum, with its imposing façade adorned with Ionic colonnades, is the work of Smirke. Cockerell's achievements are in the archaeological line. He published a description of the temples of Ægina and Bassæ, with polychrome restorations. Finally, in 1846, Mr.



Penrose issued his carefully prepared descriptions of the Parthenon, including mathematical constructions founded on Conic Sections for the Greek details. He also gives the exact curves of the cornice and steps of the Parthenon, as well as the tapering of the columns to correct optical defects. Thus Greek art yielded up her secrets just at the moment when English architects were abandoning it.

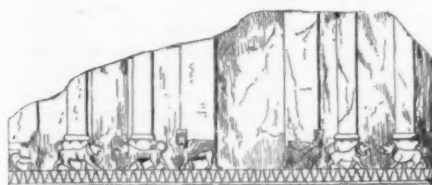
[To be continued.]

ANCIENT ARCHITECTURE FOR STUDENTS.¹—VIII.

ASSYRIA.

CHRONOLOGICAL TABLE.

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Asshur-bani-pal, (Son of Tiglath Pileser I).....	886 to 858
Shalmaneser II.....	858 to 826
Shamas Iva, (Son of Shalmaneser II).....	823 to 810
Iva Lush, (Husband of Semiramis).....	810
Shalmaneser III.....	781 to 771
Asshur Dalgau III.....	771 to 753
Asshur Lush.....	753 to 744
Tiglath Pileser II, (Subdues Kingdom of Israel).....	744 to 727
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Sargon.....	722 to 705
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Esarhaddon, (Son of Sennacherib).....	681 to 668
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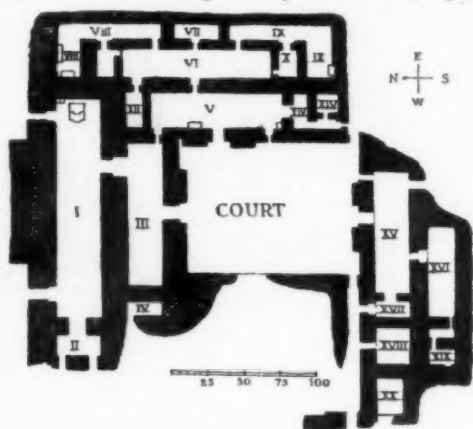


Bas-relief Representing the Facade of an Assyrian Palace.

came the Assyrian Empire. There are four other great cities, Khorsabad, Mosul, Nimroud and Kileh Sherghat, as well as others of less importance. Opposite Mosul stand the ruins of the once great Nineveh.

The Assyrians came from the alluvial plains of the lower country where the only material for building purposes was brick clay. "It has been remarked that their writing (hieroglyphics) has been derived from the Chaldeans and that their religion is almost identical with that which prevailed in the lower country from a very early time." The evidence of the monuments accords thus in a striking way with the statement of the Bible, exhibiting to us the Assyrian people who had once dwelt in the South, in close contact with the Chaldeans, and had removed after a while to a more northern position. All that is known of the removal is that it must have been anterior to the time of the Chaldean Kings Purma Puryas and Kurnigalzu, who seem to have reigned in the fifteenth century B. C.

Of all the buildings erected by the Assyrians, the palace is the one which they exalted into the position of a chief edifice and very little need be said of other buildings. They were erected, together with



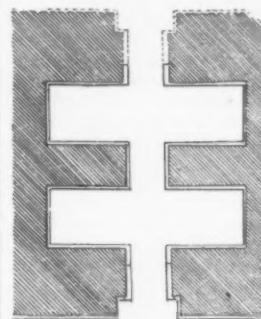
Plan of Palace of Asshur-bani-pal.

the whole city, on enormous platforms, the walls of which were carried up and finished with battlements. Different levels of the platforms were reached by means of steps. Pavements were of great slabs of stone and kiln-dried bricks of large size, often 2 feet square and patterned. Their temples were all placed with the angles pointing to the cardinal points, and not their sides facing them as in Egypt, and all their buildings were fortified.

The usual arrangement of an Assyrian palace was a series of

courts, open to the air, halls and chambers of various sizes and in great numbers, the grand halls being the chief features. All halls were narrow in comparison with their length as also were many of the smaller chambers, except that some of the latter were square, 25 feet by 25 feet. These were grouped around the courts, and thus the palace extended over a very considerable area, all of one story high.

Nineveh. Nineveh stood upon a platform measuring roughly 3 miles by 2½ miles, the walls of which were 100 feet high and made a circuit of 8 miles, besides which they were from 100 feet to 200 feet wide. To half of their height the walls were of limestone, polished, and the upper part of crude brick, a very massive structure. All the walls were finished with the battlement ornamentation and were



Gate in North Wall, Nineveh.

pierced at regular intervals with gates guarded by towers. Nineveh was well fortified, immense moats extending for half a mile on the most vulnerable side. M. Place made a discovery of one of the great gateways. It consisted of three gates one behind the other, divided through the thickness of the walls by two chambers 70 feet long and 23 feet broad. Bas-reliefs show such gates as being arched over, but no gates were found, they had apparently been destroyed by fire; the ornamentation consisted of colored human-headed bulls and panels and slabs of alabaster. A very great deal may yet be brought to light through excavations, for our information is not as full or satisfactory

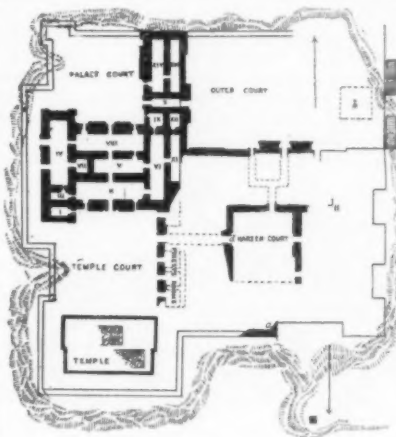
about these early cities as we could desire.

Nimroud. To Asshur-bani-pal, belong the glory and honor of those years, commencing with 886 B. C., which saw Assyria's prosperity. He built his magnificent palace at Nimroud, known as the Northwest palace, to distinguish it from others in the same city, and although it is not so extensive as some of the later palaces, it is interesting as one of the earliest examples. The palace occupied a square, of about 33 feet each way, winged bulls guarded the entrance at the summit of a flight of steps that led up from the plain to the top of the platform or terrace. In the centre of the palace is a great court 114 feet by 90 feet into which seven or eight doors open from rooms and passages surrounding it on all sides. The principal room or grand hall measures 152 feet by 32 feet, through which and through another smaller hall one has to pass from the entrance to the great court. On the other sides of the building are rooms of all sizes, two on the east side being shaped like the letter L. They are the outside rooms of a suite, three deep. How these rooms were lighted is a matter still undecided. Fergusson thinks that the walls were only carried up to half their height, with pillars resting on the top to support the roof; thus leaving space for the admission of light and air. But further on we shall have more to say on this matter.

Khorsabad. As the finest, largest and most magnificent of all the palaces of Assyria, we must turn to the great palace of Sargon, erected by him at Khorsabad, 705 B. C.

This work was all the work of one king, it is the most completely uncovered and therefore no better example of Assyrian architecture exists. The discoverer was M. Botta, and his successor, M. Place, who continued M. Botta's account of his discoveries in his book "*Nineve et l'Assyrie*." We have a little of the history of this king in the Bible where we read that he invaded the kingdom of Israel, carrying on a war begun by his predecessors against Hosea the king; he defeated the Samaritans and carried them away captive, bringing some of his own subjects to fill up their places.

The palace itself was situated to the north of the city and projected beyond the city wall, a situation apparently much approved by Assyrian monarchs. The mound on which the palace stood was raised about thirty feet above the plain, and was supported by a casing of fine masonry. This wall was built of immense blocks, from six feet to nine feet long, three feet thick and five feet to six feet high, laid as bricks are now laid, with headers and stretchers. According to the latest accounts² the total height of the wall is given as sixty feet, which includes a parapet five feet above the platform



Plan of the Palace of Sargon, Khorsabad.

¹ Continued from No. 786, page 43.

² Perrot & Chipiez.

composed of battlements with brick crenellations. No other part of the town defences were so carefully constructed, indeed the rest of the town was decidedly inferior, stone being only used to the height of three or four feet, the rest being of crude brick, and although at the angles more care was taken, yet the stones used were only one foot thick by an average of three feet long. As to some idea of the extent of this great palace, M. Place uncovered no less than 184 rooms and twenty-eight courts, both courts and rooms being of various dimensions. For a further description of this palace I will quote partly Mr. Fergusson, who in his turn has borrowed his account from M. Place.

"The great portals were among the most magnificent of those yet discovered. The façade in which they stood represented a frontage of 330 feet, in which were three portals, the centre one flanked by great human-headed bulls nineteen feet in height, and on each side two other bulls with a giant strangling a lion between them. These portals were reached from the city by a flight of steps, now entirely destroyed. They lead to a great outer court, measuring 315 feet by 280 feet between the buttresses; with which it is adorned all round. On the right hand were six or seven smaller courts, surrounded by stables and out-houses of the palace, which were approached by a ramp on the outside, at the head of which was a block of buildings containing the cellars and general store of eatables. On the left-hand of this court were the metal stores, each room having been appropriated to iron, copper, or other such materials, and behind them, outside the palace, was the Harem."

This main court was connected with what we may consider the private entrance court of the residential part of the palace, by a gateway and passage similar in arrangement to the gateways of the city of Nineveh, already described — three gates with two chambers between them. This court measures 360 feet by 200 feet, and the grand entrance to this part of the palace is situated on its western or long side, and consists of a "magnificent portal" which opens into an inner court, through two long narrow chambers, and which is surrounded by other chambers, three deep on the north and south sides, and two deep on the west. Numerous rooms and four small courts occupy the space to the south, between the great court and these residential apartments. A building projecting northward from the main block of the palace, and though attached to it, connected only by a passageway which opened onto the platform, contained the State apartments consisting of two large chambers, one 116 feet 6 inches by 33 feet, and the other 116 feet 6 inches by 29 feet 8 inches, running north and south, with two smaller chambers between them 21 feet 6 inches wide. They are flanked north and south by other chambers.

Fergusson, in his "restorations," is very decided about the correctness of his theories, and although he says nothing has been discovered up to the time of his writing to make him change his mind, he goes considerably farther than the details discovered warrant him in doing. It is, therefore, necessary to take his remarks and illustrations with regard to his theories; "*cum grano salis*." Further on, we will inquire more in detail into some of his principal theories, but let us complete the survey of this palace, having first given the note of caution. Outside the palace, but connected with it by a small double gateway (with a room between the two gates), opening out of the great court is the harem building. This connecting passageway, and also two other entrances from the platform, communicate with an open court and two smaller courts in connection with which are apparently three complete suites of apartments, probably devoted to the use of Sargon's principal wives. The exterior of this building is adorned in a remarkable manner, with reeded pilasters and panels, about which we will speak later. But the central court of



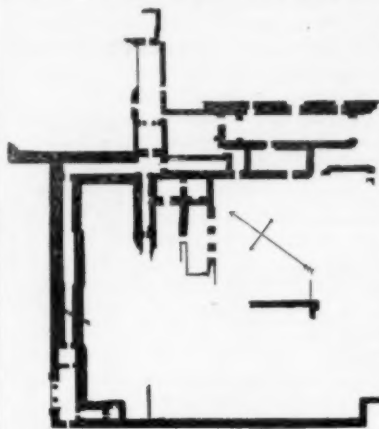
Existing remains of the Propylaea at Khorsabad.

the Harem, that with which the suites of two of the Queens' communicated directly, was very highly decorated and enriched. "The walls were wainscotted with enamelled tiles representing the king, his viziers, lions, eagles, vines and fruits, highly colored, and in addition there were found six statues, guarding in couples three entrances to the surrounding chambers."

In the course of M. Place's excavations he came upon a corner-stone, which being removed, a cavity was exposed in which had been deposited a box containing inscribed tablets of various metals, proving that this custom of modern days of so using the corner-stone as a receptacle for coins of the year in which it was laid, is of very ancient origin.

To the north, again, of this building and standing quite separate and distinct from it, is the great temple or stage tower for religious usages. When the discoverers reached the place its site was marked

by a conical mound, but this was found to contain a tower of seven stages, which in M. Place's book "*Nineve et l'Assyrie*" has been carefully restored and illustrated. In plan and arrangement it differs from the one previously described as existing at Nineveh in that each story was placed in the centre of the one below it and instead of steps the summit was reached by a ramp encircling the whole tower, at each story. As to the actual finish to the top of the tower considerable doubt does and must exist, owing to the ruined state in



Central Palace, Koyunjik.

which the tower was in when discovered, but it is most probable that there was a chapel of some kind up there where devotions were offered. A peculiarity of this tower which also existed in other towers was the coloring of each story, with the color assigned to each of the seven deities the Assyrians principally worshipped. This at Khorsabad was decorated in the following manner: The first or lowest story was dedicated to Saturn and colored black, the second to Jupiter and colored orange, the third to Mars, blood-red, the fourth to the Sun, gold, the fifth to Venus, yellow, the sixth to Mercury, blue, and the seventh to the Moon, white. Of these colors, the orange and the yellow were the color of the bricks, the blood-red was produced by half-burnt bricks of bright-red clay, the blue by burning the bricks, the black was a coat of bitumen spread over the whole surface, the gold was done by fastening plates of gold, and the white by fastening plates of whitish metal, against the walls.

The great gates of the city, constructed in pairs, one for the use of foot passengers and one for vehicles, are very interesting structures; the entrances are arched from 15 feet to 18 feet span and the faces were ornamented with archivolt of blue enamelled brick with a pattern of figures and circles in yellow enclosed with a border; beneath the archivolt a human-headed bull stood on each side, from whose head the arch sprung. We shall have occasion to see later what great arch builders the Assyrians were.

Koyunjik. At Koyunjik are the remains of the palace of Sennacherib, son of Sargon, erected about 704 B. C. This was a building of far greater magnificence and of a far larger extent than the palace of his father. Sennacherib was a warrior of renown, but he was also a builder and a lover of art. Rawlinson says that this palace not only surpassed in size and splendor all earlier works, but it was itself never surpassed by any building of later date. It was this Sennacherib who made war upon Hezekiah, King of Judah, and to whom he had to pay tribute, but his general blasphemed the Almighty and Sennacherib's host was smitten and fled away utterly routed, the whole 180,000 men. Like Khorsabad, Koyunjik consisted of a number of rooms and passages surrounding courts, but it occupied a far larger area, measuring in fact, about 600 feet each way. The mound on which it stood, raised by human labor to the height of 30 feet (but probably more) above the plain, nearly 8,000 feet in circumference and about half a mile across, was in itself a stupendous work. The dimensions of the courts, which were three in number, were 154 feet by 125 feet, 124 feet by 90 feet, and 90 feet by 90 feet respectively. Round the smallest of the courts were small chambers varying in dimensions, probably the private apartments of the palace, reached by a single narrow passage leading out of a long gallery, 218 feet long by 25 feet wide, approached only through two other passages, one from each of the two main courts. The principal rooms, immediately within the two chief entrances although not entirely excavated, measure, one, 180 feet, the other 150 feet, by about 40 feet each across. There are also about twenty rooms of considerable size and some fifty small chambers mostly square or nearly so, opening out of some hall or large apartment. The principal front of this great palace, of which, however, very much remains to be explored, had a width of 350 feet, and was ornamented with ten winged-bulls of very large size, and the decoration and ornamentation of the whole palace seems to have been of a peculiarly rich and magnificent character.

Esarhaddon's Palace. The Palace of Esarhaddon, a younger son of Sennacherib at Nimroud, known as the Southwest Palace, deserves some notice before we pass on to the consideration of the details of Assyrian architecture. Esarhaddon reigned while Hezekiah was still on the throne of Judah, at that time when he was told of the Lord that he must die, but upon his earnest prayer he was raised up to requite the Assyrians, and he was vouchsafed that wonderful astronomical phenomenon as a sign that he should recover, of the shadow of the sun going back on the "dial of Ahaz" ten degrees. Very little of this palace remains, that is at all intelligible, although it is evident that it is a great palace. The principal feature appears

¹ Rawlinson; Layard.

to have been the great hall, which in its dimensions, 160 feet by 65 feet, certainly was intended to surpass all other halls of similar character. But Esarhaddon or his architects could not get over the difficulty of roofing in so wide a space without intermediate supports of considerable size and strength, consequently this great hall was divided down the centre, by a wall. This palace had one great court measuring 220 feet by 100 feet or nearly so.

A curious discovery was made here by Mr. Layard,¹ of an inclined plain or ramp, as we have called it before, apparently leading up to an upper story. This, in Fergusson's estimation, confirms his notion that the inner walls between internal chambers were only half of the height of the halls or chambers, that the roof was supported on pillars resting on these dwarf walls, and that the space between was used as an upper room or story. But there is not sufficient information to say more than that it might possibly have been so.

Fergusson is very fond of introducing columns into his Assyrian restoration, but we shall see that columns were of the rarest use in Assyria. It was here at Koyunjik, and by this king Esarhaddon, that the Sphinx was introduced in Assyria as an ornamentation in sculpture.

Kileh Sherghat. The palace at Kileh Sherghat, (by some authors called "Calah") was erected by Shalmanezar I, 1300 B. C., and so it is probable that this city was once the capital of Assyria. The dimensions of the palace are, in round figures, 660 feet by 300 feet. It contained seven or eight large halls, and many smaller chambers, all grouped round a central court measuring 130 feet by 100 feet.

Other palaces existed at Koyunjik and Nimroud, but they are in a far more ruinous condition, and in some cases so bad as to render it impossible to get at their plans.

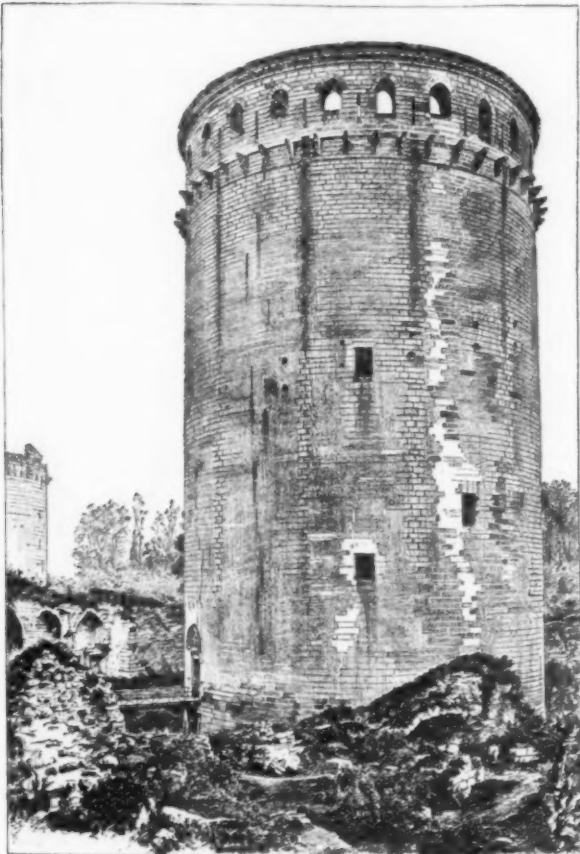
That of Tiglath Pileser, at Nimroud, built 745 B. C., is one of the ruined ones, but we are interested in its being the home of the Tiglath Pileser who attacked the children of Israel about the year 733 B. C.

From a palace erected by Sardanapalus, 667 B. C., successor to Esarhaddon at Koyunjik, a beautiful patterned pavement was taken up and brought to Europe, which shows to what a high state of cultivation their art had attained.

(To be continued.)

SAFE BUILDING.²—LII.

CHAPTER XIII.—COLUMNS (Concluded.)



Donjon of the Chateau de Coucy, France.

THE calculation of hollow circular columns is very tedious, particularly as one has to guess at the size and then calculate the strength, often involving several calculations for a single case.

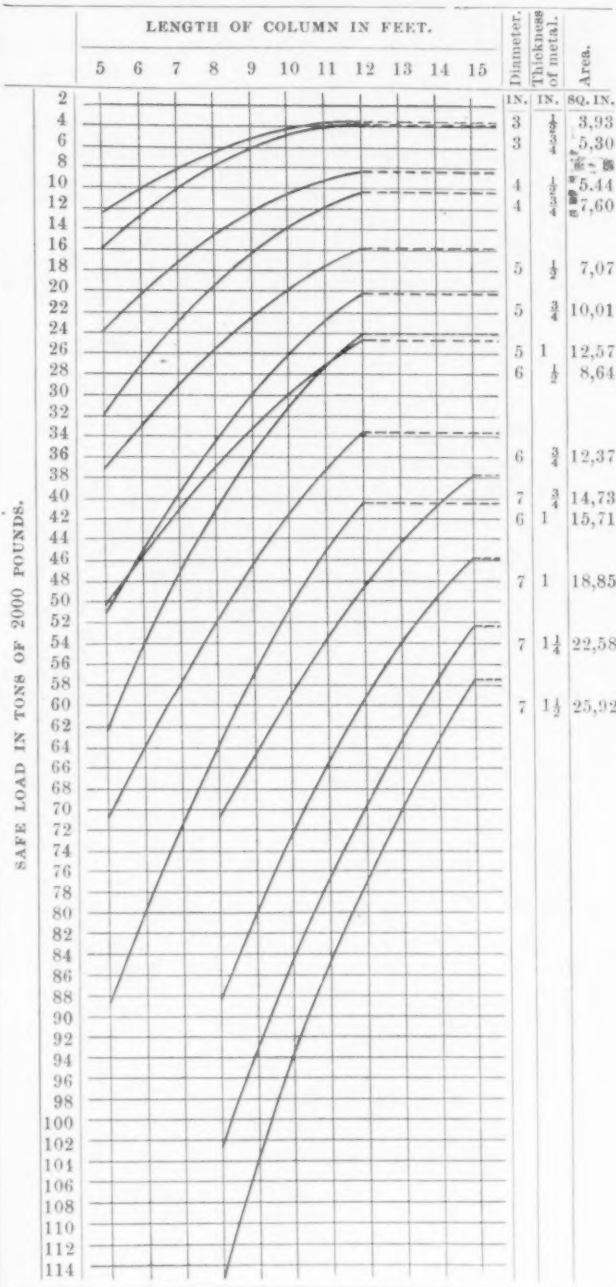
¹ Nineveh and Babylon.
² Continued from No. 792, page 134.

Tables XLV, XLVI, XLVII and XLVIII, have therefore been prepared by the writer to take the place of these calculations.

Across the top of the tables, in the horizontal line, are given the lengths in feet of the columns. Down the left side in the vertical line are the *safe* loads in tons for each particular shape. The curved lines each represent a hollow circular section, and at the end of each curve is given first, the diameter of column, second the thickness of shell, third the area of cross-section. The latter enables one to pick out the cheapest section from any of the tables, by selecting any curve below and to the right of the one found — which

TABLE XLV.

STRENGTH OF HOLLOW CYLINDRICAL COLUMNS.



has a smaller area of cross-section. Sometimes by reference to a subsequent table a still cheaper section can be found.

The tables have been calculated for cast-iron, according to Formula (3); the columns are supposed to have smoothly dressed ends and true bearings. The value used for $\left(\frac{c}{f}\right)$ was 15000 pounds. Any one desiring to use any other value, need only proportion the vertical column of safe loads in tons accordingly; thus, for 12000 pounds we should take $\frac{4}{5}$ of the loads as safe, or we could add $\frac{1}{4}$ to the load to be carried by the column, and find from the tables the diameter, etc., of column necessary to carry the increased load.

Table XLV gives columns from 3" to 7" diameter of different thicknesses, and from 5 feet to 12 feet long. Table XLVI gives

columns from 8" to 10" diameter of different thicknesses, the 8" and 9" columns from 8 feet to 15 feet long, the 10" columns from 10 feet to 20 feet long.

Table XLVII gives columns from 11" to 13" diameter, and Table XLVIII from 14" to 16" diameter, in both of different thicknesses and from 10 feet to 20 feet long.

An example will best illustrate the use of table.

Example I.

What is the safe load on a hollow, circular, cast-iron column, with turned ends, 18 feet long, 11" diameter and 1 1/4" thick?

Columns of 11" diameter are given in Table XLVII to which we turn, we find the curve marked 11—1 1/4—44.8 cuts the vertical line 18 about two-fifth way down between the horizontal lines 150 and 155, our column will therefore safely carry 152 tons.

Had we calculated our column by Formula (3) we should have had from Table I, section No. 8 for

$$Q^2 = \frac{5 \frac{1}{2}^2 + 4^2}{4} = 11.56$$

and for $l^2 = (18.12)^2 = 216^2 = 46656$.

Inserting the values in Formula (3) we have the safe load

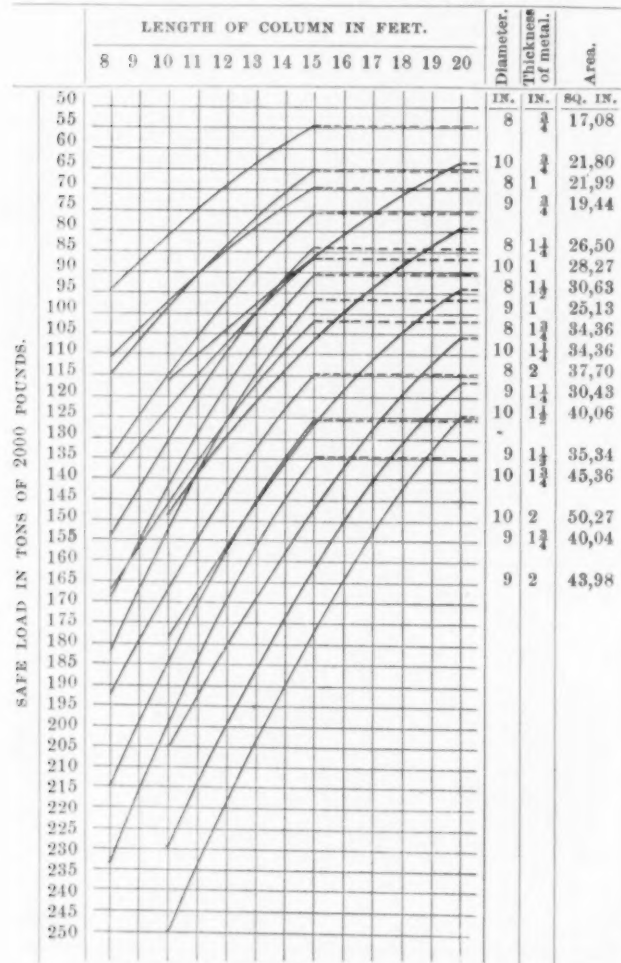
$$w = \frac{44.8 \cdot 15000}{1 + \frac{46656 \cdot 0.0003}{11.56}} = \frac{672000}{1 + 1.2108} = 303962 \text{ pounds,}$$

or, 151.98 or say 152 tons same as found from table.

Now, is this the cheapest section for that load and length of column. Its area is 44.8 square inches. We now pass to the next

TABLE XLVI.

STRENGTH OF HOLLOW CYLINDRICAL COLUMNS.



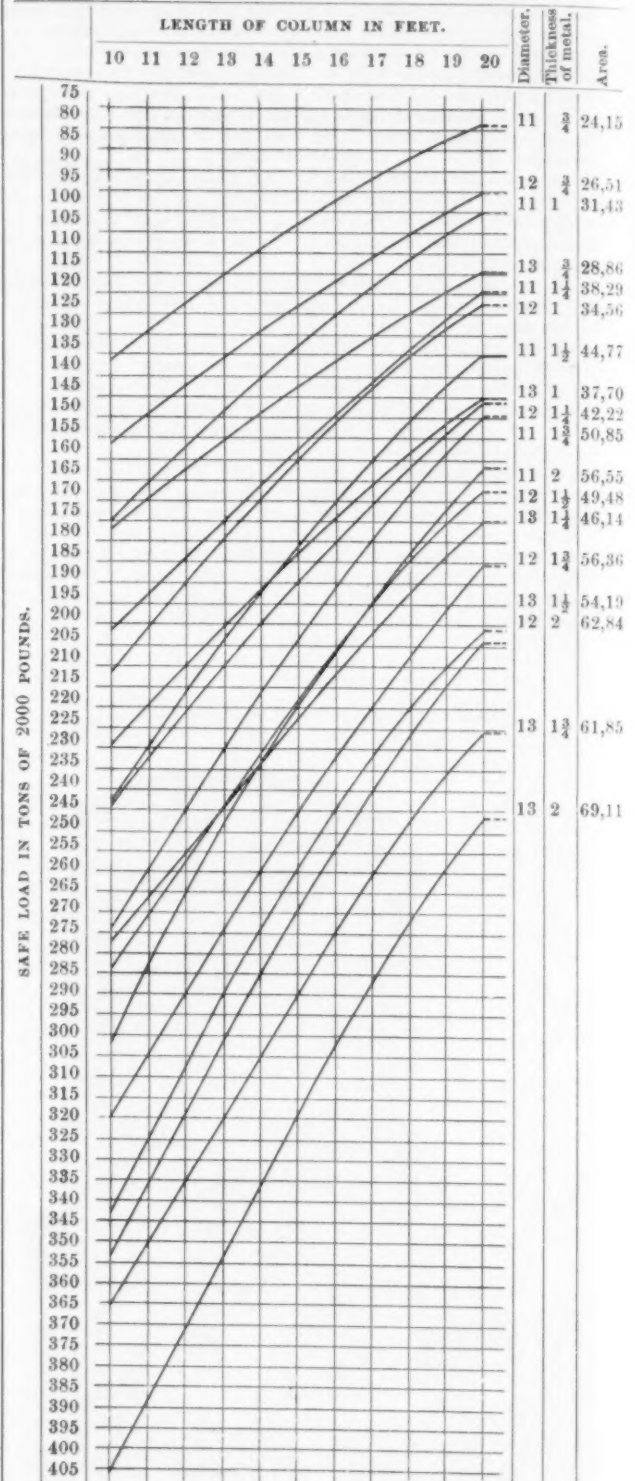
curve below and to the right, it is 13—1—37.7 or a 13" diameter column, 1" thick will be cheaper, as its area is only 37.7 square inches. Then, too, it is stronger, for at 18 feet long it will carry 158 tons cutting the vertical line 18 three-fifth way between 155 and 160. By passing further along, we find also that the 12" diameter 1 1/4" thick column of 42.1 square inches area will be stronger, carrying 161 1/2 tons safely at 18 feet of length.

By referring to the next Table XLVIII, we find some much cheaper sections, than any of these. For the 14" diameter, 3/4" thick column, has only 31.2 square inches area of cross-section, but we find it carries safely only 143 tons and therefore will not answer. However the 14" diameter 1" thick column, has only 40.9 square

inches of area and carries 185 tons, and would answer therefore, provided of course, larger diameter is not objectionable. Or, cheapest of all would be the 15" diameter, 3/4" thick column which has only 33.6 square inches of area and carries 161 tons. The 16"

TABLE XLVII.

STRENGTH OF HOLLOW CYLINDRICAL COLUMNS.



diameter, 3/4" thick column would also be economical having only 35.9 square inches of area and carrying 180 tons at 18 feet of length.

In wrought-iron construction, any number of shapes of columns are used, from plain flat bars, to the most elaborate combinations of the different shapes rolled, most of which are given, with their areas, squares of radius of gyration, etc., in Tables XIX to XXV. In Figures 280 to 287 are given a few combinations, which are frequently used for columns. Besides those shown there are frequently used combinations of I-beams and channels, or of angles and plates formed in the shape of plate and box-girders stood on end.

Figure 280 shows two channels latticed together. A plate might be used in place of latticing if the channels were placed as shown in Figure 281, but in that case the interior would not be accessible for painting.

Figure 281 is more easily riveted up than 280, but is not quite as strong.

Figure 282 shows an elevation with wrought-iron base, and Figure 283 the side view of base. Architects are apt to use cast bases with wrought-iron work, but as a rule a wrought-iron base can (and should) be designed, which will not only be better adapted to wrought-iron construction, but will be cheaper and stronger, and has the merit that it can be riveted fast to the column or other construction.

Figure 284 shows a column made of four Z irons, with central plate. It has the great merit of being a strong column, and though of five parts, it requires only two lines of rivets. This column adapts itself excellently to building walls, as the horizontal wall girders, and floor girders are easily attached to it, and it readily holds the "filling-in walls" in place, without the use of anchors. Then, too, it can be easily covered with fireproof blocks. The writer recently erected in New York City, a fireproof office-building, ten stories

TABLE XLVIII.

STRENGTH OF HOLLOW CYLINDRICAL COLUMNS.

	LENGTH OF COLUMN IN FEET.											Diameter.	Thickness of metal.	Area of cross-section.
	10	11	12	13	14	15	16	17	18	19	20			
130												14	3	31,22
140												15	3	33,57
150												16	3	35,93
160												14	1	40,84
170												15	1	43,98
180												14	1	50,07
190												16	1	47,12
200												14	1 1/2	58,91
210												15	1 1/2	54,00
220												16	1 1/2	57,92
230												14	1 1/2	67,35
240												15	1 1/2	63,61
250												14	2	75,40
260												15	1 3/4	72,84
270												16	1 3/4	68,33
280												15	2	81,68
290												16	1 3/4	78,34
300												16	2	87,96
310														
320														
330														
340														
350														
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high above the sidewalk, with only twelve inch thick brick walls all the way up, by using these columns combined with horizontal girders in all the walls.

Of course, in such construction, proper precautions must be taken to prevent the building from collapsing under wind pressure. In the case above referred to, in order to avoid cross-partitions, the wind-bracing was all done in the front and rear walls, and in the floor levels.

Figure 285 gives a combination column of two tees, riveted together with separators.

Figure 286 is made of four angle bars latticed together, a very light, but strong column.

Figure 287 consists also of four angle bars, which adapt themselves more readily to fireproofing, and require less riveting, but the column is not nearly as strong as the previous one. In the last case separators are used in place of lattice bars.

It would be quite impossible to give any curve tables for wrought-iron construction, but Table XLIX will greatly facilitate the calculation. It will be necessary in each case to find only the ratio of the length of column (in inches) divided by the radius of gyration, or the square of the length, divided by the square of the radius of gyration, and

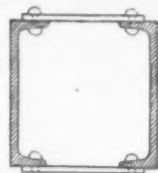


FIG. 280.

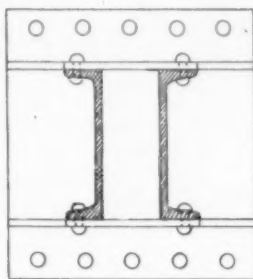


FIG. 281.

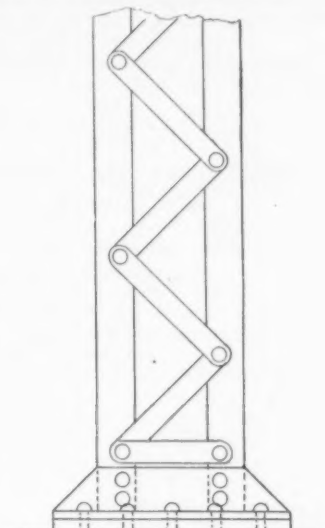


FIG. 282.

look up the value per square inch of cross-section, according to the condition of ends of column, and the assumed safe value for $(\frac{c}{f})$. The table is calculated respectively for 8000, 10000 and 12000 pounds per square inch values for $(\frac{c}{f})$. In buildings use the value 12000 for wrought-iron.

To find the ratio look up the value of the square of the radius of gyration in the tables, or if it is not given, find the moment of

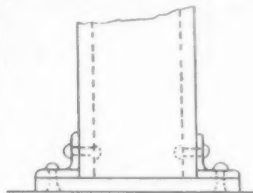


FIG. 283.

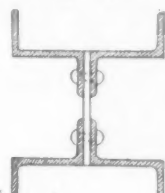


FIG. 284.

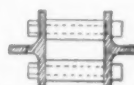


FIG. 285.

inertia according to rules given in Table I on page 10 of Vol. I, and divide by the area, see page 9, Vol. I.

It should be borne in mind that where pieces are doubled or their number increased along the same neutral axis, the moment of inertia will be doubled or increased accordingly. But the square of the radius of gyration will remain constant, as it simply represents a ratio, and the area and moment of inertia increasing in the same amount, their ratio, which gives the square of the radius of gyration,

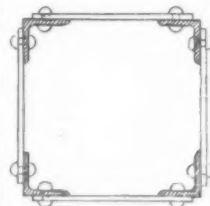


FIG. 286.

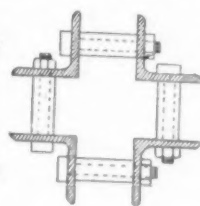


FIG. 287

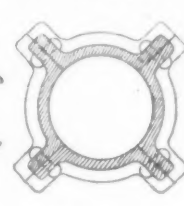


FIG. 288

will, of course, remain constant. In some cases, it will be easier to find the radius of gyration, instead of its square, and in such cases the second column in Table XLIX should, of course, be used.

An example will best illustrate the use of Table.

Example II.

Example of use of Table XLIX. A flat eye-bar of wrought-iron 1 1/2" x 6" in a truss, is liable at times to be under compressive stress, what will it safely stand? The bar is 5' 6" long from centre to centre of eyes.

From Table I, section 2, we have

$Q^2 = \frac{(1\frac{1}{2})^2}{12} = 0.19$
 the area will be
 $a = 1\frac{1}{2} \times 6 = 9$ square inches,
 and

$$l^2 = 66^2 = 4356$$

The ends being eye-bars, we use, of course, in Table II, the value n for "both ends pin ends," or
 $n = 0.00005$

Inserting the values in Formula (3) we have for the safe compressive strain,

$$w = \frac{9.12000}{1 + \frac{4356.0,00005}{0.19}} = 50232$$

Now had we used Table XLIX we should have had the ratio

$$\frac{l^2}{Q^2} = \frac{4356}{0.19} = 22926$$

The nearest value to this in the first column of the Table is 22500 and under the heading "both ends pin ends" for a value of $\left(\frac{c}{f}\right) = 12000$ pounds, we find 5655 which is the safe load per square inch on our bar, or the total safe strain.¹
 $w = 9.5655 = 50895$ pounds.

Which closely approximates the above result.

In our case it would have been easier to use the second column of Table XLIX, we should have had

$$Q = \sqrt{\frac{(1\frac{1}{2})^2}{12}} = \frac{1\frac{1}{2}}{\sqrt{12}} = \frac{1.5}{3.464} = 0.433$$

and for the length

$$l = 66$$

therefore the ratio

$$\frac{l}{Q} = \frac{66}{0.433} = 152$$

The nearest value to this in the second column of Table XLIX is 150 which would give the same result as before.

There are several patent wrought-iron columns made, of which the "Phoenix" column is undoubtedly the best.

It is made up of from four to eight segments, riveted together. Each segment somewhat resembles a channel with the web bent to a segment of a circle, instead of being straight.

Figure 288 shows one of the smaller columns, made up of four segments. For heavier columns each segment is rolled thicker, as

Table L gives the properties of these columns, as taken from the hand-book of the Phoenix Iron Co.

TABLE L.
 PROPERTIES OF PHOENIX COLUMNS.

Thickness in ins.	d inside.	d outside.	d over flanges.	Area of cross-section sq. in.	Least radius of gyration in ins.	Thickness in ins.	d inside.	d outside.	d over flanges.	Area of cross-section sq. in.	Least radius of gyration in ins.
A—3						B—4					
4	4	4	6	3.8	1.45	5	5	5	8	6.4	1.92
4	4	4	6	4.8	1.50	5	5	5	8	7.8	1.96
4	4	4	6	5.8	1.55	5	5	5	8	9.2	2.02
4	4	4	6	6.8	1.59	5	5	5	8	10.6	2.07
B—5						C—6					
6	6	6	8	7.4	2.34	7	7	7	10	10.0	2.80
6	6	6	8	9.0	2.39	7	7	7	10	12.0	2.85
6	6	6	8	10.6	2.43	7	7	7	10	14.0	2.90
6	6	6	8	12.2	2.48	7	7	7	10	16.0	2.94
6	6	6	8	13.8	2.52	7	7	7	10	18.0	2.98
6	6	6	8	15.4	2.57	7	7	7	10	19.2	3.03
6	6	6	8	17.0	2.61	7	7	7	10	21.2	3.08
C—7						D—8					
8	8	8	10	10.0	2.80	8	8	8	12	23.2	3.12
8	8	8	10	12.0	2.85	8	8	8	12	25.2	3.16
8	8	8	10	14.0	2.90	8	8	8	12	27.2	3.21
8	8	8	10	16.0	2.94	8	8	8	12	29.2	3.26
8	8	8	10	18.0	2.98	8	8	8	12	31.2	3.31
8	8	8	10	19.2	3.03	8	8	8	12	33.2	3.34
8	8	8	10	21.2	3.08	8	8	8	12	35.2	3.38
8	8	8	10	23.2	3.12	8	8	8	12	37.2	3.43
8	8	8	10	25.2	3.16	8	8	8	12	39.2	3.47
8	8	8	10	27.2	3.21	8	8	8	12	41.2	3.52
8	8	8	10	29.2	3.26	8	8	8	12		
8	8	8	10	31.2	3.31	8	8	8	12		
8	8	8	10	33.2	3.34	8	8	8	12		
8	8	8	10	35.2	3.38	8	8	8	12		
8	8	8	10	37.2	3.43	8	8	8	12		
8	8	8	10	39.2	3.47	8	8	8	12		
8	8	8	10	41.2	3.52	8	8	8	12		

TABLE XLIX.

SAFE COMPRESSIVE LOADS PER SQUARE INCH ON WROUGHT-IRON COLUMNS.

RATIO OF (IN INCHES.)		BOTH ENDS SMOOTH.			ONE END SMOOTH ONE END PIN END.			BOTH ENDS PIN ENDS.		
Square of length to square of radius of gyration.	Length to radius of gyration.	For values of $\left(\frac{c}{f}\right)$ in lbs., equal.			For values of $\left(\frac{c}{f}\right)$ in lbs., equal.			For values of $\left(\frac{c}{f}\right)$ in lbs., equal.		
		8000	10000	12000	8000	10000	12000	8000	10000	12000
100	10	7989	9986	11983	7973	9966	11960	7960	9950	11940
225	15	7955	9944	11932	7940	9925	11911	7911	9888	11866
400	20	7921	9901	11881	7894	9868	11842	7843	9803	11764
625	25	7877	9846	11815	7836	9795	11755	7758	9697	11636
900	30	7821	9779	11735	7767	9708	11650	7656	9569	11483
1225	35	7762	9702	11643	7686	9607	11529	7538	9422	11307
1600	40	7692	9615	11538	7595	9493	11392	7407	9259	11111
2025	45	7614	9518	11422	7494	9367	11231	7264	9080	10897
2500	50	7529	9411	11293	7386	9232	11078	7105	8881	10657
3025	55	7437	9296	11155	7267	9084	10901	6949	8686	10423
3600	60	7339	9184	11009	7143	8928	10714	6780	8474	10169
4225	65	7236	9045	10855	7010	8762	10515	6605	8256	9907
4900	70	7127	8908	10690	6877	8596	10315	6426	8032	9638
5625	75	7015	8769	10523	6736	8420	10105	6244	7804	9365
6400	80	6896	8620	10345	6593	8241	9890	6058	7572	9086
7225	85	6777	8471	10165	6447	8059	9681	5877	7346	8815
8100	90	6653	8316	9979	6299	7874	9449	5694	7117	8541
9025	95	6527	8159	9791	6150	7687	9225	5512	6890	8269
10000	100	6400	8000	9600	6000	7500	9000	5333	6666	8000
11025	105	6271	7839	9407	5850	7312	8775	5157	6446	7736
12100	110	6140	7675	9210	5700	7125	8550	4980	6225	7470
13225	115	6010	7512	9015	5550	6937	8325	4820	6025	7230
14400	120	5880	7350	8820	5410	6762	8115	4650	5812	6975
15625	125	5750	7187	8625	5260	6575	7890	4490	5612	6735
16900	130	5620	7025	8430	5120	6400	7680	4340	5425	6510
18225	135	5500	6875	8250	4980	6225	7470	4180	5225	6270
19600	140	5370	6712	8055	4840	6050	7260	4040	5050	6060
21025	145	5240	6550	7860	4700	5875	7050	3900	4875	5850
22500	150	5120	6400	7680	4570	5712	6855	3770	4712	5655
24025	155	5000	6250	7500	4440	5550	6660	3630	4537	5445
25600	160	4880	6100	7320	4320	5400	6580	3510	4387	5265

shown in the figure in outline. When it is necessary to have very heavy columns flat pieces are inserted between each flange, as shown in Figure 289. These columns can be readily covered with fire-proof blocks to make a circular finish in buildings, and are largely used both for this reason, and on account of their great strength, (owing to all the metal being near the outer edge).

¹ (Obtained by multiplying by the area of bar.)

Column G is made in eight sections, column E in six sections, all the others in four sections. In column A $\frac{3}{8}$ " rivets are used; in columns B¹ and B² $\frac{1}{2}$ " rivets are used; while in the others $\frac{3}{4}$ " rivets are used, until the shell becomes over $\frac{3}{4}$ " thick when $\frac{1}{2}$ " rivets are used.

The thickness given is the thickness of shell; the diameters are the "inside diameter"; "outside diameter," (or inside diameter plus the two thicknesses of shell); and the "diameter over all," that

is to outside of flanges. The weight per yard of these columns will, of course, be in pounds, ten times the given area. It will be noticed that the "radius of gyration" is given, and not its square, which will make the use of Table XLIX in connection with these columns much easier.

When calculating the load on a column it should be borne in mind, that if the girder or beam is continuous over the column, the loads

will be equal to the reactions as given in Table XVII on pages 218 and 219 of Vol. I.

If the girders or beams overhang columns and are built into the wall at the other end (such as gallery beams for instance) the respective loads on the column and wall and upward pressure on wall can be found from Formulae 116 to 119 inclusive.

If the load on the overhang is uniform its reaction would be the same as a similar amount of load concentrated at one-half the span of overhang.

If the beams or girders are inclined they can be calculated the same as already explained (in the previous chapter), when calculating transverse strains on rafters; and the amount of anchoring necessary to prevent pulling out, can readily be found by obtaining the horizontal thrust by the graphical method, as already explained.

LOUIS DECOPPET BERG.

[The end.]

A RUN THROUGH SPAIN.¹—VII. A DREAM IN THE MOSQUE.



NO city in the world probably has a more glorious temple than Cordova. To have seen it is to have had a dream of fairyland to which even the lamp of Aladdin could hardly add beauty, and one can well understand the reverence with which every Moor took off his sandals, entered its sacred precinct, and bowed to its sacred Koran within the glorious Mihrab. To him the very ground whereon he trod was holy ground, and no reverence that he could outwardly bestow was equal to that which took possession of his heart and soul, as he bowed his head in worship.

We arrived at Cordova just at lunch time and after our omelette washed down with Val de Penas, and our grapes soaked in the same wine, we sauntered out to see the remains of one of the wonders of the world.

A wild-eyed youth, tall and gaunt, was on the watch for us. It is safe to say that no person ever entered a Spanish town without being well observed by a half-dozen or more individuals, each one of whom feels it his especial duty to escort him, her, or them, to the hotel, and to every place of interest in the town, and furthermore considers it nothing less than an insult if he, she, or they look upon the question in any different light. The result is quite amusing, and the patience of Job is required to keep down the little Americanisms that bubble up, and are apt to spill over from time to time. These gentry probably speculate a good deal on the comparative chances of their game; this one they think is rich and worth a strenuous exertion to interest; this one is good-natured and free with his pesetas, and they will stumble upon him at the commencement of his rambles, and fleece him with the best nature possible; or, again, this crowd are anxious and they must be played upon, lest they lose something of interest.

¹ Continued from No. 791, page 121.

However this may be, with ourselves here was a party of four people, and this wild-eyed youth's intentions were evident from the first.

"I am the guide of the hotel," he said in Spanish.

"Oh very well, we have not the least objections," we replied, paying no attention to him at all.

"I will show you the mosque, Señor."

"No need, my friend," we replied, "the mosque will show itself, and what is under one's nose doesn't need to be shown."

Now the mosque was not quite so near the hotel as this, but resolving to rid ourselves of such a pest we started out, the fellow at our heels, however, with a scowl on his face a good deal blacker than his tanned skin.

Seeing us steer directly away from the mosque, he stepped up and remarked that we were going in the wrong direction.

"All right, my friend," we remarked, "when we wish to go to the mosque we shall go there, meanwhile we suppose there is no law to forbid us to go where we please, is there?"

Evidently he was nonplussed, for he shrugged his shoulders, and stood on the corner until we were out of sight, but turned up again at the mosque, resolved that if he couldn't guide us no one else should, and that he would make it as uncomfortable as possible for us. But after a good dinner, with such an object as the mosque and orange court before one, it must be a strange character indeed who allows himself to be bothered by any such trifles; to evade such pests it is only necessary to totally ignore them, which we did with perfect success.

Cordova is a dead city of the past, apparently engaged in thinking over its former greatness. Where one million inhabitants lived between the ninth and twelfth centuries, now only a small township remains, and this handful of people seem to be simply living in peace and quiet, unconscious of any needs. Where three hundred mosques were filled with worshippers, now only a score of chapels exist at all, yet its good people never cease to remember that it was once Karta-tuba, "a remarkable city," the seat of learning and famous throughout the East.

The mosque walls are extended on the east and form a large square orange court, upon entering which a quiet falls upon the senses difficult to describe. The sun has sunk so that the shadows of the old walls with their flame-shaped battlements fall upon the orange trees laden with fruit, just commencing to put on its coat of golden yellow. We sit down on a curb of stone in the centre of the court, where thousands of Moors had of old made their ablutions on entering the sacred mosque itself, and the train of thoughts could not but call up recollections of those days glorious to the Moor as they were hateful to the Christian. The same pavement of stones is under our feet, and the smoothness is caused by the continual tramping of worshi-pladen feet of years ago. The orange trees are many of them old and gnarled, and may have cast their fruit upon the Moor as they now do upon the Christian. The fountain walls are before us, the stone curb remains, and over against us are the low unassuming walls upon which one would scarcely look a second time did he not know the hidden beauties beyond; they have stood for years and years, and future generations will regard them with veneration as do the present generation, but it is safe to say that no eyes can ever again look upon them with the same love as did the old Moor's as he entered the court daily, and endeavored to drink in the mystical influence of a religion which he formulated by the ever present couplet "God is God and Mohammed is his prophet."

Cross over the court then and enter the little doorway pointed out. One knows somewhat of what he may expect, but he cannot fully realize the immensity of this forest of pillars, this labyrinth of jasper, verd-antique and porphyry—the wealth of France, Spain, Constantinople and Africa. A very fairyland it is, seemingly, wherein the little choir-boys in their long white garments are genii running hither and thither and doing the bidding of unseen spirits. The vistas before us change constantly, and other views and other lights and shades spring up in this dreamland; now and then a misty cloud of incense floats across the columns like fleecy clouds, but above and



around it all is the subtle influence of silence, only broken by the tinkling of a bell or the monotonous chant of a priest in some distant part of the edifice. The dream, however, is reality itself, the pillars are solid, the arches are substantial, the priests chant and recant their ritual, and we are bound to admit that we are simply in a cathedral of the present, the relic of former grandeur, and yet in its day one of the most impressive in the world.

As there is apparently no end to the vistas of this forest of columns, whichever way you look, we saunter around toward the centre which seems to be the *coro*. Nineteen aisles run across the mosque and are intercepted by thirty-three transverse aisles to form which nearly a thousand columns rise with their double horseshoe arches above, and through the roof the light is thrown in such a manner as



AN ENTRANCE TO MOSQUE
CORDOVA

always to give an undetermined hazy effect of light and shade. Thus has a cathedral sprung up on the ruins of a Roman temple which in turn gave way to a basilica, and afterward to a Moorish mosque.

While gazing at the walls, arches and columns, we discovered here and there arabesques of singular beauty but only bit by bit, and to explain this we asked a sacristan whether the ornamentation had originally extended over the whole church. "*Que'en sabe,*" he exclaimed, "who can tell?" and when pressed to explain his uncertainty, he replied, "well, you see when the Christians seized the mosque they whitewashed the whole interior."

"Ah, yes," we interrupted, "that is enough to explain the whole thing, the Christians must needs whitewash that which was purity itself." Time and again, the same reply has been received; and thus did Christianity in olden times take upon itself in anger and malice to destroy that which was beautiful.

On the north side of the mosque is the Mecca of the Moors in Spain, called the *Mihrab*, which signifies the spirit of God. Could the presence of God ever be shown forth by the work of man, could wealth of gold and precious stones be worked into forms acceptable to his infinite mind, even so, surely might this "holy of holies" have been the veritable abiding-place of the Almighty.

A horseshoe arch guards the entrance to this interesting alcove and the arch is enclosed with a square framed facade of beautiful design, and incrustated with precious stones; a solid mosaic in which the background is pure gold, and the border laid with lapis lazuli and gold combined. The effect of color is perfectly marvellous, and with the very small amount of light that enters, these colors are deep and rich and seem to stand out from their golden background like low relief work. The niche itself is roofed over by a solid shell of marble and it is below the centre of this huge shell that there used to be a pedestal of pearl and ivory upon which stood a richly ornamented and illuminated copy of the Koran, the bible of the Moors.

And so we have made our pilgrimage to Mecca like thousands of Moors and must not fail to derive all due benefits.

If you would moralize further in regard to this sacred shrine, walk over the pavement and stand at its entrance, notice that the hard stone is worn away into a hollow caused by the feet of the Faithful whose numbers must have been counted by millions rather than thousands, and if it may add anything to a just appreciation of the tremendous size of the mosque one can form a better idea from the fact that it covers about four acres of ground, and is a perfect network of columnated arches.

In the interior of the mosque is the present cathedral, so-called, marked by the high *coro* and somewhat spoiling the otherwise long vistas. One cannot help wishing that the Christian part of this temple had been omitted, and even Charles V who gave permission for the desecration was forced to exclaim, "they have destroyed what was unique in the world"; and it is to the honor of the townsmen that they had protested most vehemently against the encroachment, and were only overruled by the priests and king.

Come with us now, sit down in the far western corner, and blot out the *coro* from your minds. Picture to yourself the ancient city with its millions of inhabitants all busy with the affairs of the world, a city peopled by the Moors who regained for it the proud title of the "Athens of the West," the proudest and richest seat of learning in the country.

We are away back a thousand years after Christ with the country prosperous and in peace. Imagine the interest with which these old Moors watched the work, firm in their position of religious leadership and anxious to rival the splendors of Mecca. How they must have noted every new column and arch that was set and become acquainted with its history. Here were columns of jasper from Constantinople,

columns of porphyry from Alexandria, columns of verd-antique from Spain and columns that had been taken from the temples of the gods in many other lands. Away into the obscurity of the distant aisles they stood like sentinels 1,400 strong, supporting low arches of brick, now in two colors, and still holding above a second arch, which then supported the ceiling. In olden times this was a mass of cedar-wood carved and ornamented, and of which only traces here and there remain.

You have, perhaps, some beautiful lamps you prize because they were of Moorish origin, but here were 800 hanging-lamps of exquisite workmanship in gold and silver, and from these lamps was shed the soft light of aromatic oils, lulling the senses and leading the mind toward the mysterious promises of the Prophet to the faithful.

Banners of victory hung from the walls, standards which had been blessed by the Prophet of Allah, dedicated to the god of battles, and many of which had passed through the wars that had given to the Moors their ascendancy. As thrilling a sight to them must they have been as our own battle-flags, torn and riddled, yet showing the red, white and blue of a beloved country. And more sacred still to them and surrounded by a splendor of gold and silver and precious jewels, reposed the Koran, the mouthpiece of Mohammed the prophet of the living God, commanding the faithful to gird on the sword of battle and conquest, and promising the joys of paradise and the forgiving of all sins to such as perished under its banners.

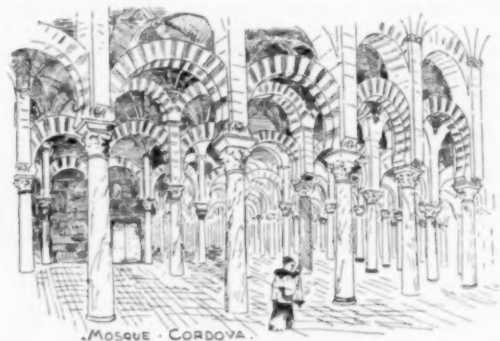
The dreamy silence of the place carries us back to such scenes, and we seem to see the place peopled as of old. Rapidly the Moors are crossing the orange-yard; they kneel at the fountain, perform their ablutions, enter the mosque, after removing their sandals, and slowly advance toward the *Mihrab*. They bow their heads until they touch the pavement, utter the cabalistic words of the Koran, breath out a prayer, and pass out. Here enters a band of pilgrims who have tramped many a weary mile, over mountain or plain, are foot-sore and dusty, yet, see, their eyes brighten, their whole aspect changes as they also file past us, perform their devotions, and then gaze around with awe-struck countenances at the splendor and wealth of this place. They have made their pilgrimage, and are content.

Still a countless throng fill and refill this wonderful building, and we begin to feel in a measure the influence of all this voluptuous wealth, and cease to wonder that these people hold tenaciously to the promises of eternal blessedness to the faithful, and are only awakened from our reverie by the darkness that has gradually permeated the building, and hidden all detail from our eyes, which has caused the columns to almost disappear into the obscurity far away, and has emptied the place of all worshippers.

We must hurry away and to-night dream over the wonders of the mosque; to-morrow we will study it more fully, next day we will sketch it, but never can we forget it, nor cease to mourn a little for the Moors whose glories show forth from the choicest bits, and who were ruthlessly driven from their earthly paradise, never more to return. Where they went, where they are now as a people, no one can say; a few remain in the old haunts, generation has succeeded generation, the waters of the Mediterranean separate a larger number, but they are forever dead as a nation or as a power.

But so goes the world, we live to-day, we die to-morrow; we conquer to-day, and to-morrow are in our turn conquered by a stronger power; it is the history of nations repeated time and time again.

Arriving at our hotel again we met an English artist whom we had before seen at Granada, and who was engaged in a sketch of an old *patio* which we visited next day. The little streets wound around in all sorts of directions until at last we came to the place indicated by number, but which would never have been known from the exterior, showing simply a large archway in the high wall of a house. Entering, we found ourselves at once in a group of mechanics at work on old wagons of different kinds. All around the *patio* was a colonnade of beautiful stone columns and arches, reminding one much of the old Italian palace-courts, and over this was still another order



MOSQUE - CORDOVA

of columns and arches, back of which were the rooms grouped around the square. This had evidently at one time been the abode of some noble lord, for the centres of the arches bore the armorial shield and escutcheon. Furthermore, the *patio* had been once paved and pieces yet remained.

But most beautiful of all, was a simple old well-curb of stone, with a wrought-iron hanging crane over the centre, and just as we entered

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our artist friend had posed a little Andalusian maid in the act of drawing a jug of water. And as the background of one side of the patio was filled with a growth of orange-trees, and some kind of running vine had clambered up around the columns and formed a perfect network of foliated drapery over the balcony above, the scene was beautiful and Spanish in the extreme.

And there, too, was our friend with his easel and canvas, outlining the whole with charcoal, preparatory to filling-in the picture in color. I could not help taking a photograph of this scene, and the workmen grouped themselves around with pleasure not unmixed, probably, with wonder that foreigners found so much beauty in a scene that to them was as common as their everyday life. And further, I could not help wondering why we did not more often build in this method in our close cities, where a central court like this could be made of so much beauty; but then I commenced to count the cost of such an expenditure of land, and was forced to admit that it was almost impossible to make art harmonize with expense, where land was more expensive than our dwellings. Evidently art has to give way for expense's sake, a conclusion maddening to the architect's artistic mind.

Having once commenced to sketch we were soon followed by a goodly number of little urchins who evidently were much interested in our proceedings. So I sat down opposite the long walls of the mosque with its flame-like top, and commenced to outline one of the entrances on the side.

"Chico," I shouted, "run across and sit down in the doorway."

"Si, Señor, if you will give me a cigarette."

"All right," I answered, "here you are," and handing him a case of paper and tobacco, he dexterously rolled himself a cigarette as he ran across.

But I had not counted on the cost of this simple promise, for no sooner did the other little urchins see this performance than they also demanded to be treated, with the result that although I soon had the good-will of my surrounding cherubs, I was minus all my cigarettes and could not think of sketching a half-hundred little urchins.

My little model, meanwhile, was posing with all his might, and stood a perfect volley of jokes from his companions who shouted with glee as the picture assumed form.

"Where do you come from Señor?" they asked.

"A good way off," I replied.

"In France?"

"No, guess again," I replied. But although they guessed and guessed until they had totally depleted their geographical knowledge, they could not one of them guess aright, and were totally in the dark when I spoke of America, having never heard of such a place.

A lady presently comes along, and looking over my shoulder, smiles. I am sitting on her door-sill I find, so I rise quickly and beg pardon for the intrusion.

"Oh no, Señor," she says, "but shall I bring you a chair?"

I thank her profusely as I see her beautiful dark complexion, long black hair, and eyes of wondrous sweetness, and she smiles again, turns and enters her house, leaving just a little glimpse of a pointed heel and a trim ankle. Oh what a graceful lot they are, these Andalusian women! And how I would have liked to talk with her and learn a little of the inside life of these people who hate work and love the luxurious life of their hot climate, and the beautiful little bit of home called the *patio*.

Later on, I did get hold of a gentleman who had been a great traveller, had been in the employ of this government in better times, and had returned to his native place to mourn over its deadness and decay. Strange, thought I to myself, that such a man can be content with a life of idleness, yet herein lies the very cause that has eaten at the heart-string of the native, until it has destroyed every vestige of a desire to work, making him prefer the lax, lazy life of a dying country. Of course the climate, sunny and laxative, the very influence of Andalusia, engenders this feeling, yet the Romans were not so influenced, neither were the Moors.

I had been speaking of the lack of interesting buildings in Cordova, supposing that there would be many of them. "Ah no," he replied, "they are things of the past. The mosque and a few churches like San Lorenzo are the only remains."

"But," said I, "is it true that the suburbs once were rich in palaces which were finer even than those of the Alhambra?" "Oh, yes," he replied, "if we can rely upon history, and the poets of the past. Yonder (pointing over the parapet of the old bridge) are the ruins of a palace or group of palaces that were like Heaven on earth, where the highest dream of the Moor or the Spaniard must have been fulfilled."

"Ah," I said, laughing, "nothing to do and plenty to eat and enjoy."

"That is it," he replied, also smiling as he went on. "There were groups of palaces whose construction was of ivory and pearl and gold inlays. The supports were all of precious marbles, glorious hanging-terraces were luxurious with exotics from foreign shores. Groves of palms with artificial streams surrounded magnificent summer houses, fountains were on every hand, formed in gold, and spouting forth perfumed spray. Thousands of slaves and servants were in attendance and musicians discoursed music continuously. Only the ruins remain, yet the fact of its existence is undoubted."

"How many centuries did this sort of life run on?" I asked.

"Ah," he replied, "that is where the interest of the history of

Medina Az-Zahra comes. Only fifty years passed while the founders and their companions were steeping themselves in all the luxuries of such voluptuous vices as necessarily followed, when a band of rebellious subjects reduced it to ruins and drove out the people."

We turned back and slowly crossed the Guadalquivir by the noble bridge, while my friend of a day told of his early life in the city, and recounted the former glories of the town. Cordova had rivalled Damascus and Bagdad; a million inhabitants had built its walls; eighty thousand palaces stood where now only a vestige here and there was to be seen; six hundred mosques pointed their minarets skyward where now only the single mosque remains.

"Ah," said I, "what must it have been if the only existing one is a criterion from which to judge the six hundred!"

"True, my friend," he replied, "and even that one has been denuded, despoiled and disfigured, while the libraries and schools and baths have all disappeared. Seneca and Lucan were Cordovans, so were Gengora and Cespedes. Averroës revealed Aristotle to the world. Morales, the historian, penned his chronicle of Spain in the street named after him, and Cespedes, the architect and sculptor, worked and wrote in this historic town."

And so he went on as we entered the deserted streets and passed through the whitened squares, where only a few people lounged about. What little life was astir tended towards the mosque, the one centre of interest and towards this I also pointed. "You will enter with me?" I asked. "No, Señor," he replied, "it is time for my *siesta*. I sleep, I awake, I eat. It is my life." And he smiled as he shook my hand kindly, and added in his mother tongue, "*Dios guardi a usted. Va usted con Dios, caballero.*"

And so I passed in as before to reflect upon the former greatness of Cordova, and its present dearth of interest, and to sketch the interior of its one point of interest before returning to the hotel.

You may walk through the streets at noon, and you would suppose the city deserted; but come back towards afternoon, after the *siesta* which is religiously observed by the Spaniard, and the solid doorways are thrown open, and through a grille-work of iron you get constant glimpses of the *patios*. The colonnades within lend an appearance of wealth, and are almost without exception miniature gardens of palm, orange and lemon trees, which give an odor of voluptuous repose and comfort. The little fountains with which almost all of them are provided, send up sprays of crystal drops which cool the air, and make you long to go in and rest from the hot sunlight. It is not a dream, but full of dreamy influences, which fill the traveller's mind with thoughts of home, and make him long to become acquainted with the people of this strange country. And if you again pass through these streets at night, the tinkling of the guitar is heard on all sides, the lights twinkle through the gratings in fantastic shapes, and one seems to hear the voices of the lovers in whose praise Spain proverbially sings. Reality forces you to suppose that the Spanish lover is not unlike the lover of all countries, but romance helps you wonderfully to connect Cupid with those beautiful *patios* with their shadowy nooks and corners, and the balconies overhead woo you into the belief that there is no more romantic spot on earth than beautiful Spain.

A midsummer night's dream indeed; would that we had the power that could put a girdle around the earth as did Puck, for were it possible, I doubt not we should hie ourselves back again to those sunny lands, where all the year's a summer, and every dream a dream of love.

C. A. Rich.

[To be continued.]

THE BYZANTINE MOSAICS OF SICILY.¹—III.

THE PALATINE CHAPEL.

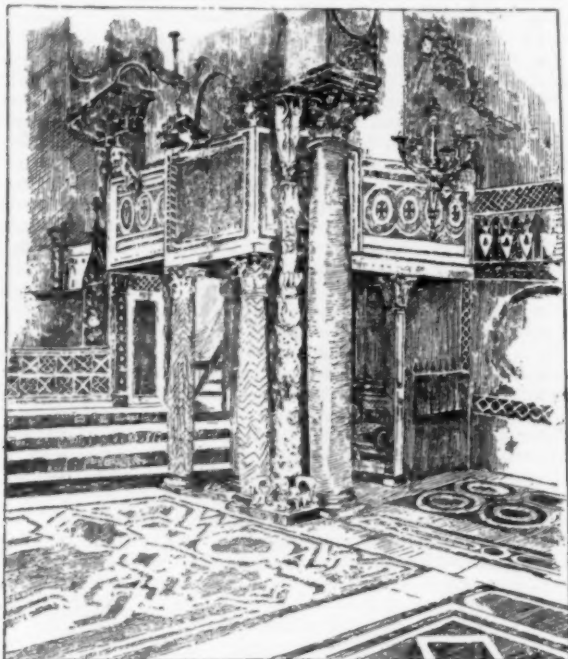


IF the church of St. Mary of the Admiral is inspired with Byzantine traditions, the Palatine Chapel, built about the same epoch, presents the most perfect and striking image of the skilful combinations which characterize Siculo-Norman Art. Founded by King Roger to the honor of the apostle St. Peter, consecrated and richly endowed by the Prince in 1140, entirely finished in 1143 (as is proved by the Greek inscriptions which run around the base of the cupola), it unites the shape of the Latin Basilica to that of the Greek church, the blazonry of the Byzantine mosaics to the splendor of the Arabian decoration. By its three naves which are defined by two ranks of granite columns with Corinthian capitals, it seems to be from the North; by its choir raised by five steps and separated from the remainder of the church by marble railings; by its three apses; by its high cupola on a square plan supported by four columns; by all this, it brings to mind the most exquisite features of the Eastern productions. The Palatine Chapel is the gem of the world, with its

¹ Continued from No. 791, page 126.

pavements where porphyry, serpentine and marble are united to the interlaced ornaments of the multicolored mosaics; with its costly ornamentation of precious marble and incrustations which line the walls; with its ceiling of wood which falls in stalactites, where the cufic inscriptions unroll themselves in gold and the finest marvels of painting; with its numberless silver lamps hanging from the vaulted ceiling, and its sparkling mosaics which cover it all over, and illuminate it with the incomparable lustre of their golden depths.

Nowhere, except perhaps at S. Mark's in Venice, was the powerful and marvellous effect of these mosaic decorations, which the Byzantine artists loved so well, better understood. Nowhere, except perhaps at the Sainte Chapelle, does one feel more deeply the magic attraction of an art which reveals itself in its whole perfection. The Palatine Chapel should be seen at the time when the solemn services are held; when the light from the candles and the richness of the sacerdotal clothing illuminate, with a new splendor, the exquisite beauty of the masterpieces; it should be seen when the rays of the sun, playing through the bluish vapors of the incense, light up the golden walls with a majestic radiance, and seem to give life to the austere and motionless faces of the prophets and saints. Then one can understand the enthusiasm of the ancients who saw the origin of these marvels of art; and one will no longer judge as exaggerated the pompous hyperboles with which they celebrated the work of Roger II. To-day, as in the time of Bishop Theophanes Cerameus, on whatever side one looks, admiration is involuntary. Here, near the choir railing, it is this marvellous pulpit supported by six columns, the marble slabs of which are incrustated with bright mosaics; there, it is that grand chandelier, about five metres high,



Ambo in the Palatine Chapel, Palermo.

the base of which is supported by four lions; and in the refined beauty of which flourish a colony of birds, animals and men chiselled on the whiteness of the marble; exquisite work, which shows at half-way up King Roger kneeling before Christ, and thus furnishes with the name of the donor, the date of this masterpiece; elsewhere, at the entrance of the nave, it is the royal throne with its marble ornaments and its delicate inlaid work, above which a mosaic of the time of the Kings of Arragon (1345) represents St. Peter kneeling before the Saviour; then the bold spring of the high narrow arches, which throw toward the vault their almost Arabian ogive; and everywhere, against the walls of the naves, against the curve of the arches, the vaults of the dome and the apses are these wonderful mosaics; beautiful in composition, brilliant in color, with firm and studied drawings; everywhere groups of figures with faces that dazzle the sight, and some of which may be considered among the most beautiful works of the Byzantine art of the twelfth century.

It would be impossible to describe in complete detail such a vast decoration; moreover, among these mosaics more than one has lost its primitive character through restoration; such is the case with the Madonna seated between two images of saints at the foot of the principal apse; also the figure of St. Andrew which decorates the left-hand apse. It is in the right-hand part of the sanctuary and on the vaults of the dome that the indisputable masterpieces of the Byzantine artists can be found. At the top of the edifice the Christ Pantocrator, in bust, is at the centre of the dome; a beautiful and severe figure done by a skilful hand and near which runs this inscription, "Heaven is my throne and the earth is my footstool." Around this central medallion eight archangels with outspread wings, their garments spangled with golden trimmings, spears in their hands, and

their hair crossed by a narrow white band, guard the Son of God, — while on the drum of the dome evangelists¹ and prophets proclaim his glory, and at the curve of the arches which support the dome the archangels, Michael and Gabriel, and all the holy warriors of the Greek Church attend the Saviour. Next are scenes from



Interior of the Palatine Chapel, Palermo.

Christ's life which cover the walls and the apse of the right-hand aisle. Here is the Nativity, more elaborate here than in the excellent mosaic of the Martorana, and where the adoration of the Magi is united to the birth of Christ. Here is the baptism of the Saviour, where the symbolic representation of the two streams which form the Jordan may be seen in the transparent water. Here is the resurrection of Lazarus with a very realistic detail of a personage who at the opening of the sepulchre holds on to his nose



12th Century Mosaic in the Cupola of the Palatine Chapel.

with his mantle; above all, here is the flight into Egypt and the entrance of Christ into Jerusalem; two very excellent scenes, where a deep study of anatomy, knowledge of drapery, and real talent in composition are united to rare technical ability. True, the proportions may be out, the attitudes somewhat formal and stiff; but this solemnity conveys, nevertheless, an effect of real grandeur. The group which at the gates of Jerusalem comes out to meet Christ, is beautiful in every respect, and the rather realistic detail of the person who draws his shirt over his head in order to cast it under Jesus's feet shows an art which did not disdain naturalism. On this

¹ They are identified by Greek and Latin inscriptions.

vault also, are representations of the Pentecost, and in the left portion of the sanctuary the Virgin Hodigitria's (the conductress) face (one of the most worshipped of the madonnas at Byzantium), and the images of the fathers of the Greek Church, designated by Greek and Latin inscriptions.

The mosaics which line the dome, apses and choir of the Palatine Chapel are usually ornamented with Greek inscriptions only; it is not so with the mosaics of the naves, which represent in the middle a series of scenes from the Old Testament, from the Creation to Jacob's wrestle with the Angel; and in the aisles St. Peter and St. Paul's history. All these representations are indicated by Latin inscriptions, and they seem to be of another kind and from another hand than the mosaics of the choir. While the decoration of the sanctuary dates, as attested by the inscription on the dome, from King Roger's reign and the year 1143, at least a part of the mosaics of the nave belong to the time of King William I, who, according to de Romuald of Salerno, completed the Palatine Chapel and ornamented it with mosaics. But between these two series of works the difference is very marked. In the former, the predilection to represent the saints of the Greek Church, the constant use of the Hellenic language, and above all, the superior quality and universal merit of the work attest the hand of the Byzantine master; in the latter, on the contrary, where the saints and the language of the Latin church are used, the Italian students who were trained at the artist school of Byzantium must have worked; and at once marks of decadence are perceived. Therefore in these mosaics of Sicily, if one is interested in Byzantine art, it is necessary to determine with accuracy the part which belongs to each one. The Greek artists to whom King Roger gave the charge of decorating the Sicilian churches, may claim with pride the most remarkable among these works. The mosaics of Cefalu, completed in 1148, which are the most beautiful in Sicily, the decoration of St. Mary of the Admiral, and the choir of the Palatine Chapel are their own work; but in their school Italian pupils were quickly trained; and these native masters after having tried their skill on the less important parts of the Palatine Chapel, proceeded to take the largest part of the work on the sumptuous decoration of the Cathedral of Monreale upon themselves.

[To be continued.]



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

HOUSE OF JOHN SLOANE, ESQ., 883 FIFTH AVE., NEW YORK, N. Y.
MR. R. H. ROBERTSON, ARCHITECT, NEW YORK, N. Y.

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

EASTERN MAINE INSANE HOSPITAL, BANGOR, ME. MR. G. M. COOMBS, ARCHITECT, LEWISTON, ME.

HOUSE OF WALLACE HACKETT, ESQ., PORTSMOUTH, N. H. MESSRS. BALL & DABNEY, ARCHITECTS, BOSTON, MASS.

SKETCH OF COUNTRY HOUSE. MR. C. EDWARDS, ARCHITECT, PATERSON, N. J.

"THE JARVIS" APARTMENT-HOUSE, CAMBRIDGE, MASS. MESSRS. J. E. & W. P. RICHARDS, ARCHITECTS, BOSTON, MASS.

THIS building is constructed of red and Perth Amboy brick with terra-cotta trimmings. Its cost is \$44,000.

COTTAGE AT ATHOL SPRINGS, N. Y. STABLE FOR J. S. BLISS, ESQ., BUFFALO, N. Y. MR. C. D. SWAN, ARCHITECT, BUFFALO, N. Y.

[Additional Illustrations in the International Edition.]

THE CASCADES OF THE CHATEAU DE VAUX, FRANCE.

[Copper-plate Engraving.]

DETAIL OF THE CHOIR OF THE CATHEDRAL, MONREALE, SICILY.

[Gelatin Print.]

HOUSE IN THE ARCSSTRASSE, MUNICH, GERMANY. HERREN KAYSER & GROSSHEIM, ARCHITECTS.

[Gelatin Print.]

ST. ALBANS ABBEY.

THIS plate is reproduced from a water-color drawing by the late S. A. Hart, R. A., and is a record of the appearance of the building several years ago, before any restoration was undertaken.

CASE OF A GRAND PIANOFORTE. MR. T. G. JACKSON, ARCHITECT, LONDON, ENG.

A HAMPSHIRE CHURCH.

ASHMOLEAN MUSEUM, OXFORD, ENG.

THESE drawings, by Mr. Claude de Neuville, an Oxford artist, have been recently exhibited in London. The treatment, it will be observed, is very elaborate, as the effect has been produced by a sort of stippling that requires both time and patience as well as skill.



THE T-SQUARE CLUB OF PHILADELPHIA.

THE T-Square Club of Philadelphia held a regular meeting on the evening of February 18. The competition was a very spirited and interesting one, the subject being a 40-foot front for a City Club-house in the Italian Renaissance style, regular competition drawings only being allowed. The first mention was won by Mr. J. P. Jamieson, second mention by Mr. W. D. Mulligan and third mention by Mr. Chas. Z. Klauder. The Club was very pleasantly entertained by the hosts of the evening, Messrs. Moses and King.

THE ARCHITECTURAL LEAGUE OF NEW YORK.

At a regular meeting of the Architectural League of New York, held on Monday, March 2, 1881, the following resolutions were unanimously adopted.

Whereas:—The Architectural League of New York, through the undersigned, who have been appointed a Committee for the purpose, deplore the great loss it has sustained in the death of John Wellborn Root, one of its most honored members, therefore,

Resolved:—That this society, composed of his professional brethren, record his death with sorrow and regret that a career so full of brilliancy and promise has been abruptly terminated. By his untimely death, the profession has lost one of its most accomplished practitioners, and his associates, a true and genial friend.

Resolved:—That the sympathy of the League as a body be extended to the bereaved family of the deceased in their great affliction.

RICHARD M. UPJOHN.

GEORGE B. POST.

WARREN R. BRIGGS.

Chairmen.



[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.]

CONCRETE CONSTRUCTION.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Kindly tell me where I could get information in regard to the forms necessary for the construction of a concrete house. I have Reid's work on Concrete, but it is not at all complete in this particular.

Respectfully,

S. P. ANNAN.

[If by "forms" you mean moulding-frames we can only say that they are made on the job. EDS. AMERICAN ARCHITECT.]

A QUESTION OF SCALE.

SACRAMENTO, CAL., February 21, 1891.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—I should feel obliged by your consenting to answer the following question and thus decide a point at issue between two draughtsmen, A and B.

A, having finished a detail drawing to a scale, 6 inches to the foot, wrote on the sheet as follows:—"Scale half full size." To this B objected stating that it should have been "Scale half size." The question I wish you to decide is just this: While both agree that "Scale half size" is correct, A maintains that, "Scale half full size" is also correct. To you this point is submitted, if you will be good enough to give your answer in the next issue of your paper. Would you, if a draughtsman in your office so worded his drawing, find fault, tell him he was altogether wrong, and desire him never again to commit such an unpardonable blunder? I have the honor to be,

Your obedient servant,

ARCHITECT.

[This question has been discussed in the offices for a considerable part of a century. Strictly, neither expression is right. "Scale 6 inches to 1 foot," would be geometrically correct, as this gives the relation of the linear dimensions only, while, taking the areas into consideration, the drawing, at that scale, is one one-fourth the size of the object depicted. Still, this geometrical blunder is sanctioned by a loose usage. As to the geometrical advantage of the expression "one-half size" over "one-half full size," we are not so sure as some persons that we have seen. "One-half size" appears to us indefinite, as "size" is a word of very various meanings, and

we can see no more objection to qualifying the word "size" in this sense by the addition of "full" than in the case of drawings at the actual size of execution, where it is universally employed. In matters like this, also, the custom of educated people is of considerable authority, and the expression "one-half," or "one-quarter," or "one-eighth full size" is certainly far more frequently employed than the others. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

RESPONSIBILITY OF ARCHITECT AND BUILDER. — The following case — *Mosdell vs. Mitchell* and others, reported in *The Times* of the 20th January — is the sequel to the unfortunate mishap which occurred in Great Titchfield Street in 1888. It brings home to architects the fact that it is impossible to be too careful in the construction of buildings in London; and without entering upon the evidence given on both sides as to the precise cause of the accident, I cannot but express sympathy with those concerned in the calamity — knowing, as we all do, that with the utmost care and vigilance it is at times impossible to avoid the occurrence of such misfortunes as that now under notice. But I do not agree with the endeavor to make the client, Mitchell, responsible for the fall of the houses. Surely when a client employs an architect he so employs him as an expert, to exercise his professional skill and judgment; and if the architect and builder, between them, are unable to detect a flaw in construction it is not to be expected that the client will be better informed: —

This was an action under Lord Campbell's Act brought by the widow, claiming damages for the death of her husband from injuries received through the falling of a house in Great Titchfield Street, in consequence of the alleged negligence of the defendants.

The defendant Mitchell was the lessee or occupier of certain land in Great Titchfield Street, and being desirous to erect some houses there, employed the defendant Miller to prepare plans and specifications, to be submitted to him for approval. Miller accordingly prepared the plans and specifications which met with Mitchell's approval, who then entered into a contract with the defendants Messrs. Oldrey & Co., building contractors, who proceeded, in August, 1888, to erect the houses under the superintendence of Miller. The plaintiff's husband was employed by Oldrey & Co., as a carpenter and joiner upon the houses, which were almost entirely built by 9th November, when suddenly, on that day, a three-storied house standing at the corner of Great Titchfield Street and Ridinghouse Street, crashed down, killing five men, amongst them the plaintiff's husband; and she now claimed damages on her behalf and for three children that were left. The case attempted to be set up against Mitchell, the owner, was that the accident had arisen owing to the wall of the basement not being able to bear the weight of the superincumbent structure, causing the upper courses of the bricks to slide away and let down the columns by which the girder above the ground-floor was supported, and it was suggested that this was not a proper method, and that looking at the plans, Mitchell ought to have known that these were dangerous buildings, and that he was thereby put on his inquiry. Evidence was called to show that the wall was not of sufficient strength.

At the close of the plaintiff's case defendant's counsel submitted there was no case against Mitchell.

Lord Coleridge. — If I say there is no evidence to go to the jury, probably another Court will say that there was. I have my own opinion about it. What is being said is that if an owner sends for an architect and employs competent contractors and builds a house, as thousands of other houses are built in London, he is to have an action against him if an accident occurs. The case, however, must go on.

The jury said they considered there was no liability at all on the part of Mitchell.

Lord Coleridge. — I entirely agree to that, which disposes of the case against the owner. But there is the case against the other two defendants, the architect and the contractor. They have not appeared, and as a *prima facie* case has been made out against them which they are not here to answer, so you must consider the question of damages, which is entirely for you. You must not give indemnity, only compensation, and allocate the sum between the widow and the three children. The jury found for the widow £250, and for each of the children £50 each.

Lord Coleridge accordingly gave judgment for the plaintiff for £400 as against the defendants Miller and Oldrey & Co., and also gave judgment for the defendant Mitchell. — *Wm. Woodward in the R. I. B. A. Journal.*

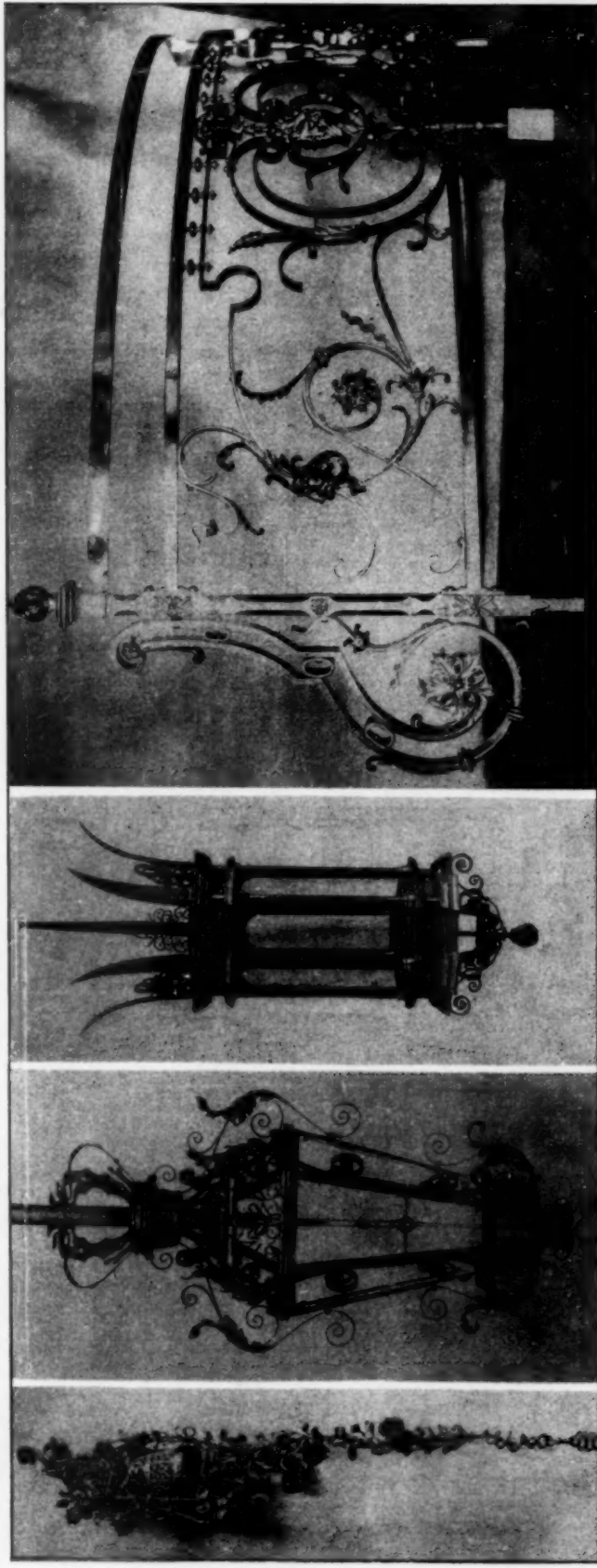
DR. OTTO. — We regret to record the death, at Cologne, on January 26, of Dr. N. Aug. Otto, the inventor of the Otto gas engine. He succumbed, after a brief illness. His career exemplifies the success of perseverance and energy paired with skill and ingenuity. Luck often follows pluck, and a false start is not fatal. Mr. Otto started as a commercial traveller, for which duties his great mechanical skill was of little avail. Some circumstance turned his attention to gas engines, where his commercial capacity remained valuable. In 1867 he, in conjunction with Eugene Langen, surprised the engineers who had flocked to the Paris Exhibition, with a real practical gas engine, an engine of the vertical type with flywheels on the top, not uncanny in appearance, but terribly noisy. The noise had to be borne, and was borne — for the new engine became very popular — for nine years, when the "Otto Silent" was presented. That engine has undergone such manifold improvements by the inventor and by Mr. Crossley that startling innovations and perfections are hardly to be looked for. The gas engine in its practical career has thus quickly attained maturity. Yet the early history of the gas engine has to go back more than 200 years. It is orthodox to quote Huyghens as the first in the field; the series of originators commences, therefore, with one of the best names of

physical science. Among the papers of the great physicist is one dated 1640, on a "Novel Motive Force Derived from Gunpowder and Air." Papin took this idea up in 1688, one year after his classical experiment which initiated the steam-engine; but he was not satisfied with the results. Fully a century later, Street reopened the researches by bringing out and patenting a motor cylinder with explosion by means of a torch. Many others followed, Lebon, Samuel Brown, Wright, Barnett, Newton, Barsanti and Matteucci, Million, and Lenoir and Hugon, who came very near producing a practical engine. But Langen and Otto's engine of 1867 was so decidedly superior in the economy of gas consumption that the Lenoir and Hugon engines were at once put out of the field. Otto's gas engine embraced the characteristic features of some of its predecessors — it is rarely otherwise in our days — the compression of Barnett, the cycle of Beau de Rochas, and the free piston and other advantages of Barsanti and Matteucci's engine, which was remarkable in many respects and effected ignition by means of the electric spark. But engineers remain indebted to Dr. Otto for supplying an engine which realized and did what others, who deserve all credit, had been aiming at. We will not here contest the question of priority of invention. It has been fought out many a time; and we believe that no one will grudge Dr. Otto the benefits and comfort which his work and exertions brought him. He was an honorable man, esteemed by all who knew him, and his invention was not a lucky hit. He was not trained as an engineer, but he made himself one by hard work and study; and his achievements prove his great theoretical knowledge, mechanical dexterity, and fertility of resources. — *Engineering.*

TRADE SURVEYS

The record of the week in financial and commercial circles indicates an expansion of traffic, an increase in loans, a decrease in bank reserves, an increase in inquiries and orders for merchandise and material, and an improvement in manufacturing activity. Business interests are now knit together more firmly than they ever have been, and damaging agencies are not able to reach far. Prices rather incline downward than upward in all wholesale channels. In some retail channels there is a temporary upward tendency in some articles and products, which is likely to be of short duration. Productive capacity has been expanded in nearly all directions, and is still being extended. Small industries are increasing in number, and the long hauls of years past are gradually being reduced to shorter hauls on railroads by the springing up of a multitude of little industries in all parts of the country. Texas proposes to make its own iron and much of its textile consumption, instead of continuing, as usual, to depend on far-off sources. All through the South and West industries are furnishing productions which have heretofore been hauled long distances. Coal, iron, lumber, oil, gas and a multitude of secondary products are now being furnished from local sources in the newer sections. The advantage of so doing has become apparent to many score of manufacturing concerns, which, since last autumn, have arranged to remove from their old quarters into Southern and Western new ones, rather than permit more enterprising concerns to step in between them and these growing markets. The strongest active influence in the business world to-day is the increase in self or automatic control through the development of a multitude of agencies of recent origin. Every line of activity is finding itself acted and reacted upon by this new force, which, for want of a better descriptive term, may be called automatic. For instance, over-production is becoming more and more impossible, even where there is an inclination among individual producers or combinations of them to over-produce. A power seemingly outside of trade is exercising a control which is felt at every corner. Banking interests control railroad-building. Crop conditions indirectly control much manufacturing. The two great factors, viz, agriculture and manufacture, balance each other and regulate production. Railroad managers are less able to do as they please than ever. Cotton planters are contemplating extraordinary extensions to the cotton area. Sugar-planting interests anticipate a great development in their industry. Southern coal-mining companies and coke-makers see much encouragement in the market developments of the past few weeks. Iron and steel quotations are advanced in some markets. The heavy restriction continues. Lumber manufacturers are pushing work at mills in all lumber regions. Manufacturers of building material, such as brick, cement, shingles, lath and material for the interior finishing of buildings, houses and factories, are crowding work ahead, mostly on orders placed. Builders say there is a greater increase of building activity in rural sections and in small towns than in large cities, after, perhaps, a half-dozen have been excepted. These conclusions do not accord with census returns, but yet they may be correct so far as little manufacturing industries are concerned. It certainly applies to a belt one hundred miles wide between Pittsburgh and Kansas City. There is a remarkable growth of transportation facilities on the great lakes, and all the ship-yards are crowded with work. Orders for several thousand cars have been placed during the past month, and so great is the demand for locomotive power that three or four new works will be put into operation during the next four or five months. Capitalists feel safe in placing money in manufacturing enterprises. The only weak spot in investing money is in pushing up land values in new places, but there are signs that that evil will be averted. Electricians declare that they have practically solved the problem of rapid transit in cities, and the whole subject is now under serious consideration in New York City. Schemes are under commercial consideration looking to a much wider adaptation of electricity than has yet been thought of. Capitalists are waiting for general business to take one more start, and on a broader basis. Two or three authorities say there is a larger volume of money awaiting and seeking investment than for years. Most of it is barred out of railroad enterprises by the peculiar situation in which the entire railroad question rests. A new field is wanted, but possibly the railroad field will be the first to open. In eight years the railroad business of the country has increased forty per cent, but the operating expenses have increased much more. Managers are now successfully retracing their steps in the direction of an economical management, so that when the corner is turned, as it soon will be, an additional impulse will be thereby given to railroad building. Meanwhile short-haul traffic will have greatly increased, and the question of a wiser management will have been solved. All influences are converging to the point of more profitable management and an ulterior expansion of the railway system.

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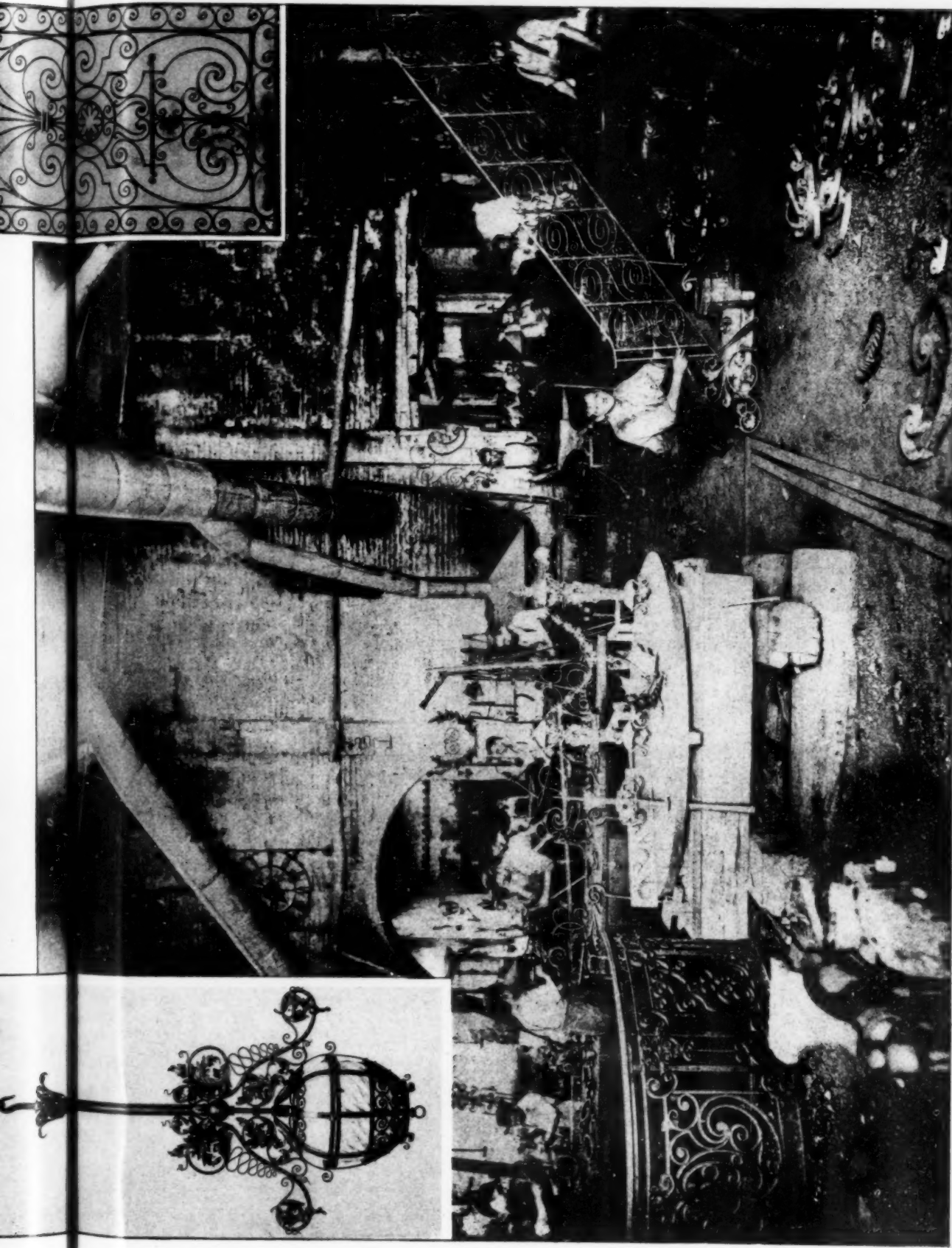
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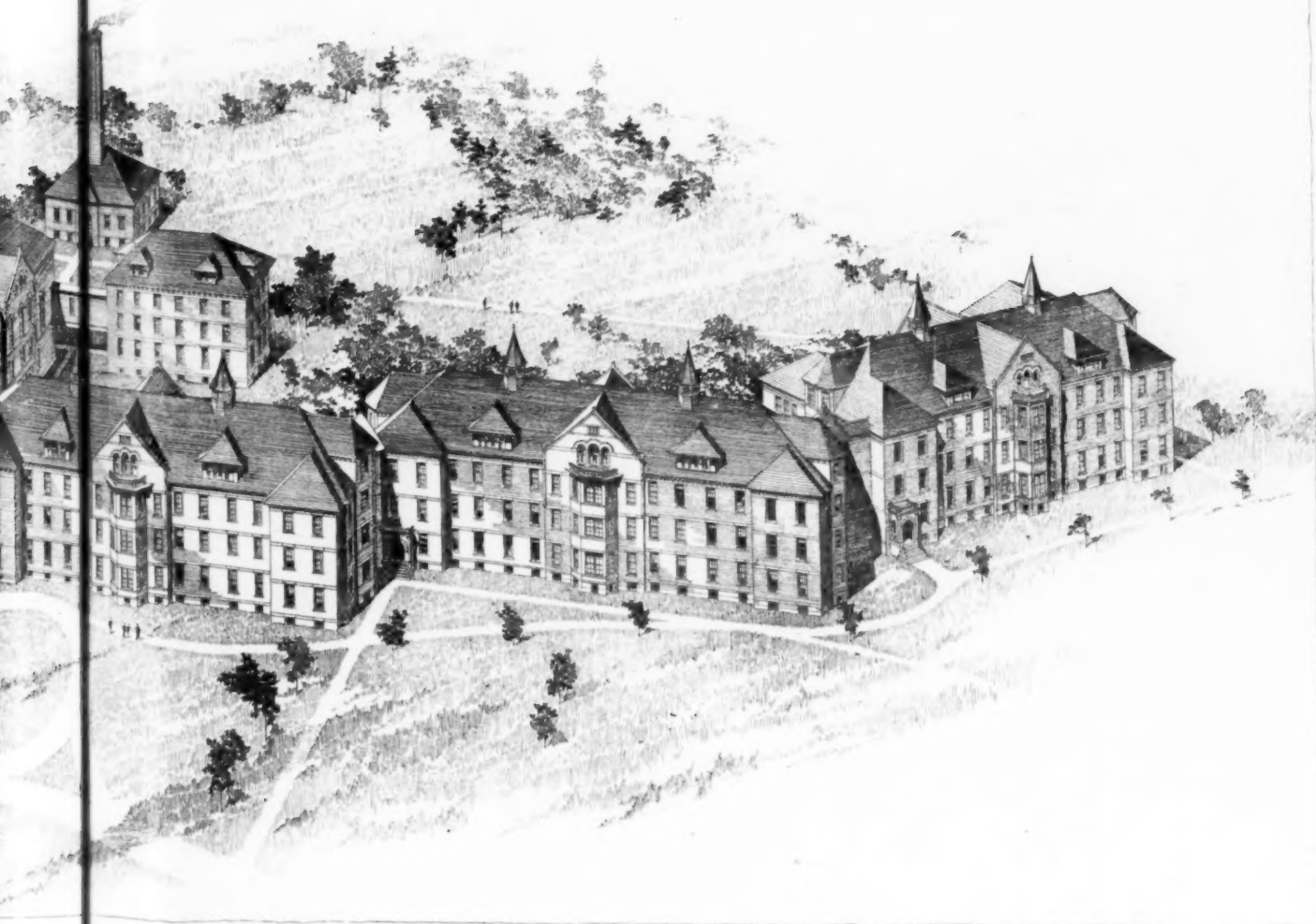
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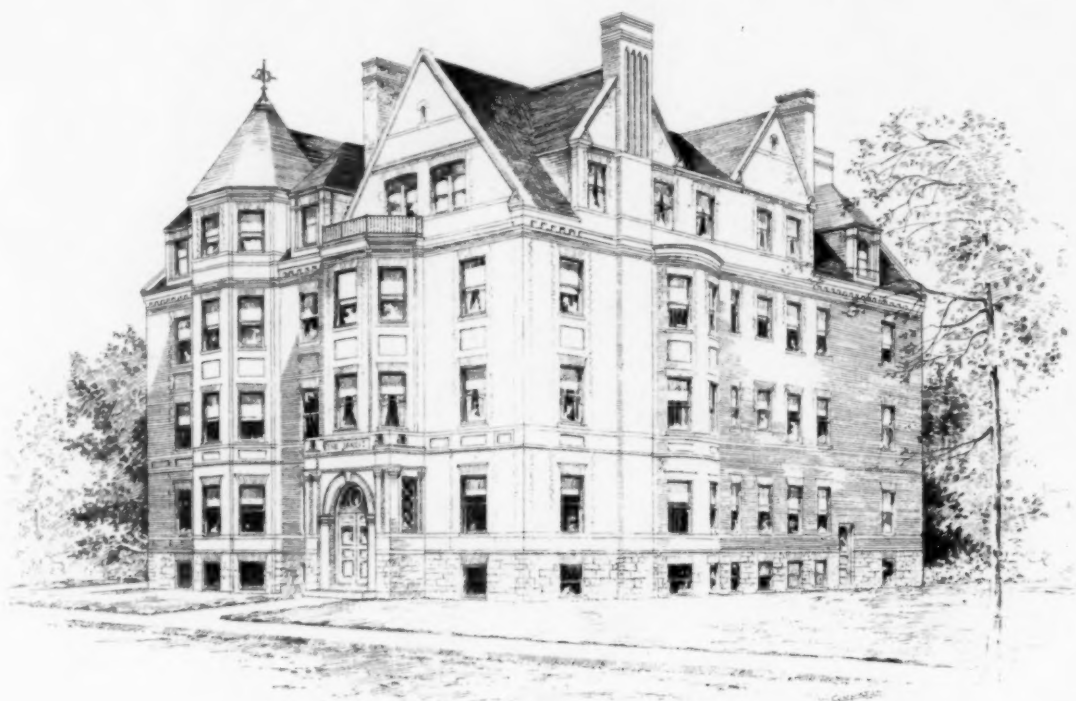
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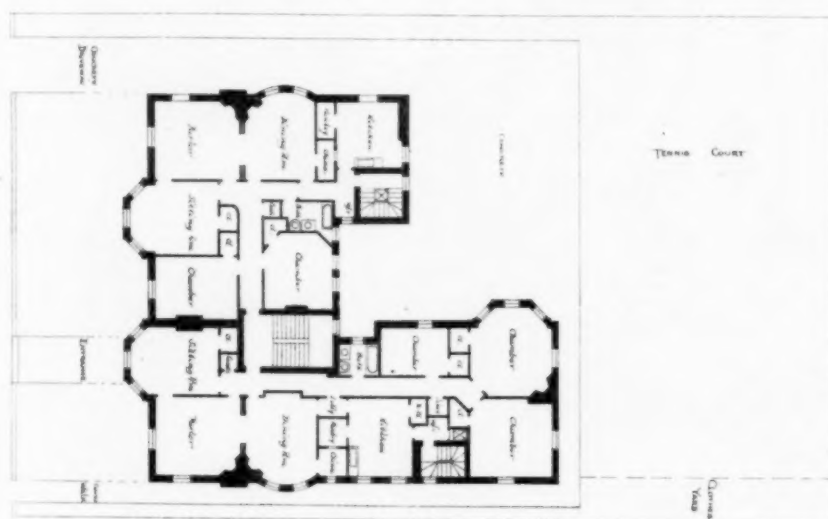
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