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THE AMERICAN ARCHITECT AND BUILDING NEWS

VOL. XXX. REGULAR EDITION NO. 776.

ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

TICKNOR & COMPANY

BOSTON MASS.

CONTENTS.

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CONTENTS

WE have been requested to mention the fact that an International Exhibition is to be held in the island of Jamaica, opening January 27, 1891, and Americans interested in showing their goods to the people of the West Indies are earnestly requested to forward them for exhibition. Through the kindness of Mr. L. D. Baker, of Jamaica, President of the Boston Fruit Company, exhibits from New England will be transported free of charge, and as space in the exhibition buildings is free, and there are no duties to pay on goods, unless sold, manufacturers have a good chance to try to increase the list of their customers, at a very small expense. To people who have nothing to show, the exhibition promises to be extremely interesting. Jamaica is a very different place from what it was twenty years ago, and aside from the natural beauty of the island, an aquarium and a horticultural display have been provided, in connection with the exhibition, which should attract many visitors. The practice of shortening the winter by a trip to a warm climate in the coldest weather is spreading so rapidly here that arrangements for excursions to Jamaica on an extensive scale might perhaps be made, with profit to the railroads, and comfort to travellers. The usual route is by land to Tampa, Florida, thence by steamer to Jamaica, only three days' sail away. Any communication from New England should be addressed to Mr. T. T. Stokes, 44 Boylston Street, Boston.

MR. CHARLES EDWARD PARKER, a well-known Boston architect, died at the home of his son in Virginia, last week. Mr. Parker was born in New Hampshire, but came to Boston when a young man, and had lived and practised there ever since. He was the architect of many public and private buildings throughout Massachusetts, and was for several years superintendent of construction of the Boston Post-office and Sub-Treasury. In this capacity he distinguished himself by his ability and faithfulness, and, after the resignation of Mr. M. E. Bell, was one of the most prominent candidates for his position as Supervising Architect to the Treasury Department. In private life Mr. Parker was held in universal respect and regard, and his loss will be sincerely regretted.

ANOTHER Boston architect of high reputation also died a few days ago, at the age of eighty-two. This was William Washburn, also a native of New Hampshire, but for many years a resident of Massachusetts. Mr. Washburn began life as a builder, at a time when architects were nearly unknown in this country; but gradually gave up practical building, to devote himself to planning and superintendence. He was a man of great natural ability, and was particularly successful in the arrangement of hotels, of which he designed many, the most noted ones being the Fifth Avenue and Victoria in New York, and the Parker House, Tremont, Revere, Adams, Young's and the American House, in Boston. He also designed the Tremont Temple in Boston, the Charlestown City-hall, and many other public and private buildings.

MR. CHAUNCY M. DEPEW, in a recent address, mentioned an occurrence which, although trifling in itself, sheds a brilliant light upon the treachery, meanness and hypocrisy of the greedy liars who manage certain labor organizations. Not very long ago, a deputation from the Knights of Labor visited him, with a list of grievances in which their members were interested, and informed him that a strike would be ordered unless the grievances were redressed. Mr. Depew examined the complaints, and was able to give satisfactory assurances that the matters complained of should be adjusted. The deputation then presented a similar list of grievances from the locomotive engineers. Mr. Depew, rather surprised, asked them how they, representing the Knights of Labor, happened to be charged with the complaints of the engineers, who belonged, not to the Knights, but to an organization of their own. He said that the Brotherhood of Engineers had every facility for making known their wishes to him, and he could not receive or consider complaints submitted through the officials of another organization, which did not count a single engineer among its members. The deputies were, naturally, rather confused by this plain statement of the case, but replied that they wished all arrangements between Mr. Depew and his engineers to be made through them, and, if their demand was refused, would order a strike, and "tie up" the railroads under Mr. Depew's care; and then, in a burst of confidence, explained that they wanted the engineers to be brought by force into their fold; and that if Mr. Depew would help them by negotiating with his engineers through them, and by discharging all engineers who did not become Knights of Labor within a given time, they would return the favor by making for him a schedule of engineers' wages at lower rates than those which had been adopted by the Brotherhood, and which Mr. Depew was regularly paying. In other words, they wanted the engineers to be forced into their organization, so that they could lay hands on their initiation-fees, fines and dues; and, in order to bribe Mr. Depew to drive their prey into their clutches, they offered, after they had got them in their power, to deprive the poor engineers of a part of their hard-earned wages, thinking that this would tempt the employer for whom they worked so faithfully, and who appreciated so thoroughly their services. Fortunately for the engineers, Mr. Depew is made of very different stuff from those chivalrous modern knights, who sell out their confiding dependants so cheap, and he sent the deputies about their business, regardless of their threats. Much as they would have liked to revenge themselves, they did not then dare to order the strike they promised; but it is not impossible that their previous disappointment had something to do with the malicious zeal of the leaders in the strike which took place subsequently.

A NEW penny-in-the-slot contrivance has been adopted by the Gas-Department of the Corporation of Birmingham, for the benefit of small consumers, and incidentally, its own. The price of gas in Birmingham, as everywhere else in England, is, according to our ideas, low, the regular rate being sixty cents per thousand feet. Small householders, however, often like to enjoy a definite amount of such luxuries, without being bound to any regular contract; while the gas-company is glad to make sure of its pay from such customers, by getting it in advance. To meet the wants of both parties, a sort of meter has been constructed, which, on dropping a penny in a slot, will deliver twenty-five cubic feet of gas. This is at the rate of eighty cents a thousand feet instead of sixty; but the company feels justified in charging a rather higher rate to such small customers. If any of the latter wish for a larger supply, they may drop nine penny-pieces at once into the slot, and two hundred and twenty-five feet will then be delivered before the valve closes. The accumulated pennies are collected once a week by an official of the gas-company. The burners on the house fixtures are regulated to burn five feet per hour, but, of course, they can be turned down, so as to burn more slowly. No direct charge is made for the measuring apparatus, the extra price of the gas delivered through it covering the expense.

EVERY one has heard of the revival of the old process of casting bronze *à cire perdue,* which has recently been used in the production of several important statues, but every one may not know just what the process is. The usual method of casting bronze statues at present is to take from the sculptor's clay model a mould of plaster. When this is hard, the clay is cleaned out, and plaster poured into its place: the moulds are then removed, leaving a plaster statue, corresponding to the clay model. A new mould is then made around the plaster cast, of fine sand, tamped hard. In the sand mould is formed a core, also of tamped sand. The mould is again taken off, and the surface of the sand core scraped off, to a depth corresponding to the thickness of metal desired. The core is then replaced in the sand mould, and the melted bronze poured in. The objection to the process is that by the expansion and contraction of the plaster moulds and casts, and the unequal pressure caused by tamping the sand, the final figure is likely to vary somewhat from the model, and as the bronze cannot be altered, the sculptor must be content to see his idea interpreted in the metal with certain alterations of proportion. It is to avoid this variation that the "*cire perdue*" process, which was probably invented in Japan, where it is still commonly used, was adopted by the French sculptors of two or three hundred years ago. In this process, after moulding the clay model in plaster, and casting a plaster duplicate of the statue, the surface of the latter is scraped off, to a depth of half an inch or so. It is then replaced in the mould, which it no longer fills, and melted wax is poured into the vacant space. On removing the mould, the statue is found renewed, but with a surface of wax, instead of clay or plaster. The sculptor is then called in, and works upon the wax, adding or changing at will, and modelling the surfaces and textures with as much delicacy as he chooses. When he has done all he wishes the statue is handed over to women, who, with very small camel's-hair brushes, cover the wax, by delicate touches, with a fine dust, of a special composition. After this dust has been applied all over the statue, a second coat is put on, followed by many others. Weeks, and often months, are employed in this operation. As the coating of earthern dust grows thicker, it hardens, and when it has attained a thickness of half an inch, it is safe to apply the material with large brushes, and finally with trowels, until the wax model is safely inclosed in a mass of hard material. The mould, with the figure inside, is then placed in a furnace, raised to a white heat, which not only melts, but burns out the wax, leaving no trace of it. Nothing more is required but to pour in the melted bronze, through conduits left for the purpose, and the figure, when the metal is cold, comes from the mould in the exact shape, to the smallest details of surface, of the wax model. The process is so delicate that the impression of the skin of the fingers on the wax is reproduced in the bronze; but it is expensive on account of the long labor required, and has for many years been used only on special occasions.

PROFESSOR T. ROGER SMITH, of University College, London, recently delivered a lecture before his pupils on the Technical Education of Architects, which contains much interesting matter. Speaking of the manner in which the art of designing buildings is to be learned, he refers to a special lecture on that subject which he delivered some time ago, and which has been extensively reprinted, and adds that "the first essential in designing buildings is knowledge of buildings — of their plan, of their structure, of their intention, uses and qualities. The next is a knowledge of the architectural features which are put together in forming a design — a knowledge only to be gained by drawing them, and to a considerable extent only by drawing them from existing examples. Thirdly, some familiarity with the principles of design or composition to be detected in good buildings; and lastly, repeated and persevering effort." "If," he says, "there is any branch of knowledge or skill in which it is more true than usual that practice makes perfect, it is in the designing of buildings." Comparing the early works of Sir Charles Barry with his latest masterpieces, "you will see how far he was when he began from meriting the distinction which has often been accorded him, of being the foremost architect in Europe in his time; and his great genius was only brought out by unwearied practice in using the vast store of architectural knowledge which, during his long period of pupilage, and of study abroad, he had accumulated."

THE first part of the very interesting competition for designs for the new building of the American Fine Arts Society, in New York, has been decided by the selection of three designs, the authors of which will be allowed sixty days to study and complete them, when a final choice will be made. The three selected designs, which, of course, are regarded for the present as of equal merit, are by Messrs. Babb, Cook & Willard, Edmund B. Wells, and Henry J. Hardenbergh, with whom are associated Messrs. Walter C. Hunting and John C. Jacobsen. Besides these, honorable mention is accorded to the designs of several other competitors.

WE must confess that we are glad to hear that Millet's "Angelus" has been resold by the American Art Association, and is to go back to Paris, where, it is understood, it will be placed in the Louvre. The picture is to be exhibited for a short time longer in this country before it is sent away. It is supposed that the total proceeds of all the exhibitions made of it here will be about fifty thousand dollars, and the French purchasers pay one hundred and fifty thousand, so that the American Art Association will make a profit on its purchase of about forty thousand dollars. The managers of the Association regret that the painting could not have been kept in this country, but the subscription for buying it and placing it in the Metropolitan Museum failed, and they could not well keep so costly a piece of property at their own expense. Although it is something to lose a great picture, it is doubtful whether any picture is worth such an enormous sum as two hundred thousand dollars, and we are quite sure that the American Art Association can do more for American art with the money than it could with the picture. Millet was not a wonderful master of color, or composition, or light and shade, so that his picture would have been less useful to students than a good Titian or Raphæl or Rembrandt, and the sentiment which formed the charm of the "Angelus" could not be copied or taught.

THE practice of sewage irrigation, for disposing of the wastes of large cities, appears to be more and more successful as the details of the work are better understood. Berlin, which has had its sewage partially disposed of in this manner for several years, has recently enlarged its system, and now possesses a sewage-farm of nineteen thousand acres, on which two thousand men are employed. The health of the men and their families appears to be perfect; in fact, the reputation of the farm for salubrity is so good that two convalescent hospitals have already been established upon it. Although the sewage of a population of a million and a half is disposed of on the farm, there is sufficient area for meeting the requirements of a much larger population. The Gennevilliers farm, near Paris, uses twenty million tons of sewage annually, on fifteen hundred acres, and, with the three thousand acres recently acquired at Achères, is expected to take all the sewage of Paris. It is singular that no experiment of the kind, except on the very smallest scale, has ever been carried out here. Our dry climate is admirably adapted to the system, and nearly all our large cities are surrounded by vast areas of land, once fertile, but now exhausted and barren, which only need feeding to make them valuable. It is not likely that there would be any trouble from cold. One of the earliest and most successful sewage-farms is that of Dantzic, which has a winter climate as cold as that of any of our large cities, and experience shows that land irrigated with city sewage will never freeze. Of course, the application of the system is expensive, but in most cases it is no more so than drainage into the sea, and in the latter case the sewage is worse than wasted, while by irrigation it is saved to give warmth, food and employment to hundreds or thousands of citizens.

AUSTRIAN ARCHITECTURE.[1]—V.

GOTHIC ART IN AUSTRIA.—II.

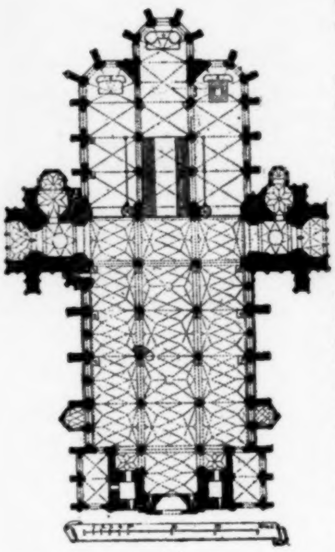


Fig. 4. Plan of St. Stephen's, Vienna.

THE most important Gothic edifice in all Austria is the cathedral of Vienna (Figures 4, 5, 6, 7). No trace is now visible of the first construction [1147]; the gigantic door and the two western towers date from the thirteenth century; the original intention was that the cathedral should be a Romanesque basilica of the type common in Austria, that is, divided into three aisles without a transept, with three apses and two towers flanking the porch. After a fire, in 1258, a very prominent transept was begun, and the choir was deepened. A second fire in 1276, destroyed the vaulting, after which (about 1300), the present cathedral was founded. The choir was completed under Albert the Wise in 1340; the construction of the aisles was undertaken in 1359 by Wenceslaus of Klosterneuburg; it

Fig. 5. View of St. Stephen's, Vienna.

was not until 1446 that the vaults were closed by Hans Puchsbaum. The lofty southern tower, which gives the church its characteristic silhouette, was finished in 1433 by Hans of Prachatic, while the northern one, the foundations of which were not laid till 1450, has remained incomplete since 1562.

The disposition of this church is simpler and less harmonious than the sumptuousness of the details would seem to demand. The architect returned to the original plan, and replaced the prominent transept with towers, which have no connection with the construction, and serve as nothing but decorations to the side porches, the more so since the two towers on the western façade have been retained, although they are unfinished. On the outside, the three aisles with their apsidal terminations unfortunately reveal only too clearly that the work is of two different periods. The eastern part, comprising three lateral and four central bays, was constructed between 1300 and 1340; the aisles are all of the same height, but are too low in proportion to the width.

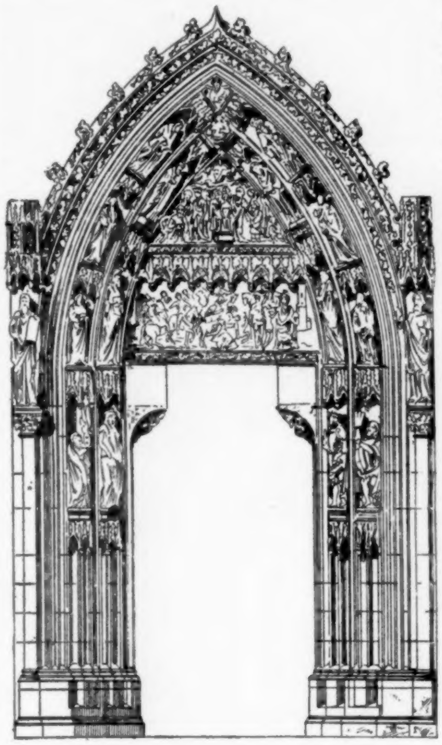


Fig. 6. A Portal of St. Stephen's, Vienna.

Wenceslaus, who built the western bays, attempted to remedy the faulty construction of his predecessor by lengthening these new bays and carrying the nave higher. But, as he restricted the introduction of light to the broad windows which he opened in the walls of the side-aisles, no direct light was obtained on the lofty vaulting of the nave; the shadow here was further augmented by the strong mouldings of the ribs, and destroyed the effect of the height of the vaults, which assumed, contrary to the architect's expectation, a heavy and gloomy aspect.

The isolation of the southern tower is made more apparent by the absence of a perpendicular basement, and it has the appearance of an obelisk rather than of a tower. The roof is disproportionately high and mars the vertical proportions of the body of the edifice. But in the wealth and elegance of its sculptural ornamentation, especially those of the towers and the four magnificent side doors, this church can hardly be surpassed.

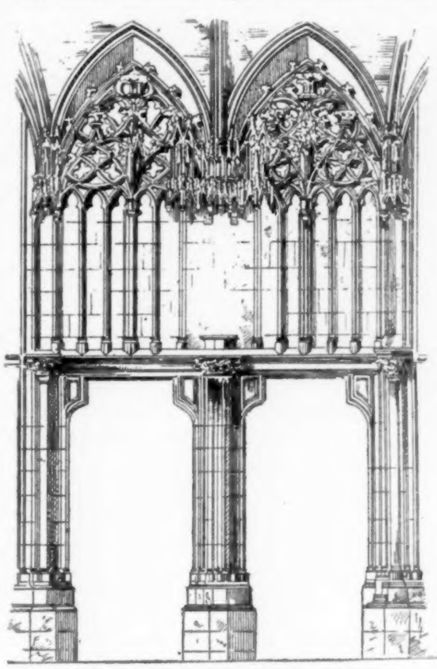


Fig. 7. A Portal of St. Stephen's, Vienna.

The lodge of Vienna swayed the architecture of the fourteenth century in Lower Austria.

We recognize its influence in the church choirs at Deutsch Altenburg, Seitenstetten and Ardagger, in the Minorite church

[1] From the French of H. Semper, in Planat's "*Encyclopédie de l'Architecture et de la Construction.*" Continued from page 64, No. 775.

at Wiener Neustadt and the Carthusian church at Aggsbach, in the church of Weitra, and even at Vienna, in St. Mary's on the Banks, and in the Augustinian and Minorite churches (Figures 8, 9).

Even in the beginning of the fifteenth century, the lodge of Vienna still prescribed the rules of the flamboyant style of Lower Austria. Aisles of equal height and a complicated system of ribbing were generally accepted as necessary features of the architecture of the period. We cite as examples of this new Viennese school the church of Dürrenstein, St. Wolfgang

Fig. 8. A Portal of the Minorite Church at Vienna.

at Pfaffenschlag [1407], the conventual church of Ardagger [1410], the church of Lichtenworth, the choir of Friederbach church [1408], and the hospital chapels at Berchtoldsdorf and Mœrling.

The same school is also recognized in the following edifices, dating from the end of the fifteenth century, and nearly all having their aisles of the same height: St. Stephen's (Figure 10) at Eggenburg; St. Mary's at Krems (Figure 11), which exhibits in some respects exact reproductions of the rich details of St. Stephen's at Vienna; St. Othmar at Mödling, with an aisle encircling the choir; the church of Berchtoldsdorf, and (the only one with the nave carried above the side aisles) the church of Baden, near Vienna.

Another architectural centre was formed in the second-half of the fifteenth century at Wiener-Neustadt, the favorite residence of the Emperor Frederic III.

The prototype of this school is found in the beautiful sanctuary and transept of the church of Our Lady at Weiner-

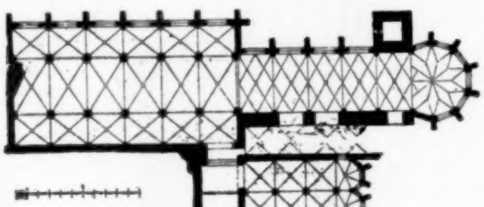


Fig. 9. Plan of the Augustinian Church at Vienna.

Neustadt. The Cistercian church, St. Peter's, St. George's at the castle (with the aisle bent around the choir), in the same town, as well as the parish church of Neuenkirchen, all belong to the same group.

In the sixteenth century the Pointed style of Lower Austria, as in the other provinces, was on the decline; it fell either into an arbitrary and confused exaggeration of details, or into a monotonous repetition of the merely indispensable constructive members, with neither ornateness nor delicacy in the mouldings. It is sufficient for our purpose to cite the principal churches of the period belonging to one or the other of the debased types just indicated. They comprise the churches of Bromberg, Brunn-am-Gebirge, Döllersheim, of the Convent of Erla, of Gumpoldskirchen, Heiligenstadt, Haag, Kirchschlag, Külb, Korneuburg, Lunz, Mank, Saint-Michael, Maria Laach, Ober-Hautzen-Thal, Pernegg, Payerbach, Imbach, Retz, Scheibb, Steinakirchen, Seebenstein, Schwallenbach, Stein, Spitz, Tulln, St. Valentin, Wilhelmsburg, Weissenkirchen and Weidhofen-an-der-Ibbs.

Fig. 10. Pulpit in St. Stephen's, Eggenburg.

In the province of Upper Austria the oldest Gothic structures do not antedate the fourteenth century and these are quite rare. They also retain certain Romanesque dispositions; such are the parish churches of Völkermarkt and St. Lawrence at Lorch, both constructed on the plan so common in Austria, that is, with two western towers, and three aisles, without a transept, terminating in apses. The nave is in both cases higher than the aisles: but in the parish churches of Steyer and Efferding, built in the fifteenth century, and on nearly the same plan as the preceding, the three aisles are of the same height. The last-named church is also remarkable for its slender and symmetrical proportions, and its rich and delicately wrought details, in the flamboyant style.

The most common type of the parish churches of the fifteenth century, includes two or three aisles of the same height, rather broad and short (sometimes even of equal breadth

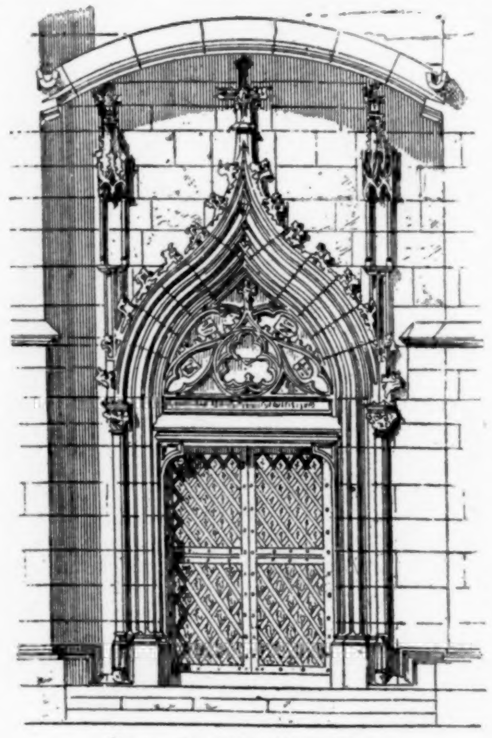


Fig. 11. Portal of St. Mary's, Krems.

and length). The sanctuary, the wall of which forms three sides of an octagon, is generally quite long; the width corresponds to that of the nave or exceeds it a little. The rib system is complicated, the slender pillars have no capitals, and all the mouldings, ornaments and openings are in the flamboyant style. The bell-towers, with the sacristy, usually flank the sanctuary; sometimes they occupy the centre of the western façade. In many of the churches there are galleries for the organ and singers, supported on columns or pillars and on vaults beneath the first bays of the aisles.

Among doubled-aisled churches we note those of Mauthausen, Ried, Weitersfeld, Weissenbach, Königswiesen, Kreützen and

Reinbach. Well executed churches with three aisles of the same height are more numerous; for example, the churches of Allerheiligen, Zirking, St. George (having three very broad aisles), Wartberg (with extremely ornamental vaulting ribs), Schwertberg, Perg, Pergkirchen, Mitterkirchen, Pierbach (with aisles broader than long), Guttau (covered with beautiful star-ribbed vaulting), Grünbach (the aisles all of equal width), Waldhausen, Hirschbach, Neumarkt, the Church of Our Lady and St. Peter at Freistadt (both the work of the same architect) and the church of Heiligenblut in the valley of the Möll. The last is perhaps the most symmetrically graceful edifice in the entire group. A singer's gallery extends across the western side, supported on low vaults and pillars which form a porch; the gallery projects into the side-aisles, resting on the pillars separating them from the nave.

Among all the churches of the fifteenth century in Upper Austria, the parish church of Freistadt is the only one in which the nave is carried above the side-aisles, and here it is double their height. The entire right aisle is surmounted by a gallery. Among churches with a broad single nave, mention should be made of the parish church of Hallstadt, because of the beauty of its execution. The nave forms a square, the western portion of which is surmounted by a gallery borne on two short columns and two star-shaped vaults. In the centre of the nave rises a column from which the ribs of the four vaults of the nave radiate. The choir is divided into two sections by a pillar and three slender columns, which support the radiating vaults. There is likewise a richly vaulted chapel, on the northern side of the nave.

The province of Styria boasts of one of the most important Gothic churches in Austria — the church of the Cistercians at Strassengel, erected between 1346 and 1355. It belongs to the type which we have already encountered so often, that is, with three aisles without a transept, and with three angular apses. It is, however, not the plan but the admirable harmony of the proportions, the rare grace of the architectural members and of the interior mouldings and more especially the beauty of the open fretwork of the tower over the northern apse, on which the high artistic value of the church depends. The Cistercian church at Neufstift is of the same type, but the details which are even richer than in the former church are less pure. The bell-tower also occupies a different position in the latter, being placed in the middle of the façade. In both structures the aisles are of equal height, a disposition likewise to be observed in the large conventual church of St. Lambrecht, belonging to the fourteenth and fifteenth centuries; this last church has the aisle extending around the choir. The portal of Göss church (Figure 12) is worthy of note.

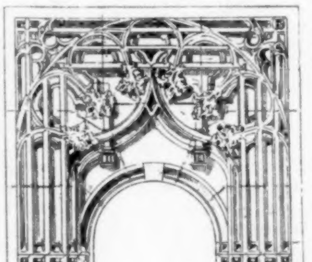


Fig. 12. Portal of the Göss Church.

There are also a few churches of the fifteenth and sixteenth centuries in Styria in which the aisles are all of the same height; for example; the Cistercian church of Neuberg [1471], having a rectangular choir, and the details being quite paltry, with the exception of the rose-window on the façade; the church of St. George near Murau and that of Schladming [sixteenth century].

Styria, however, unlike the other provinces of which we have thus far treated, in the fifteenth and sixteenth centuries adopted almost universally the disposition of a loftier nave in the three-aisled churches; but we know of only one fourteenth-century edifice of this type, namely, the church of Pettau, in which the nave is carried up to a great height. The parish church of Murnau [fifteenth century] even presents an almost Romanesque plan; it is in the form of a Latin cross, with the nave and transept of equal width and equal height; the side-aisles are much narrower and lower. An octagonal tower rises over the intersection of the transept and nave. The mouldings of the formeret and transverse arches exhibit a simplicity of profile suggestive of the Romanesque style. On the outside, flying-buttresses, which are of very rare occurrence in Austria, serve to disengage the transverse arches of the nave, which are supported in the interior merely on consoles.

The parish church of Cilli belongs to nearly the same type; it is remarkable for the charming little chapel of the Mother of God.

In the church of Radkersburg, also of the fifteenth century, the aisles are entered on the east through richly profiled openings. There are still a great many churches in Styria either having two aisles or with the nave wholly undivided, which are of no importance as architectural monuments.

[To be continued.]

SAFE BUILDING.[1] — XLVII.

CHAPTER XI. — GRAPHICAL ANALYSIS OF STRAINS IN TRUSSES (*Continued*).

FIG 247.

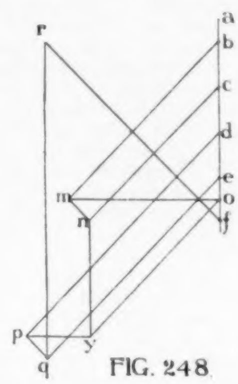


FIG. 248.

Example I.

Example of curved strut. *A Georgia pine strut is* 10 *feet long (measured on a straight line) but is curved, the versed sine at centre being* 20 *inches. It resists a compression strain of* 15000 *pounds. What size strut is required?*

THE bending-moment at centre will be Formula (129)

$$m = 15000.20 = 300000 \text{ pounds-inch.}$$

The safe modulus of rupture $\left(\frac{k}{f}\right)$ for Georgia pine (Table IV) is 1200 pounds. Inserting these values in Formula (18) we have the required moment of resistance to this bending-moment:

$$r = \frac{300000}{1200} = 250.$$

From Table I, Section No. 2, we have for a rectangular cross-section

$$r = \frac{b.d^2}{6} \text{ therefore}$$

$$\frac{b.d^2}{6} = 250, \text{ and}$$

$$b.d^2 = 1500$$

If now we make $d = 12$ inches, we should require a width

$$b = \frac{1500}{144} = 10{,}4 \text{ inches.}$$

It should be noted that d must always be assumed in the direction of the versed sine, that is resisting the bending-moment.

We must now add sufficient material to resist the longitudinal compression. As the strut will evidently be nearly square, 12 inches will be our least diameter, inserting therefore values in Formula (3) we should have (assuming the ends to be secured by bolts only):

$$15000 = \frac{a.750}{1 + \frac{120^2.0{,}00067}{12}} \text{ or,}$$

$$a = 36 \text{ square inches.}$$

Now as $a = b.d$ and d having been fixed at 12 inches we should have,

$$b = \tfrac{36}{12} = 3 \text{ inches.}$$

Adding this to the above we should require a strut,

12 inches $\times$ (10,4 + 3) = 12 $\times$ 13,4

In practice we should probably make it 12 inches $\times$ 12 inches.

Example II.

Example of curved tie. *The lower chord of a wrought-iron arched truss is made of a channel iron. At one panel the length between bearings is* 5 *feet; the tension* 36000 *pounds; the versed sine of the curve* 6 *inches. What size channel is required?*

The bending-moment m will be

$$m = 36000.6 = 216000 \text{ pounds-inch.}$$

[1] Continued from No. 773, page 36.

Inserting values in Formula (18) we have required moment of resistance

$$r = \frac{216000}{12000} = 18$$

The additional area required to resist the direct tension will be

$$a = \frac{36000}{12000} = 3 \text{ square inches.}$$

We now consult Table XXI. We take the neutral axis normal to web, as this will, of course, be the position of channel in the truss and in resisting the bending-moment.

We select for a trial the 10 1-2 inch — 105 pounds per yard channel; its area a is 10,5 square inches, and its moment of resistance $r = 24{,}64$. Now of the area 3 square inches resists tension leaving us 7,5 square inches or $\frac{7{,}5}{10{,}5} = \frac{5}{7}$ of the whole amount to resist cross-bending. The amount of r available to resist cross-bending will, therefore, be $= \frac{5}{7}.r = \frac{5}{7}.24{,}64 = 17{,}6$.

This is not quite equal to the required r (18) but is near enough for all practicable purposes, we should, therefore, use a 10 1-2 inch — 105 pounds per yard channel.

We will now return to our hammer-beam truss. Assuming then that the wall is capable of resisting the thrust we should analyze our truss somewhat similarly to the way we did with the scissors truss.

Truss with abutment.

On the left side of truss (Figure 244) we omit the circle corresponding to $O\,W$ entirely, and draw the one corresponding to $O\,V$ straight. We now can assume that we can divide the truss horizontally at $P\,O$ which will give us a truss above $P\,O$ similar to Figure 213 and a truss below it consisting of an inclined trussed strut running from bottom joint X to joint $C\,D$ with a horizontal strut $P\,O$ and an outward thrust $O\,X$ to be resisted at its foot. To obtain this outward horizontal thrust $O\,X$ we will temporarily consider the inclined trussed strut as a straight line running from joint X to $C\,D$. The load will evidently be three-quarters of the load coming on the entire rafter, if then in Figure 247 we make $a\,x =$ this load or $= 3$ in our case, and draw $x\,o$ horizontally and $o\,a$ parallel to the straight line (representing the inclined strut in Figure 244) we shall have the amount of the horizontal thrust $o\,x$. We can now make separate

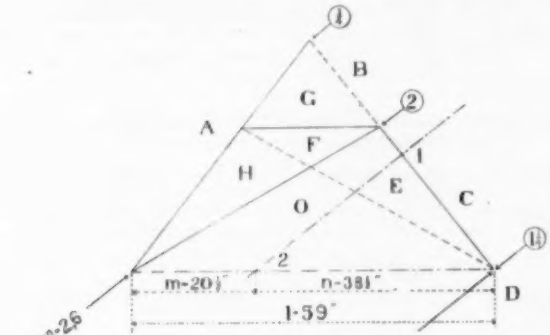


FIG. 249.

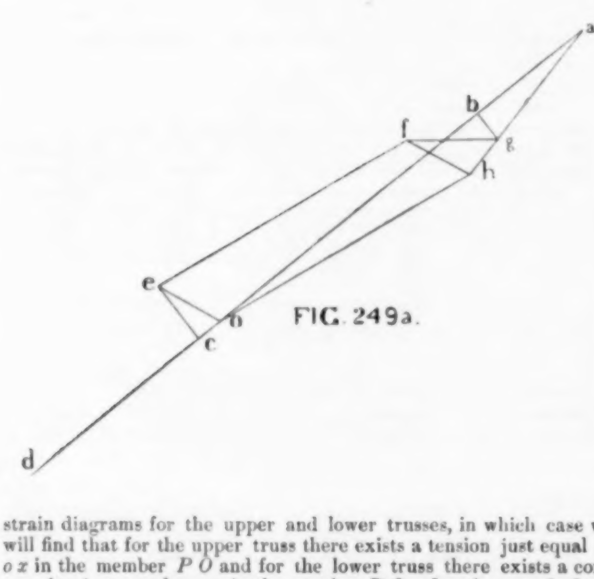


FIG. 249a.

strain diagrams for the upper and lower trusses, in which case we will find that for the upper truss there exists a tension just equal to $o\,x$ in the member $P\,O$ and for the lower truss there exists a compression just equal to $o\,x$ in the member $P\,O$. In other words there is no stress in $P\,O$. This is confirmed by drawing the combination diagram (Figure 245) where p and o fall on the same point.

That these strains just equal each other is due to the design of the truss and its uniform loading. Were the design of the parts less symmetrical, or the load not symmetrical, or the wind on one side only, the two strains would not be found to be equal.

Truss without abutment.

In Figure 246 where we consider the wall as incapable of taking up the thrust, and the truss has to take care of it itself, it will be found that this horizontal member (now called $P\,Y$) is in tension.

The drawing of the strain diagram (Figure 248) presents no difficulty, but it will be seen that nearly all the strains on the truss are very much larger.

The actual thrust of the truss Figure 244 on the wall will be parallel to and equal to $o\,a$ of Figure 245. To resist it there must

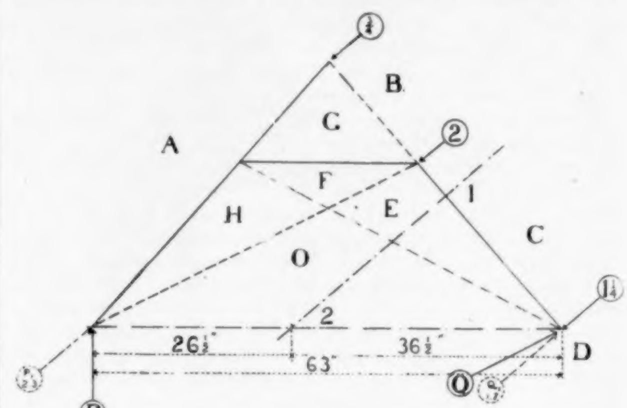


FIG. 250.

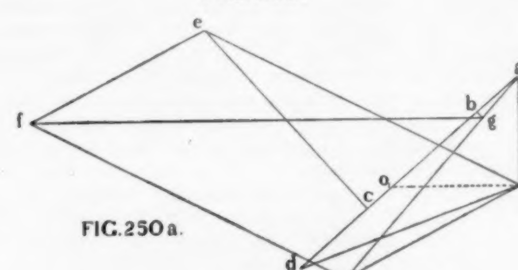


FIG. 250 a.

be weight enough to deflect this line sufficiently not to overturn the wall. This subject was thoroughly treated in Chapter V, Vol. I, under the heading "Arch with Abutment."

Wind load-line normal to roof.

The analysis of strains due to wind pressure, when taken separately on one side of the roof only, and at right angles to same, is treated the same as for dead loads, excepting that the load line is no longer vertical, and is drawn therefore parallel to the wind arrows (that is, at right angles to the main rafter on which wind blows). Where the roof is a broken one the wind load line is broken also, its different parts being proportioned to the amounts and parallel to the directions of the wind on the different parts.

Wind reactions unequal.

It will be readily seen that the left and right reactions due to the wind cannot be equal, and the calculation of these reactions offers the only difficulty.

Let us take a truss similar to the one shown in Figure 240 and overlooking the steady or dead load assume that the wind is blowing from the right hand side. Its effect will be as shown in Figure 249.

The pressure on the apex or $A\,B$ will be equal to half the length of rafter $B\,G$ multiplied by the product of the distance between trusses and the wind pressure per square foot, as given in Table XLIV. It is indicated by the arrow $A\,B$. The pressure in the middle joint — indicated by arrow $B\,C$ — will be this same (latter) product multiplied by the sum of half the length of $B\,G$ plus half the length of $E\,C$. The pressure at the foot — or arrow $C\,D$ — will be the same product multiplied by half the length of $E\,C$. The reactions at p and q which resist this wind pressure will evidently be in the opposite direction to the wind, or slanting, as shown. If, therefore, the truss and dead load is not heavy enough to sufficiently deflect these reactions, there would need to be bolts or buttresses at p and q to keep the truss from sliding-off the wall. This will be explained at the end of the chapter in speaking of spires.

We now have the amount and direction of wind pressures and direction of the reactions, but we do not know the amounts of the reactions, as they evidently cannot be equal.

If we imagine the neutral axis of the entire wind pressure, that is the entire wind pressure concentrated at the point l at the centre of the length of rafter, the effect, so far as reactions are concerned will be the same.

We now draw the horizontal line $p\,q$ connecting the feet of rafters, prolong the centralized wind pressure (or neutral axis) arrow l till it intersects $p\,q$ at 2, then will the reactions p and q be inversely as the divisions of line $p\,q$; that is, if $p\,q = l$ and $p\,2 = m$ and $2\,q = n$ and the whole wind pressure $= w$, we should have

Amount of wind reactions. $p=\frac{w.n}{l}$ (130)

and

$$q=\frac{w.m}{l} \qquad (131)$$

Where $p=$ the amount of (slanting) left reaction, in pounds, due to wind pressure.

Where $q=$ the amount of (slanting) right reaction, in pounds, due to wind pressure.

Where $l=$ the length, in inches, measured horizontally between centres of feet of truss.

Where m and $n=$ respectively, in inches, the lengths into which the horizontal line is divided by the prolongation of the centre line (or neutral axis) of wind pressure, m being nearer p and n nearer q.

The analogy between these formulæ and Formulæ 14 to 17 should be noticed. The analyzing of the strains by means of the diagram Figure 249a will present no difficulty. We draw $a\,b$ parallel and equal the pressure $A\,B$ at the apex, $b\,c=B\,C$ pressure at central joint and $c\,d=C\,D$ pressure at foot. Along this load line $a\,d$ we now lay off in opposite directions the reactions, namely,

$d\,o=D\,O$ or reaction q

and

$o\,a=O\,A$ or reaction p.

We first find the strains on the foot joint $O\,A$ by drawing $a\,h\,o\,a$, then skip to the apex joint and draw $a\,b\,g\,a$; the rest presents no difficulty.

It will be noticed that the effect of the wind is to reverse the strains on two pieces.

The upper part of the rafter on the side on which the wind is blowing is now in tension, whereas in Figure 240 it was in compression; further the tie $H\,O$ now becomes a thrust member opposing the wind, where before it was in tension.

Had we drawn the wind on the left side of truss the calculation would have been similar. The direction of p and q would have been from right upwards to the left; p would have been the larger reaction and we should have found the strains same as in Figure 240, except on $A\,G$ which would become tension and on $H\,F$ (or $O\,E$) which would now become compression. It is not necessary to make more than one wind diagram, therefore, where both feet of the trusses are bolted down.

Truss with rollers. If, however, one foot only were bolted down and the other foot were placed on rollers, to allow for expansion and contraction, we should have to make two diagrams, with the wind from left to right respectively, as it makes a decided difference to the strains as shown in Figures 250 and 251. In Figure 250 the wind is from the right with rollers under the left or opposite foot of truss; in Figure 251 the wind is from the left and the rollers are under the left (or same) foot of truss. It will be readily seen that in both cases the (left) roller foot will not oppose any tendency to slide due to the wind, the right

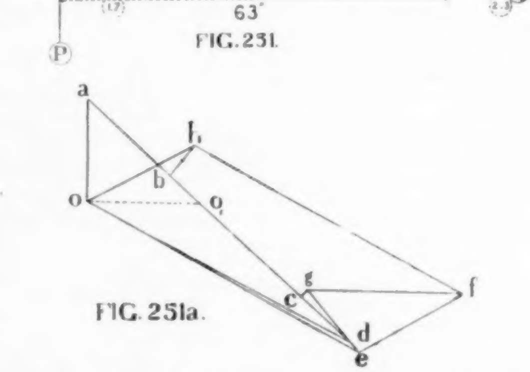


FIG. 251.

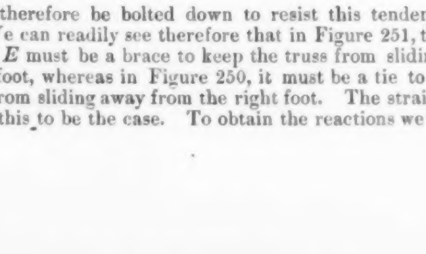


FIG. 251a.

foot must therefore be bolted down to resist this tendency in both cases. We can readily see therefore that in Figure 251, the member $H\,F$ or $O\,E$ must be a brace to keep the truss from sliding towards the right foot, whereas in Figure 250, it must be a tie to hold back the truss from sliding away from the right foot. The strain diagrams will show this to be the case. To obtain the reactions we proceed as before, so far as the central wind pressure ($\frac{1}{2}$) and lines p 2 and 2 q are concerned, but it is evident that the reaction p will be horizontal, while the reaction q will no longer be in direct opposition to the wind as shown by dotted line, as it is deflected from this line, owing to the horizontal (sliding) strain to be taken up from the other foot.

Wind opposite rollers. We therefore draw in Figure 250a the load line $a\,b\,c\,d$ as before, also the reactions $d\,o_1=q$ and $o_1\,a=p$. Through a draw the vertical projection $a\,o$ of $a\,o_1$ — (that is draw $o_1\,a$ horizontally and $a\,o$ vertically) — then will $o\,a$ be the amount of vertical reaction p and $d\,o$ the direction and amount of vertical reaction q. The rest of the strain diagram is

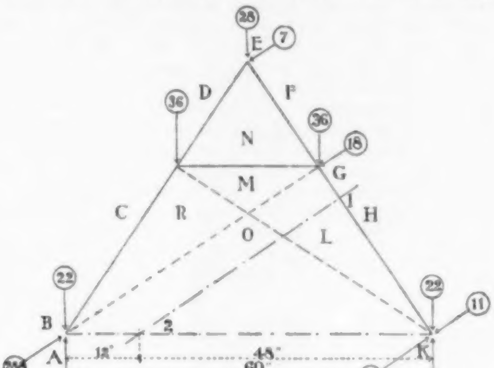


FIG 252.

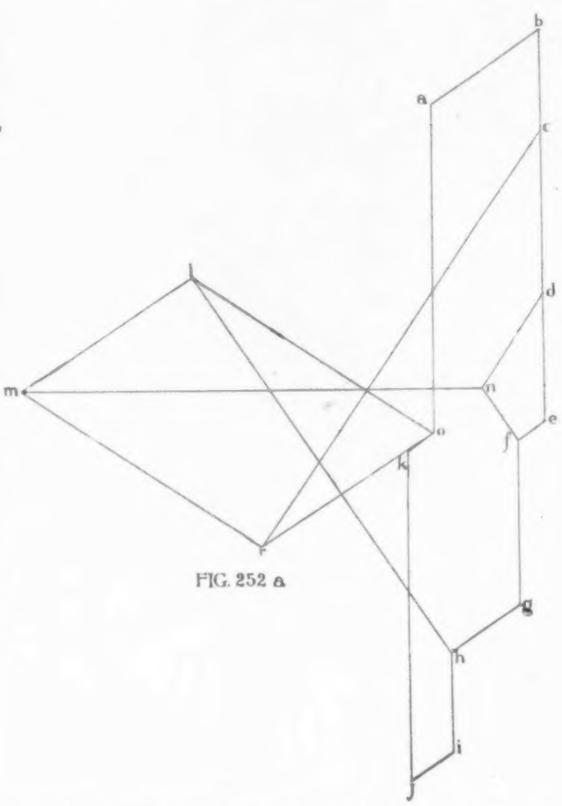


FIG. 252 a

easily drawn, remembering to take the foot joint first and then to skip to the apex joint.

Wind on roller side. To analyze Figure 251, it must be treated in exactly the same way and it offers no difficulty. The letters C and D were left in the drawing, but they have no significance, nor do they appear in the strain diagram Figure 251a as there are no loads or strains between them. In complicated trusses frequently whole series of letters in the panels must be omitted when calculating wind pressure, as they have no functions except in resisting vertical loads. We notice that Figure 250 has strains similar to those in Figure 240 excepting the upper part of rafter on the wind side, which is now in tension. In Figure 251, however, things are greatly changed. The upper end of rafter becomes a tie, both ties become struts and the short strut $G\,F$ (or $J\,H$ in Figure 240) now becomes a tie.

Wind and load in one diagram. Wind strains and steady loads can be calculated from one strain diagram, as shown in Figure 252 and Figure 252a. This is a combination of the conditions obtaining in Figures 240 and 249 and the strain diagram of their respective strain diagrams, Figures 243 and 249a. By simply following around the arrows, as there shown (first obtaining the amounts of $A\,B$ and $K\,O$) the diagram offers no difficulty whatever. If an actual example were figured out, first separately, as shown in Figures 240 and 249, and then in combination, as shown in Figure 252, the result would be the same, remembering to make all compressive strains positive and all tension strains negative and to obtain the arithmetical result of the consequent additions or subtractions. A practical example will be given in the next chapter.

Wind on broken roof. Where the roof rafter or top chord of a truss is not in one straight line, but is made-up of a series of differently inclined lines, as in a broken roof, or in a circular or arched truss, the wind pressure will, of course, be at different angles too, each at right angles to its respective surface. We can in such a case, work out separately the reaction due to the wind pressure on each surface, and then obtain the resultant (reaction) of all these lesser ones, as explained on p. 71, Vol. I, or we can combine them all into one diagram. In Figure 253, we have a mansard roof with wind pressure from the right. We draw the neutral axis (or central lines) of wind pressure on each rafter prolong them to their intersections with the horizontal and can thus figure out the respective reactions due to each. In the strain diagram Figure 253*a* we now draw $c\,e$ parallel and equal to total wind pressure (3) on rafter $F\,D$; and $a\,c$ parallel and equal to total

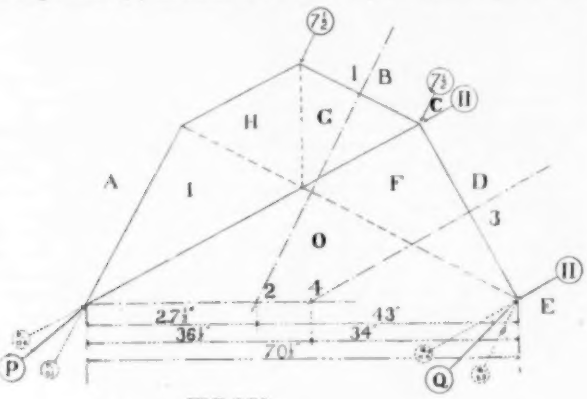


FIG. 253

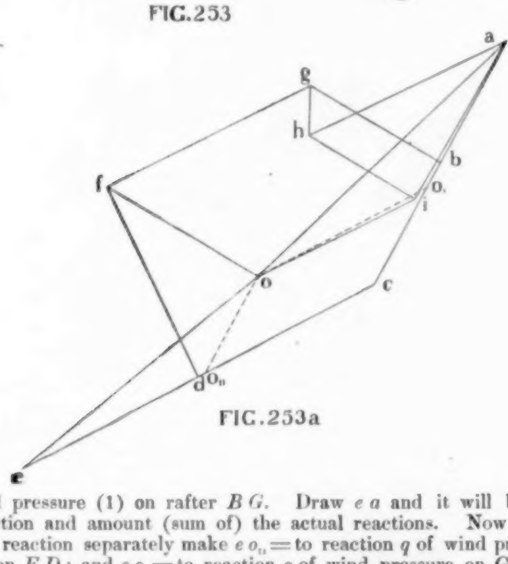


FIG. 253a

wind pressure (1) on rafter $B\,G$. Draw $e\,a$ and it will be the direction and amount (sum of) the actual reactions. Now to get each reaction separately make $e\,o_{ii}$ = to reaction q of wind pressure (3) on $F\,D$; and $c\,o_i$ = to reaction q of wind pressure on $G\,B$; of course $o_{ii}\,c$ and $o_i\,a$ will equal the reactions p due to the respective wind forces. Or we might divide $e\,c$ and $c\,a$ so that

$$e\,o_{ii} : o_{ii}\,c = A\,4 : 4\,E$$

and

$$c\,o_i : o_i\,a = A\,2 : 2\,E$$

We now draw $o_{ii}\,o$ parallel $c\,a$ and if we have drawn correctly $o\,o_i$ must be parallel $e\,c$. Having found o the rest of the diagram presents no difficulty. We make $a\,b = A\,B$ or pressure at apex; $b\,c = B\,C$ pressure at joint C due to wind on $G\,B$; $c\,d = C\,D$ pressure on same joint C due to wind on $F\,D$ and finally $d\,e = D\,E$ pressure at foot and proceed with the other lines.

Were we to make a strain diagram for a steady load on all joints we should find similar strains on all members except $I\,H$. This is a compression member of the truss, but becomes subjected to tension when the wind blows from the right.

Similarly $G\,F$ would become tension if the wind were from the left.

Wind tendency to overturn roofs. We will consider the tendency of wind to overturn roofs, and this can best be done by calculating one or two practical examples of steeples. Before doing this, however, the student should be warned to *always* arrange for *wind braces*, that is, diagonal ties between the trusses and in a plane at right angles to the trusses. The object of these, is to make all the trusses (that is the entire roof), act as one mass and thus keep the wind from blowing over each truss individually, and thus collapsing the roof. The arrangement of these ties varies with circumstances.

Wind braces. They are usually placed immediately under the roof surface, that is, from foot of one rafter to apex of next rafter on each side. If the rafters are long they are placed diagonally in the individual panels. Sometimes a longitudinal truss is made the entire length of ridge, by bracing from each apex to centre of each neighboring main tie.

Example III.

A wooden slate-covered steeple, 27′ 6″ high, covers a 24′ square brick tower. The walls are 16″ thick at the top and the steeple is anchored down four feet into the walls. Is this sufficient to keep it from blowing over?

Wooden steeple. It makes no difference just how the anchoring is done, it can be either by means of iron anchors bolting the plate down to the masonry below, or by means of wooden trestle work built inside and against the walls, which will also force the steeple to lift the walls from their bearings, before the steeple can topple over.

The wind pressure on one side of the roof will be the area of this side multiplied by 40 pounds per square foot (see Table XLIV) and it will act or can be considered as centralized at the centre of gravity of the side, which, being a triangle would be at one-third its height, or at D in Figure 254. The length of rafter will be 30′ therefore area of one side $= 30.12 = 360$ square feet, and wind pressure

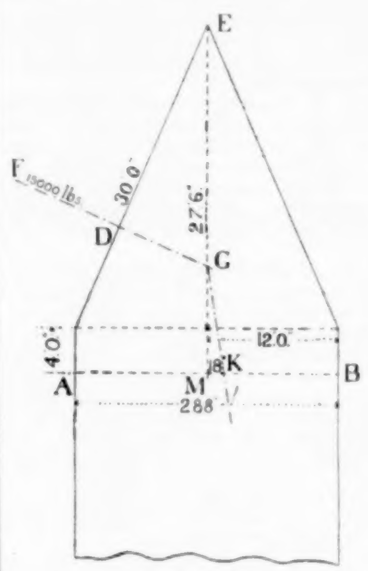


FIG. 254.

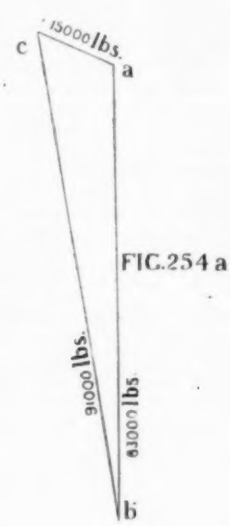


FIG. 254 a.

$F\,D = 360.40 = 14400$ or say 15000 pounds total wind pressure which we consider as centralized at D and normal to rafter. Resisting this, we have the dead load, that is the weight of steeple and of the masonry as far as steeple will have to lift it.

Taking the weight of steeple at 20 pounds per square foot (making, of course, no allowance for snow) and weight of brickwork at 112 pounds we have weight of (four sides of) steeple,

$$= 4.360.20 = 28800 \text{ pounds.}$$

Weight of masonry

$$= 4.\,(24 - 1\tfrac{1}{3}).4.112 = 54208 \text{ pounds,}$$

or total dead (vertical) load $= 83000$ pounds.

We now draw $c\,a$ parallel and $= 15000$ pounds, the wind pressure; and $a\,b$ vertically and $= 83000$ pounds, the dead load. Draw $c\,b$ and from intersection G of $F\,D$ with the main vertical neutral axis of the dead load draw $G\,K$ parallel $c\,b$ till it intersects the horizontal joint line $A\,B$, which we draw four feet below the tops of walls or at the anchor level. We now use Formulæ (44) and (45) to obtain the extreme edge strains at A and B.

We have these values:

p = the pressure $= c\,b = 91000$ pounds.
$x = M\,K = 18''$ (by measurement)
$d = A\,B = 240.12 = 288''$
a = area of wall at $A\,B = 4.16''.\,(288 - 16)$
$= 17408$ square inches.

We have then for pressure at nearer edge B

$$= \frac{91000}{17408} + 6.\,\frac{18.91000}{17408.288}$$

$= +\,7{,}21$ pounds compressive pressure, per square inch; and at A

$$= \frac{91000}{17408} - 6.\,\frac{18.91000}{17408.288}$$

$= +\,3{,}25$ pounds compressive pressure, per square inch.

If the latter value had been a negative one, we should have to rely on the quality of the mortar not to tear apart at A and thus allow the steeple to fall. It would be better, however, in such a case to carry the anchoring process further down, and thus gain more dead vertical load to resist the wind pressure.

Example IV.

A square stone steeple has 12″ stone sides at the top; 19 feet from the top vertically, the length of side is 12 feet. Is the steeple safe against wind pressure at this point?

Stone steeple. This example is intended to show that we can examine any point of steeple similarly to the manner of examining the base.

In Figure 255, $A\ D$ measures 12 feet $= 144''$; $M\ C = 19$ feet and $C\ D$ scales 20 feet, hence area of each side $= 6.20 = 120$ square

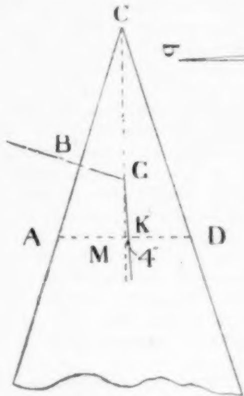


FIG. 255.

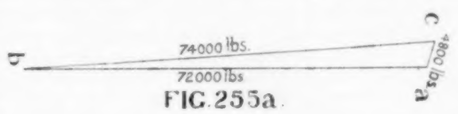
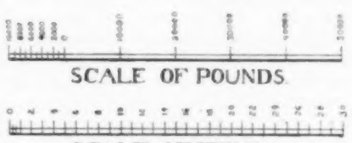


FIG. 255a.



SCALE OF POUNDS

SCALE OF FEET.

FOR FIGS. 254 & 254 a AND 255 & 255 a

feet, and weight of each side approximately $= 120.150 = 18000$ pounds and weight of four sides or vertical load $= 4.18000 = 72000$ pounds.

The wind pressure will be

$= 120.40 = 4800$ pounds and will be centralized at B or one-third the height of $A\ C$.

We draw $B\ G$ normal to $A\ C$ till it intersects $C\ M$ at G.

Make $a\ b = 72000$ pounds and vertical, draw $c\ a = 4800$ pounds and parallel $B\ G$ and draw $a\ b$ which scales 74000 pounds. Draw $G\ K$ parallel $c\ b$ and we find K is 4″ distant from centre of joint M. The area of joint is $= 4.11.144 = 6336$ square inches. We have, therefore, pressure at nearer edge of joint D,

$$= \frac{74000}{6336} + 6.\frac{4.74000}{6336.144}$$

$= + 13{,}65$ pounds, per square inch.

and at edge A

$$= \frac{74000}{6336} - 6.\frac{4.74000}{6336.144}$$

$= + 9{,}75$ pounds per square inch.

In a similar manner we might examine any other joint of the steeple.

It will be found that at the very top or near it the greatest danger exists. The finial frequently exposes a large surface to the wind and almost at right angles to the vertical dead load, deflecting this line much more in proportion. Then, too, the mortar is so much exposed that it cannot be relied on. For this reason there is placed usually a vertical iron tie-rod from the finial to some point below, frequently even below the springing line of the steeple. This arrangement is all right, provided the rod is properly put in. The writer has seen ponderous rods 2″ diameter or more and perhaps, fifty or sixty feet long, intended as tie-rods, that had become so loosened by contraction and expansion that they could be easily swayed back and forth by the hand. Hence their only service was their own dead weight.

Vertical tie-rods in steeples. The way to put in such rods is to leave the lower end free to move vertically, that is up and down, but secure it against lateral movement and then to attach to the lower end a heavy weight, proportioned according to circumstances.

Wind allowances for different surfaces. In figuring the allowance for wind it is customary to take only one-half the usual allowance for circular or surfaces slanting to the direction of wind. This is done because they offer less resistance than a flatly opposed surface, allowing the wind to slip by more readily. In a circular steeple we should take as our area the half circumference of base multiplied by the length on the rafter line and multiply this by only one-half the pressure for wind as given in Table XLIV. This usually would be 20 pounds per square foot.

For an octagonal roof we should assume full pressure on the central surface and only half pressure on the two side surfaces. Where the octagon is a regular one, this would amount practically to assuming double pressure on one surface only.

There is no danger of a steeple blowing over diagonally, as the sides would in such a case present slanting surfaces to the wind, allowing it to slide off readily; and besides the base line, being the diagonal of the square, would be so much longer.

On vertical (wall surfaces) the writer usually allows only for a maximum wind pressure of 30 pounds per square foot, for, as a rule, they (or part of them) are low down near the ground and therefore not exposed to the full force of the wind.

LOUIS DECOPPET BERG.

[To be continued.]

THOUGHTS ON ARCHITECTURE.[1]

Monument in the Church of Suerbempte, Belgium, by C. de Vriendt, (16th Century). From *Architektonische Rundschau.*

OF deep interest in the history of art is the description of the ancient Tabernacle given in Exodus XXV to XXVIII. Moses is commanded to take from the people an offering: "Gold and silver and brass — and blue linen and purple and goats' hair — and rams' skins dyed red, and badgers' skins and shittim wood — oil for the light, spices for the anointing oil and for sweet incense — onyx stones and stones to be set in the ephod and in the breastplate" and to build thereof a tabernacle as minutely described. This sacred and costly tent was, as we know, moved from place to place as occasion demanded, lastly to be supplanted by the far more splendid temple of Solomon.

What is most interesting to us is its peculiar ornamentation. Its wooden parts were of the best of that material known, yet all are wholly enveloped with plates beaten of pure gold. It has curtains of the most artistic fabric: "a vail of purple and blue and scarlet, and fine twined linen of rare and cunning work with cherubims shall be made." Silver was used on the columns of the court which were with brazen feet. The court gate had a hanging made "of blue and purple and scarlet and fine twined linen wrought with needle-work." We are left ignorant whether the gold was left plain and bright — or whether it had been covered with handiwork of any kind, or even some other material, be this wax or varnish, intended to tone down the original excessive lustre of the gold. Yet the description spurs the mind to more and deeper investigation and leads speculation back to the very origin of art.

This first origin or, if you prefer, the first invention of art must be

[1] A paper read before the American Institute of Architects at Washington, D. C., by Frederick Baumann, of Chicago.

presumed to have been the work of primitive man at an age infinitely remote and perhaps prior to the invention of speech. He found the textile products of nature and intertwisted them in useful fabrics, beginning with the plainest and simplest. Follow by degrees the art of braiding, stitching, weaving, lacing and what else there may be of the kind. The principle, the style, of these arts is a simple or a more complicated flat pattern, without relief, any more than must result from the thicknesses of threads or tapes therein used. It represents a drawing of one or more geometric designs, singly or in endless repetition.

Later on, after the properties of moistened clay had been observed and fire had been utilized in the process of hardening, bodily objects were formed, soon to be dedicated to sacred use and become variously ornamented. We find that all the ornaments before invented for textile products are, as they were, or transformed into bodily shapes, used and incorporated upon the exterior of the vessels. Added are representations relating to the animal world, which grow into sundry imaginative forms.

Thus, probably, for many centuries, existed textile and ceramic arts, before any occasion was found for the art of building. But whenever, at a later time, architecture came into existence it stood upon no other ground than the one cultivated prior to it. How could it stand upon any other? It results that we must seek the enigma of original forms of architecture in the sister arts prior to it, which had fruited the soil from which it originated. Thus it came upon the world as a natural child, and it is in vain for human reason to attempt the fabrication of any originally new system of it. This has been tried, and ever has been buried with the "inventor" or prior to his demise.

Architecture has its own especial language. Its works narrate their history. Were this possible in a language which has not been transmitted from generation to generation.

Architectural construction, according to Semper, bases on four constituent parts: the fireside as centre; the protecting roof; the circumvallation; the substruction. From these originally very modest parts the temple bases its origin. It starts with the simplest wood to become the finest marble structure. The sacredness of the purpose demanded the best material at command. And this did not suffice. Even the finest and at the time the most appreciated of wood materials, the cedar of Lebanon, had to be ornamented and wholly covered with metal, precious gold not excepted. In this fashion, which must have been at the time thousands of years old, we find the tabernacle gorgeously ornamented as related in Scripture.

Its partitions were mere curtains of the most precious kind. This most original fashion of partitioning off was retained by Solomon in the gorgeous construction of his temple. Palaces in olden times had partitions merely fashioned in this style. The king was equal at least to a demi-god and was entitled to fashion his domicile accordingly. Even in later times we find partitions thus made. Think of Polonius stabbed by Hamlet when listening behind a partition made of cloth!

But partitions were, with the progress of culture, made of solid material. Yet wherever they thus appear they are not artistically treated as structural parts. They are decorated in a manner to represent curtains, and at no time become an expressed mechanical element. Do we not at the present day decorate the entire interior walls of an edifice exclusively in this fashion? Can our papering and fresco-painting be taken as anything but a sham of the original curtain? More correctly do we work with Gobelin tapestry, the designs of which being stretched upon wooden frames and thus secured to the wall. The partition proper, however, bears no artistic relation to the art of any such decoration.

Empaistic art, *i. e.*, the art of covering structural wooden parts with costly metal, did by no means remain on first principles. The glare of plain gold upon large surfaces was soon found offensive to the eye. Designs were wrought upon and into it, and its surface was covered with wax transparent enough to allow a subdued show of the metal. Precious gold covered with mean wax! Can this be possible; can this be art? According to Ruskin, in the meaning of his doctrines, it should be called barbarism, but in accordance with the principles by which ancient art was governed, it was true art which in those times knew of no construction as such. As well might we speak of the construction of a large block of stone or marble for purposes of a large statuary work. The material is secondarily considered, was a mere matter of necessity for mechanical being.

We have a right to assume that the woodwork of the great temple at Ephesus, destroyed by Herostratos, 356 B. C., had been empaistically treated. How could it burn without wood, and why should such wood have been left bare contrary to the fashion of art prevailing at the time of its first construction?

Later on we find empaistic art, with a new method, taken up by the sculptors, who, as for instance great Phidias, employed on their statuary wood, ivory and gold, the latter unquestionably deprived of its natural lustre. Thus we find an art, barbaric in its origin transformed into the highest art that ever distinguished man's ideal mastery over nature.

Greek art, however, began early to utilize building stone as a common material. The first stone quarried was a poor sort of oölithic limestone, called Poros stone, which received a covering of plaster made very smooth for purposes of imitating — as must be presumed — as nearly as possible, the former covering of the wood with metal. Column, pilaster and wall thus plastered were then correspondingly tinted and waxed. Later on the celebrated Pentelian marble was quarried and used, to be tinted by the painter without the employment of stucco. For, with this fine material, the work could be wrought to absolute mechanical perfection, fit to afford the painter a surface more polished and more true than could formerly be obtained by plastering the poor stone. It has become evident beyond doubt that this marble in no instance remained without its due tint, probably at first the very one originally obtained by tinting and waxing the metal in various degrees and shades. The tints evidently were necessary in an æsthetic sense to gratify the exquisite good taste of the ancients so generally acknowledged. Not only the temples, but all statues, as it appears, were also tinted. Modern archæologists, besides, will have it that this tinting was a universal rule also in the days of the Roman Empire.

We modern people stand here as before an insoluble enigma. We expressly leave our better buildings and all statuary with the original tints of their material. Many arguments have been had on this subject, but the decision has — universally so — ever preponderated in favor of our fashion. Possibly at a later day the true tints may be discovered which might convert our taste and ourselves.

From the above premises it would seem evident that, as already indicated, in Greek architecture the material is nothing and the form is all. The temple is a unit without parallel in the history of art. Semper says in an article on "the original elements of architecture and polychromy:" "Comparing the various styles in architectural history we are met by the idea that all are based on very sound principles of statics and mechanics. One of the nations, however, succeeded in imparting organic life into their architectural creations and their industrial productions. The temples and monuments of Greece are not built, they are grown; are not merely ornamented, like the temples of Egypt, with organic bywork; their forms are such as are produced by organic life in its strife against gravity and substance. Otherwise we fail to comprehend or explain the incomparable beauty of a Greek column.

The age of architecture in which we live, however, is emphatically one of construction, so that I find myself induced to give here some facts of what to the Greeks was mere bywork, the construction of the Parthenon, taken from a comparatively recent work of Adolph Boetticher, entitled "*The Acropolis of Athens.*" According to measurements, the walls were six feet thick with alternate courses of two and two feet [? six] in height. One course consisted of a solid block six feet wide; the other of two parallel blocks each two feet six inches wide, leaving a vacant space of one foot between them. They were dowelled into one another and anchored with heavy irons carefully inserted. The drums of the columns were about six feet in diameter, four feet high, connected with each other by means of central stone dowels. The sacredness of the building prohibited the use of mortar, and the blocks, most carefully and precisely wrought to form by the hands of skilful mechanics, were set dry one upon the other, and this was done without allowing the occurrence of any sort of spalling off. Considering the extreme difficulty of thus setting course upon course, and the high degree of perfection in which the mutilated remnants appear at the present day, we must bow deeply with respect before the mechanics who accomplished this, be this with tools even more accomplished than ours. Yet perfect, absolutely without blemish — as must be judged from remaining ruins — as this work was, the consideration of this particular quality bore no weight, it was as a matter of course, of no special account. The building was a work of fine art in the widest as well as in the narrowest sense of the word. The like of it, on the scale of high art, as on the scale of mechanical art, can nowhere be found, and it must unquestionably be placed at the head of all buildings ever erected in this wide world in any age. This Parthenon served for a thousand years as a Christian church till taken by the Turks.

The founding of Alexandria gave origin to the ideas subsequently followed by the Romans, whose practical genius adopted Greek architecture to the multifarious uses coming in demand. The basilica and the Pantheon find existence, either one a prototype of subsequent Christian churches, the former for the West, the latter for the East. Constantine is credited to be the author of a thousand churches with small central domes. But not until under Justinian a new and original form was inaugurated. I refer to the Hagia Sophia at Constantinople. Its originality consists in the circular dome over a square room with adjoined extensions toward the four sides. This huge edifice, celebrated for its then originality as well as for its mechanical perfection and size, was completed in the amazingly brief space of five years, while it took 160 years to complete St. Peter and forty to build St. Paul, to say nothing of the Gothic cathedrals, most of which were left uncompleted.

The basilica arched became the type of the Romanesque style, so-called, samples of which are principally scattered over Germany and France.

When the Christian spirit as then understood and reigning, had more and more alienated the human mind from this earth; when it had reached the hearts of the masses in a measure to inspire them to march to the Holy Land for the liberation of holy Jerusalem from the yoke of infidel Mohammedans, which march they carried on and followed up in a most reckless and unwarlike manner to their own and to the ruin of millions to follow, then had arrived the time for the Christian mind to be not satisfied with the height and extent of churches as they were. Roofs and spires were to be raised higher up to the clouds to satisfy a most general demand. Arches were consequently made pointed to gratify this desire, and thus churches became the grandest edifices in existence. When we consider that the idea of grandeur has ever been a captivating one to the human mind, even regardless of higher considerations, we must contemplate with due respect the admiration and awe with which these edifices were and even now are regarded, though it is due to us to be conscious of the fact that they are productions of what we call "Dark Ages."

The cathedrals are essentially constructive in all their being, but they fail in construction because too complicated in detail for the means then at command of man. Hence the great number of uncompleted edifices and the early decay of the comparatively few which were, at least in a measure, completed.

Mechanical art of the present day begins to be able to master buildings of this character. The central tower on the roof of the Cologne Cathedral was first erected about forty years ago. It is taken down to-day because frail and fast decaying, to make room for the construction of a wholly new tower, of identical exterior, on approved modern principles.

The Renaissance, *i. e.*, the period of dissolution of mediæval ideas and customs, and the quickening of human thought with the fruits of ancient culture, which gradually followed the crusades, completely overthrew the architectural conceptions of the Middle Ages. Classic architecture of ancient Rome was brought to light and cultivated to a higher degree.

Renaissance ideas waning history proceeds with style after style and fashion after fashion, till it arrives at Classic Renaissance so-called, inaugurated by Winkelman and Stewart and Revet, for a time followed by architects in all countries, of whom Shinkel at Berlin was evidently the most conspicuous and refined. He is the father of a number of celebrated buildings. They were but poorly constructed from regard for the then reigning poverty of the country. And his greatest, most originally, truly Classic designs, of rare beauty, were left unexecuted. Shinkel was one of the few architects who understood to impart life into a Greek column, while generally the same appear like mere corpses, telling a form carefully constructed in accordance with Vitruvius's rules, yet without the spirit of true art which alone gives them life.

Thus subtile are the forms of Greek architecture, in most direct distinction from Gothic, which rests on a mechanical basis, that the positive correctness and harmony of all parts of the structure must come, as it were, like a revelation to the well-trained eye of the architect, as much as, and perhaps more so, than must the true expression of a human face reveal itself to the artist painter who undertakes to cast it upon his canvas.

Greek architecture, in its true bearing and compass, is a subject which cannot be mastered by superficial study. On the continent of Europe its acquirement belongs to the necessary requisites of a student desirous of introduction into the profession. In England, and in our country, however, it is treated with a sort of levity, as I believe. This should become otherwise.

Younger architects in particular should set at work to become acquainted with the lofty secrets of Greek architecture. Not that they might be led to strictly follow it in their designs, but that through its study their minds may become elevated far enough above the common level to enable them to impart life to their designs, and thus give them a character of a higher nobility.

The spirit of Greek architecture is, and should be acknowledged as being one of the greatest treasures of common humanity.

A myth has it that at the erection of a sacred temple at Mægara, the god seated himself upon a rock, thence inspiring the workingmen with the tunes of his lyre. Subsequently the rock sounded in like tunes upon the touch of a wand. Be to you Greek architecture this tuning rock when with heart and spirit you touch it.

THE FOUNDATION FOR THE KANSAS CITY CITY-HALL.[1]

KANSAS CITY, MO., October 6, 1890.

TO THE AMERICAN INSTITUTE OF ARCHITECTS, IN CONVENTION ASSEMBLED, WASHINGTON, D. C.

ABOUT a year ago the question of building a new city-hall in this city was formally decided upon; the site selected and bonds voted by the people. The Common Council passed the ordinance authorizing the Board of Public Works to construct the City-hall. The site selected being the Market Square, which a few years ago consisted of a ravine running diagonally through the same, on either side of which were abrupt bluffs and hills. But now the bluffs have been cut away and the ravines filled up, making to the casual observer a nice plat of ground, but with a fill of fifty feet under about two-thirds of the building and a solid clay bank under the remaining third; to those that know the possibilities of failure to obtain a uniform bearing for a foundation at a reasonable cost, it is not quite so nice. The "fill" referred to was made at different periods with rubbish of all kinds, tin-cans, rock, etc., and for some time this ravine at this point was used as a "public dump," making altogether a most unsatisfactory site to erect a large building upon. The question of foundation for the proposed building was discussed and the Board finally authorized me to develop some tangible method that would not bankrupt the city nor endanger adjoining property. Piles were generally suggested, but in my judgment that system would be bad in this particular location, owing to the dryness of the earth in the fill, and the tendency of piles to dry-rot in such soil, and to dig a trench in the conventional manner would not only be very expensive but dangerous.

I finally concluded that a system of piers for the whole substructure would solve the problem; but to dig square holes or pits and crib the excavation would not only be laborious but expensive and dangerous. The cylindrical form of piers was finally adopted, and of uniform size so that the excavation could be done with a large auger operated by steam-power and a three-sixteenth-inch caisson could be made to follow the auger. This much being decided upon the question of material was taken up. Concrete was the first to suggest itself, but upon mature deliberation and investigation, vitrified brick was adopted as the material best suited for the filling of the caissons. These brick, singly, in a testing-machine withstood a pressure of 135 to 140 tons to fracture to each brick. The piers four feet six inches in diameter, laid in hydraulic-cement mortar and grouted solid in each course and well bonded in all directions across the piers have proved to be all for solidity, tenacity and great strength, that my most sanguine expectations had hoped for. The piers are sunk to rock-bed of oölite limestone, about eight feet in thickness, and are capped with cast-iron webbed plates on which rests steel I-beams all bolted together with standard connections and separators; and the interstices between the beams and the excavation of one foot each side, and one foot under the beams and caps are filled with concrete. The upper surface is capped with boiler-plate one-fourth inch thick bolted to flanges of beams; on this surface the walls of the building are started. The piers under the north wing, tower and smoke-stack, and on each side of the main structure (having excessive weight in addition to the ordinary loads imposed on them) are reinforced by 12-inch "7" bar columns which also rest on the rock bottom.

The whole system, in essence, is the direct transmission of the entire weight to the solid bed-rock by so arranging the interior construction that the whole weight is subdivided, each subdivision being carried by an isolated pier capable of carrying its own individual load. By making these piers of uniform size the load superimposed on each is made about equal, by locating them at a greater or less distance apart. The total weight of this structure is figured in its entirety and this subdivided into loads corresponding to the number of piers required; these being transmitted to walls and isolated columns by the system of steel I-beams at each floor thence to the I-beams resting on webbed cast-iron plates, and thence to the isolated piers and rock-bottom.

The substructure of this foundation is completed and is very satisfactory indeed, and the work of the foundation and basement story will be completed by November 1, 1890, and as the work progresses I can see no reason to regret the adoption of the system employed; but on the other hand, I am pretty thoroughly convinced that the system of isolated piers as here used is the most economical, substantial, and lasting of any that could be employed under a large building on such a site.

[1] A paper by Mr. S. E. Chamberlin, Architect: read by Mr. Fassett at the Twenty-fourth Convention of the American Institute of Architects.

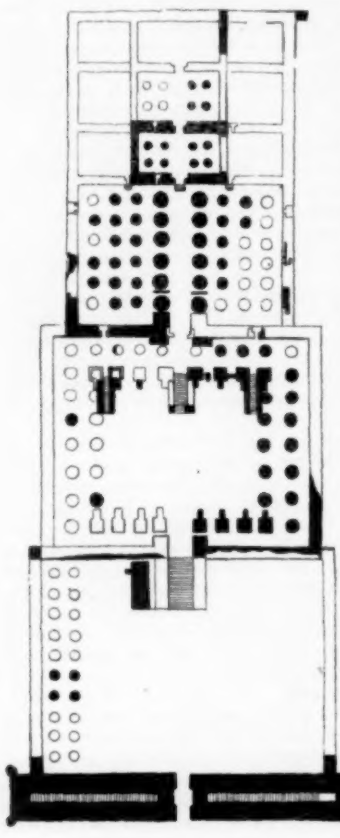
AERIAL NAVIGATION.

In a recent number of the *Forum*, Prof. R. H. Thurston, director of the schools of mechanical engineering of Cornell University, discusses in an entertaining way the "Problem of Air Navigation." After reviewing many interesting experiments in aëronautics, Professor Thurston thus speaks of the probability of the ultimate solution of the problem:

"The researches of Langley have shown the power demanded for flight to be about two per cent of the amount once supposed a minimum. We know that nature's energy can be directly converted into useful power through the production of electricity, as in the gymnotus, and possibly in all animal mechanisms. We know that modern storage-batteries are ten times the weight that science indicates to be the limit of perfect efficiency; both steam engines and electric accumulators have been made light enough and powerful enough to raise their own weight, with something to spare.

"The flying lemur, the flying-squirrel, the rude sustaining membranes that inventors have constructed, have sustained their heavy weights in drifting many yards. Man has imitated such animals. His predecessors, the bats and the great pterodactyls, have flown on membranes. Why may not he hope some time to combine the highest products of his inventive genius in some contrivance which shall enable him to drive his fusiform balloon a hundred miles an hour, defying wind and storm; or why not hope to learn from the albatross and the condor and the eagle the secrets of flight, and, like them, to soar aloft and above the clouds, to glide hour after hour on widespread, motionless wings with the speed of gales that vex the earth below, and as far as the wild goose or the carrier-pigeon or the migratory eagle can fly, crossing continents and oceans as certainly and even possibly as safely as do railway trains or steamships to-day? It would be rash as yet to assert that all this is even possible; but it would be still more rash to assert the contrary. Man has accomplished hardly less wonderful tasks. Who shall say that the limit of his powers of invention and construction has been reached or even approached? The engineer, like the man of science, has an infinity of opportunity still before him. And it is to the combination of scientific knowledge and constructive talent of the engineer rather than to the haphazard operations of the hand and brain of the ignorant contriver of olden time that we are to trust, if at all, for the accomplishment of this, the most stupendous of his tasks. Scientific research, exact computation, precise adjustment of means to well understood conditions, are the lines which lead to final success." — *Scientific American.*

ANCIENT ARCHITECTURE FOR STUDENTS.[1] — IV.

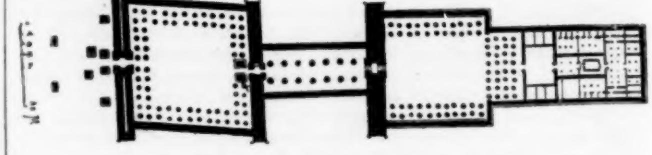


The Rameseum at Thebes.

THE great Ramesseum erected by Rameses II, who came to the throne, was the largest temple on the western side of the river, as Karnac was the largest on the eastern side. All these temples are comprised within an area of 2 1-4 miles north and south and 3 miles east and west, known as Thebes. These ruins have suffered far less than at other places, owing to the natural protection afforded them by a ridge of rocky hills to the westward, which shelters them from the sand of the desert, which elsewhere has buried whatever was left of ruins. Although badly ruined, and at one part to so great an extent that it is almost impossible to make out the form of the lesser sanctuary, yet the other part is so well preserved that the general arrangement can be easily perceived, and this temple serves us as the finest example of an Egyptian temple.

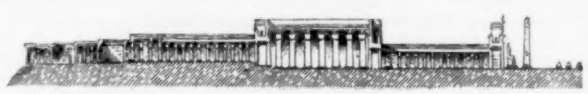
Two great masses of masonry, of sloping or pyramidal form, with a gateway between, make the guarded entrance which we call the propylon, and behind which is a great open court-yard with colonnades on the two sides, running from the propylon to the temple. Then comes an inner court, which is at a different level and was probably reached by steps; it is smaller than the first court but more richly adorned. A single row of columns runs around the three sides near the enclosing wall, and in front of these on two of the sides is another row adjoining square piers with colossal figures in front, which complete the square. Beyond this second court, through a doorway, is the great hypostyle hall, the most beautiful part of the whole building. Down the centre is the aisle, flanked by six columns on each side, behind which are four rows of six columns on each side, of much smaller diameter. If, as it is generally supposed, these hypostyle halls were roofed-in, the smaller columns would no doubt support the main roof, while the larger ones would rise above this level and support an attic, as described for Karnac. The capitals of the large columns differ from the small, but all the columns are richly decorated from top to bottom. The large caps are like inverted bells, with a good wide abacus, while with the others, the lower part is wider than the upper, like a flower-pot turned upside down, only without the rim, and they are much deeper than the large caps. Beyond this great hall, again, are several smaller rooms, but the ruination is so complete that a correct plan cannot be obtained. The probability is that here were situated the chambers that would have been inhabited by the monarch or the priests of the temple. Very gorgeous must have been the religious ceremonies that took place in these magnificent halls, all aflame with brilliant color decoration on walls and columns, and the splendid festival vestments of the priests.

Luxor, a temple a few miles away, whence came the obelisk that now stands in the Place de la Concorde, in Paris, must have been another magnificent example of Egyptian architecture, though smaller than the foregoing. The dimensions were about 830 feet long and from 100 feet to 200 feet wide, but owing to its propinquity to the river, it is in a very ruinous condition. Built at the same time as Karnac, it is thought these two temples may have been connected by an avenue, for the first great court at Luxor faces towards Karnac and lies in a direction different from the other parts. Behind the great court was a hypostyle hall, and behind this again the rooms or private chambers. Two great colossal figures of Rameses II, its founder, stand before the first court. Here we see how careless the Egyptians had become in setting out their buildings. Hardly any angles are right angles, and the pillars are spaced out very irregularly, a great



Plan of the Temple of Luxor (15th Century B. C.).

departure from the care and precision that, 2,000 years before, had been exercised in the construction of the Great Pyramid. The southern end of this temple is attributed to Amenophis III, the eighth king of the eighteenth dynasty. One other building deserves notice, and that is one situated on the south side of the great temple of Karnac and believed to belong to the same date, having been erected by



Section of the Temple of Luxor.

Thothmes III. It is approached by an avenue of colossal sphinxes. Behind the great propylon is an hypæthral court, or a court surrounded by a double row of columns within the outer walls. A small hypostyle hall succeeds to this, and beyond this again, entered by two side doorways, is a wide corridor enclosing another, which is entered directly from the hypostyle hall, this second corridor enclosing the sepulchral chamber or shrine. The outer corridor of all is extended considerably in the direction of the length of the temple, so as to enclose another chamber, almost a square, in which were four columns. The particular interest attaching to this building is that it is peculiarly a temple, and not in any way part temple and part palace, as are the others we have considered.

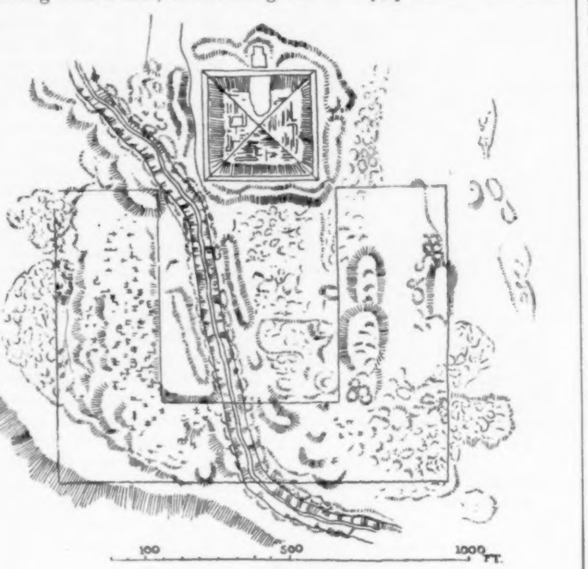
Before proceeding further with descriptions of Egyptian buildings, it is necessary to note the existence of an empire, until recently almost forgotten, but which at this period was almost as powerful as the Egyptian. Investigations conducted within the last twenty years have brought to light many curious inscriptions and bas-reliefs, which prove beyond a doubt that the Hittites spoken of in Scripture history were the remnants of a vast empire whose sway extended from Arabia, northward to the Black Sea, and thence westward over the whole of Asia Minor. The knowledge of this empire was brought about through the almost accidental discovery of some very curious cuneiform inscriptions, the writing of which was unlike that of either the Egyptian or Assyrian, or any other previously known characters, at Harnah, the city to the north of the Kingdoms of Canaan and also in the Pass of Karabel, to the west of Asia Minor. Other places, notably Carchemish, the ancient capital of the Hittites, produced inscriptions of similar form. Amenophis IV, the seventh king of the eighteenth dynasty, married a Hittite princess, who brought with her her own religion, which she continued to practise to the disgust of the Egyptians. Her son, Amenophis III, when he succeeded his father, withdrew from Thebes, the great stronghold of Egyptian religion, and established himself not far from Assouan, at a place now known as Tel-el-Armana. Here among the ruins have recently been discovered "a large collection of clay tablets, similar to those disinterred from the mounds of Nineveh and Babylon, and like the latter, inscribed in cuneiform characters, and in the Assyrio-Babylonian language."[1] A description of these tablets is given in the chapter on Assyria, and it will suffice to mention now that they have proved of the greatest value, giving minute accounts of the events of the times. This religious quarrel had momentous consequences for Egypt. Out of it sprang wars with and inroads of the Hittites, whom the Egyptians were not strong enough to subdue; but though in the end they were victorious, the wars proved a terrible drain upon the country, so that from this time Egypt fell an easy prey to whatever conqueror came up against her.

A very extraordinary building remains to be described, and one concerning which we have very meagre information. It is known as the "Labyrinth" from its singular formation, as it consists of a number of passages and chambers ranged in two tiers on three sides of a quadrangle. The Greek historian, Herodotus, says he saw the Labyrinth, at least so much of it as the priests would show him, and he says he found it a more wonderful building than the pyramids, and altogether beyond his powers of description. "It has twelve courts enclosed with walls, with doors opposite each other, six facing the north and six the south, contiguous to one another, and the same exterior wall encloses them. It contains two kinds of rooms, some

[1] Continued from No. 775, page 66.

[1] Sayce. "*The Hittites.*"

under ground and some above ground over them, to the number of three thousand, fifteen hundred of each. The rooms above ground I myself went through and saw, and relate from personal inspection; but the underground rooms I only know from repute, for the Egyptians who have charge of the building would on no account show me them, saying that they were the sepulchres of the kings who originally built this Labyrinth, and of the sacred crocodiles. I can only, therefore, relate what I have learned by hearing concerning the lower rooms; but the upper ones, which surpass all human works, I saw myself, for the passages through the corridors and the windings through the courts, from their great variety, present a thousand

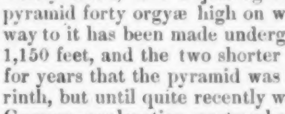


Block Plan of the Labyrinth.

occasions of wonder as I passed from a court to the rooms and from rooms to halls, and to other corridors from the halls, and to other courts from the rooms.

"The roofs of all these are of stone, but the walls are full of sculptured figures, each court is surrounded by a colonnade of white stone closely fitted, and adjoining the extremity of the Labyrinth is a pyramid forty orgyæ high on which large figures are carved and a way to it has been made underground."[1] The longest side measures 1,150 feet, and the two shorter 850 feet each. It has been supposed for years that the pyramid was the tomb of the founder of the Labyrinth, but until quite recently we have been waiting the results of the German exploration party who in 1843 conducted operations there, but have up to this time never published their report. Happily, we live at times when the interest in these explorations is shared by the public and we follow the accounts of the daily press, from which the public is able to ascertain the latest news regarding the work of the explorers actually engaged upon this very tomb at the time of writing.

It was generally held that the name of Amenemhat III had been found in the hieroglyphics, and the indefatigable efforts of Petrie have now proved this beyond a doubt. Amenemhat III was one of the last kings of the twelfth dynasty and every corner inside and out of his tomb has now been examined. No entrance could be found to the sepulchral chamber, and after vainly searching for a long time Petrie obtained the aid of masons and cut an entrance through the roofing stones. The chamber appeared to have neither entrance nor exit and must have been closed after the burial of the king and of his daughter "Phatneufr" who was buried in a rapidly constructed sarcophagus, one side of which was formed by the wall of the chamber, the other by her father's tomb, and with slabs joined to these sides at the head and foot and with a lid placed on top. But, once in, the secret of the true entrance passage was discovered. Unlike the entrance to all other pyramids, this one was entered by a passage of the most complicated plan. It started, as Herodotus says, at some distance from the pyramid and leads to it underground. It takes various directions, and as Petrie says "does not run straight into the chamber." It slopes down northward for some distance, than a branch passage leads eastward, the main line continuing on as a blind. The branch passage, still going eastward, ends blank, but the issue from it is by a trap-door in the roof, which opens with an upper passage going north which presently turns off to the west. Here it ends blank, and another trap-door gives access to another passage running farther west. This passage ends in a well, leading to a short passage southward which ends in another well, now full of water. "This well," Petrie imagined, "must lead to another short



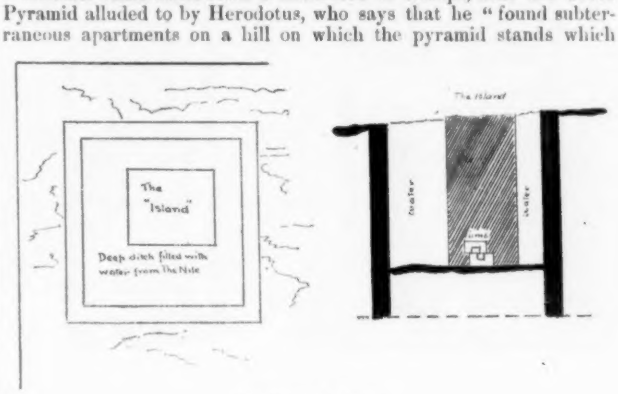
Chambers in the Labyrinth.

[1] Carey's "*Herodotus*."

passage, going eastward, whence a last well would ascend into the chamber."[2]

The construction of the sepulchral chamber is very curious. It is three feet deep in water now; like a great cistern, it is hollowed out of a huge sandstone, six feet deep inside; one course of stone above the edge of this monolith supports the roofing slabs of which there are three. Petrie has been unable to ascertain the connection between this chamber and the winding passage, the presence of the water in the chamber and in the well forming a barrier to further operations. Both sarcophagi were under water, but our ingenious explorer was able to prove that previous explorers had been there before him and had burnt the mummies; charcoal and the remains of costly mummy-cases were found in the sarcophagi. A Roman jar shows that at the time of the Roman rule in Egypt the passage was open, and the broken fragments of the funerary vases in the chamber indicate their presence there, but since that time there is every reason to suppose it has never been re-entered.

Another remarkable tomb is attributed to Cheops, near the Great Pyramid alluded to by Herodotus, who says that he "found subterraneous apartments on a hill on which the pyramid stands which

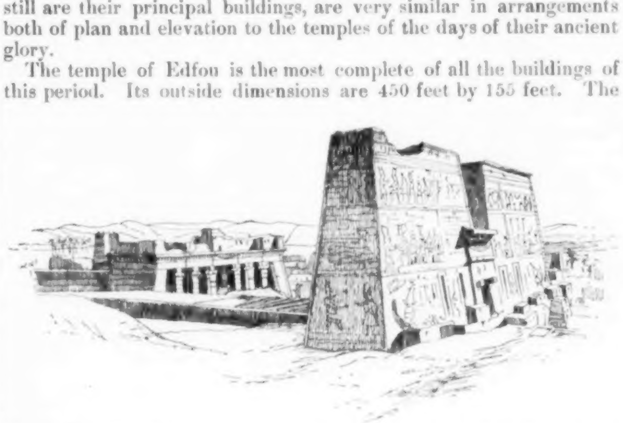


The Tomb of Cheops.

Cheops had as a burial vault for himself, on an island formed by draining a canal, from the Nile." This tomb appears to have been constructed at a considerable depth from the surface of the ground, a deep ditch hewn out of the rock, environing it, supplied by means of a canal, with water from the Nile, thus transforming the burial place into an island.

From the end of the nineteenth dynasty, comes a break in the long period of prosperity the result of which we have just described, until the end of the twenty-sixth dynasty when the Persians under Cambyses invaded Egypt, a period of nearly 600 years, during which the Egyptians suffered from their contact with the Hittites and then under the domination of the Shepherd Kings. True, in the twenty-second dynasty we find in the ruins of Bubastes additions carried out by Osorkon of a very extensive character, proving that in his time, at least, there was a revival but it did not last. Ground down by the Persians and then together with the Persian invaders under Artaxerxes Ochus, defeated by the combined Greek mercenaries, serving the two opposing nations, Persians and Egyptians, it was not until the Romans took possession of the country that Egypt regained some of her former splendor. It is a remarkable fact that the architecture of this period is so free from Roman influence; the country was revived by the Romans but the instincts and feelings of the people remained the same as for the past 2,000 years and their temples, which still are their principal buildings, are very similar in arrangements both of plan and elevation to the temples of the days of their ancient glory.

The temple of Edfou is the most complete of all the buildings of this period. Its outside dimensions are 450 feet by 155 feet. The

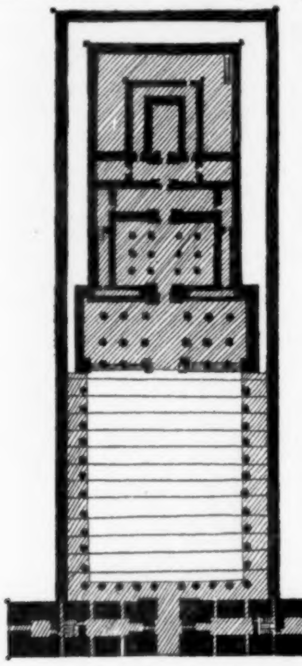


View of Temple at Edfou, before clearing out and the Removal of Dwellings on the Roof.

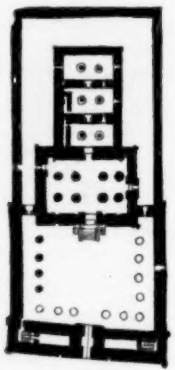
entrance is commanded by two magnificent and lofty pylons extending laterally beyond the outer walls of the temple and its precincts 35 feet on each side making up a total frontage of 225 feet. These propylons contain rooms and stairways and through the central doorway the court is reached with columns on three sides. This court

[2] *London Times.*

unlike those described previously, instead of having a level pavement, has a series of steps, the whole width of the court making a magnificent approach to the temple proper which is a lofty building, the façade of which measures 138 feet wide by 55 feet high. The elevation is composed of six columns equi-distant (except the central couple which are further apart to admit of an entrance), flanked by two wide pilasters. Between the columns are dwarf walls over the top of which light was admitted to the hall behind them. This hall contained two rows of six pillars. A doorway at the back of this



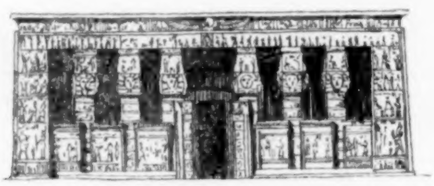
Plan of Temple at Edfou.



Plan of Temple at Kalabsche.

hall, leads into another hall, with three rows of four columns, and passing through this, one comes upon another chamber, communicating with smaller ones right and left, and having direct access to the shrine which is surrounded by another gallery, in its turn enclosed by a wider corridor. Between the external walls of the temple and the enclosing or boundary walls of the sacred edifice is a narrow open area not more than eight feet or ten feet wide. The whole temple is beautifully decorated, and the Isis-headed caps to the columns, of which we shall speak of later, are very fine examples.

Another temple of this period slightly larger than Edfou, is at Denderah; its façade is similar to it but it has no forecourt or propylons and no enclosing wall, but in interest it has the advantage



Façade at Temple at Denderah.

over Edfou, in having been originally the site of a shrine founded by the before mentioned Pepi Mervia of the fourth decade B. C.

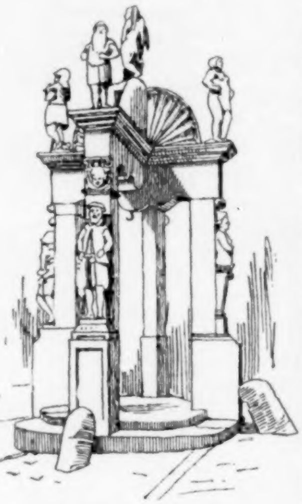
The temple at Kalabsche, exclusively Roman, is another of the same character but more irregular, its propylons, which, as usual, form one side of the great court, are not parallel with the façade of the temple, so that the court is not square. The inner chambers of this temple, of which there are only three, have each two columns in them and the whole is surrounded by a boundary wall.

One other temple remains to be described, one which by the excessive carelessness in setting out the walls, presents one of the most picturesque groups of all the temples. This is the temple of Philæ. Immediately behind the pylons is a court flanked on one side by a complete miniature temple measuring 85 feet by 35 feet with its entrance hall, and three inner chambers, surrounded by a gallery enclosed with columns and dwarf walls. It centres with the right-hand half of the propylons and seems to have its own entrance in the centre of this half. The other half of the propylon is irregular and has the appearance of being an addition. On entering the central doorway, to the left of the court stands a building composed of some seven or eight chambers all opening into a gallery of columns and dwarf walls. On the other side of the court, facing the entrance, is the temple proper, the walls of which externally and internally are as irregular as they can well be. The entrance chamber is only partly roofed in, and has on the further side a double row of columns, with two single columns forming the arcade at the sides. Beyond this hall are the smaller chambers, probably for the use of the priests, forming a perfect labyrinth. This whole group of buildings occupies an area of 230 feet by 150 feet wide at the widest parts. Egypt, we see, has been gradually declining, and thus has faded away the pomp and magnificence of Egyptian power with all its despotic cruelty and wonderful ingenuity.

R. W. Gambier-Bousfield.

[To be continued.]

HOW TO LAY SHINGLES.



Fountain at Wertheim.

It is not altogether within the province of *The Timberman* to enter into matters of building construction, only as the use of timber, lumber or shingles by builders and contractors, is manipulated to the advantage or disadvantage of the forest products; but for years past a good deal of contention has been observed among builders in regard to the proper way to place shingles on the roof of a building. Some have held tenaciously to the view, that inasmuch as custom has made the laying of shingles tight together almost a rule of law, that any other practice in regard to the laying of shingles was entirely erroneous, but the only way to decide such an important question, is as to the durability of the shingles whether placed tight together on the roof, or with proper openings between the under shingles. In this connection the following argument going to prove the desirability of placing the shingles at least an inch apart, is presented from the pen of one who has studied the question in all its various practicable phases:

"Why dam up the water in 700 or 800 to every 1,000 shingles where it will necessarily soak under them. Every crack must be full when it rains. Sawed shingles lie so tight that the water does not dry out, and they last but a short time. They should be laid at least three-fourths of an inch apart, so that the water can run freely down the roof. The joints need not be broken over more than one inch, for the water will not soak under them at all. Some fifteen years ago I shingled a barn, laying my shingles in the usual way. The roof is now rotten and must be replaced. Thirteen years ago I shingled another building with precisely the same kind of shingles, but in this case I laid them half an inch apart. The roof of this building is to-day as sound as when first put on. Three years ago I roofed a building, laying the shingles three-fourths of an inch apart, but now regret that I did not lay them one inch apart. There are two eaves spouts pouring water from other roofs on the shingles of this building, which is an ell, but not the slightest leak has ever appeared, or the slightest dampness on the under-sides of the shingles. The experiment has panned-out a perfect success, proving that there is no need of placing shingles directly side by side, also that they will last double the ordinary length of time if not so placed, for direct contact holds moisture and leads to decay." — *The Timberman.*

THE ILLUSTRATIONS

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

THE METHODIST BOOK CONCERN BUILDING, NEW YORK, N. Y. MR. EDWARD H. KENDALL, ARCHITECT, NEW YORK, N. Y.

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

THIS building on the corner of Fifth Avenue and 20th Street measures 104 feet on the avenue and 170 feet on the street. It is owned and, in the main, tenanted, by the great publishing house whose name it bears.

ST. MARK'S SCHOOL, SOUTHBORO', MASS. MR. H. F. BIGELOW, ARCHITECT, CLINTON, MASS.

This drawing was shown at the Spring exhibition of the Boston Architectural Club.

FIRST PRESBYTERIAN CHURCH, WEST PITTSTON, PA. MR. ISAAC PURSELL, ARCHITECT, PHILADELPHIA, PA.

PROPOSED COURT-HOUSE AT ———. MR. T. C. LINK, ARCHITECT, ST. LOUIS, MO.

"THE GARDEN ENTRANCE," DESIGNED BY MR. ARTHUR TRUSCOTT, ARCHITECT, COLUMBIA, TENN.

A DOORWAY IN THE CLOISTER OF THE BADIA, FLORENCE, ITALY. MEASURED AND DRAWN BY MR. W. A. BORING.

[Additional Illustrations in the International Edition.]

A LOUIS XVI GRILLE.

[Copper-plate Etching.]

THIS gate, of bronze with hand-wrought leafage, has recently been made by the founder Baudrit for Lord James Duncan.

DOORWAY OF THE OLD SCHLOSSKAPELLE (PALACE CHAPEL), DRESDEN.

[Gelatine Print.]

THIS doorway was part of the additions made to the electoral palace by Hans von Delm, court architect under the Electors Moritz and Augustus in the sixteenth century, and bears the dates 1554, 1555 and 1556. When King Augustus the Strong reverted to the Catholic church and the present Catholic Hofkirche was to be built beside the palace, in 1737, this portal was removed and prefixed to the Sophienkirche; and in 1875, after that church had been renovated and restored to its original Gothic style, the portal was again removed to its present position in the Sporen-gasse, close by the Johanneum. The composition, imitated from a Roman triumphal arch, is heavy, not to say clumsy, in proportion, but the detail is very rich and spirited; and shows throughout, a singular union of German and Italian influences. There is no better executed piece of work among all the old architecture of Dresden.

BUILDINGS AT FRANKFORT-ON-THE-MAIN, GERMANY. HERR PAUL WALLOT, ARCHITECT.

[Gelatine Print.]

HOUSE AT WIMBLEDON. DRAWING-ROOM. MR. E. J. MAY.

PLAN AND VIEW OF HOUSE AT WIMBLEDON.

HALL OF HOUSE AT WIMBLEDON.

DINING-ROOM FIREPLACE OF HOUSE AT WIMBLEDON.

CASTLE EDEN DEAN, DURHAM. FROM A DRAWING BY JOHN SELL COTMAN.

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

THE ARCHITECTS OF THE "AURELIA" APARTMENT-HOUSE.

NEW YORK, November 3, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — We have received a parcel of prints "Entrance to the Aurelia Apartment House, Fifth Avenue, New York City," which we return. We are credited with the design, but beg to say that Messrs. J. C. Cady & Co. were the architects. We do not understand how the mistake has occurred, but beg you to correct it in your next issue. Truly yours, D. & J. JARDINE.

[THE work was credited to our correspondents on the strength of what we believed good and sufficient information, which unfortunately reached us too late for verification. — EDS. AMERICAN ARCHITECT.]

THE REAL STATUS OF THE DELPHI EXPLORATION FUND.

November 3, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — May I ask you to correct a rather radical misapprehension likely to be caused by a paragraph in your report of the Second day's Session of the recent Convention at Washington, which reads thus:

"A letter from Mr. C. A. Cummings upon the matter of the proposed excavations at Delphi, stated that beyond the appropriation of $500 by the Boston Society of Architects, little had been accomplished in raising the sum needed by the American Archæological Institute for this exploration, etc."

The letter in question was in answer to a request from the Secretary of the American Institute, asking me to present the subject of the Delphi excavations to the Convention; and what I said was that since my previous letter of last March, in which I stated that the amount then raised was somewhere about $25,000, little had been accomplished so far as I knew, beyond the subscription of $500 by the Boston Society of Architects. I am, sirs,

Yours very truly, CHARLES A. CUMMINGS.

THE NEW PENSION OFFICE-BUILDING.

WASHINGTON, D. C., November 4, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,— In your issue of November 1st, appears in the editorial columns, a gracious sneer, directed against persons who use features of Classic architecture who do not know how they ought to look, and that columns 80 feet tall and 8 feet thick ought not to be employed to hold up skylights.

The sneer is evidently directed at the New United States Pension Office. But whatever the taste, knowledge or courtesy of its author, he ought to have known before publishing them, that the columns of its hall, though 7½ feet in diameter and 75 feet tall, hold up no skylights, but do support masonry walls 49 feet high, on which rests an iron-framed roof covered with hollow blocks of terra-cotta 4½ inches thick; said roof being of 116 feet clear span and its supporting walls 7 feet in thickness above the columns. Its ridge is 149 feet above the floor. M. C. MEIGS.

[ADVERSE criticisms are generally unpalatable, but it is hardly fair to construe them as "sneers." That the immense columns in the Patent Office Building are not solely for decoration, and that they do serve a purpose which less bulky features of the same material could not perform, is not denied. But the fact is that the duty they discharge is merely the upholding of a skylight, although the construction of that skylight, as General Meigs explains, required masonry walls seven feet thick and forty-nine feet high. The criticism was directed at the design of this singular composition, not at its construction. — EDS. AMERICAN ARCHITECT.]

THE CAPITOL AT WASHINGTON.

BOSTON, November 3, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Lest your characterization of the Capitol at Washington in the last issue of your journal as "the noblest architectural object in the world" should be taken to represent the opinion of American architects generally, will you permit me a word of protest. Had you spoken of it as being "in mass and proportion among the noblest" in the world, the expression it seems to me would have been quite as strong as the most ardent admirer of the Capitol would be justified in using. More than that savors surely of spread-eagleism. But the word "noble" hardly seems the right term to apply to a building whose central portion is painted freestone (not marble) and whose most prominent feature — the dome — is after all only a huge piece of iron scenery, the square plinth from which the drum rises being formed of mere iron screens suspended in mid-air and having neither foundation nor roof.

In mass and proportion the design of the Capitol is undoubtedly fine and the impressiveness and beauty of the general effect certainly gives it a high place among the great buildings of the world. But this is all. It can hardly be denied that the detail of the building lacks interest, to say the least. Considering how many buildings in the world there are having in a high degree all three of the great qualities of mass, proportion and detail, a building so utterly devoid of interest in the last named particular as is the Capitol at Washington cannot be given the highest or even a very high place. It requires a good deal of temerity, it seems to me, to say what building among the many noble is the noblest, but surely no competent critic can after careful consideration continue to claim that place for the Capitol. Magnificent and impressive as it is in general effect, I cannot forbear to express the opinion that much of its detail is not only without interest, but painfully and hopelessly vulgar.

Respectfully yours, H. LANGFORD WARREN.

[MR. WARREN ventures on rather dangerous ground when he begins his discussions by calling people, whose opinion differs from his own "incompetent critics." We do not care to defend our competency, or to repel charges of "spread-eagleism," but will ask Mr. Warren whether he does not think it is a good thing to be "in mass and proportion among the noblest buildings in the world"; to be "fine in mass and proportion"; to have a "general effect" of "impressiveness and beauty" and "magnificence"; and, further, whether he knows any other building in the world which possesses these qualities in so high a degree, and if he does not, we do not see how he can deny to the Capitol the rank which we give it, as the noblest architectural object in existence. We said, and still say, advisedly, "architectural object," instead of "building." To speak of it as a building would suggest structure, detail and many other things, having nothing to do with the general effect, which we continue to think unrivalled. Mr. Warren will remember that we did not praise the detail, except where Walter improved the profiles of the work which he continued around the wings, nor did we approve the principle of using cast-iron screens, or of painting sandstone; but these matters, while interesting, are foreign to the subject under consideration — the impression produced by the Capitol on the mind of the spectator; and should not be mixed up with it. Mr. Ruskin, who was one of the worst sinners that ever lived in the way of jumbling together morals, history, logic, construction, beauty of sculptured detail, and other things, and serving up the mixture as the proper architectural impression of a building, once said, in relation to learning to paint, that the student should avoid the habit of reasoning and inferring about what he was sketching, and cultivate an "innocence of the eye," which would lead him to put down on his paper or canvas just what he saw, without troubling himself about what he ought to see, or what that which he did see signified. We need in architecture a discipline of the same kind, to enable us to look at an architectural object, let us say, simply as a combination of line, form, texture, light and shade and color, disembarrassed of all historical, constructive or moral considerations. When we can do so, and not till then, shall we have great architecture. We suppose that Mr. Warren will not deny that we could put beautiful detail on an ugly building, or that an architectural taste would be very unreliable which could not decide whether to like the external effect of a building until it had made investigations into its construction and material, and the sooner these matters are disentangled the better. — Eds. American Architect.]

NOTES AND CLIPPINGS

The Woodstock, Canada, Court-house — Naturally there is rejoicing among Canadian architects over the failure of the county buildings at Woodstock, Ontario. The authorities when inviting designs fixed the outlay at $60,000, and as that sum was inadequate, few Canadians competed. One of their designs was admired, but as it could not be erected for less than $100,000, an architect from Detroit was entrusted with the work, with a Detroit contractor to aid him. Some weeks ago it was alleged that the work was not being carried on satisfactorily, and there was a suspension. Two architects were asked to examine what was done, and their report was so unfavorable that two other architects were called in. They also were compelled to declare that, owing to the character of the mortar and cement, the masonry was unsatisfactory. They also pointed out that the specifications were so vague "that the contractor may read them very much as he may choose." The American architect was in consequence dismissed, and the offer of a firm to carry on the work for a commission of 2 1-2 per cent was accepted. The original architect intends to bring an action against the Council, and declines to part with his plans. His successors will say their percentage was based on the supposition that plans were available. It may be assumed that the inhabitants of the Canadian County of Oxford will find they will have to pay for the official muddle just as if it occurred in England; and the cause is also one that is familiar in England, *viz.*, unwise economy. — *The Architect.*

It Looked like a Judgment. — Residents in a certain seaport town of Lincoln County remember a circumstance connected with the erection of its oldest church. There is a deal of superstition as native to these ledges as the ill-smelling rockweed. The townspeople were very poor when the old church was built. The actual amount of money given toward it was very small indeed. Hardly a person in town but contributed some material, however. In the northern part, close by a cove whose banks were mantled with beautiful moss, after the first few feet of cliff, and crowned with sturdy trees and straight, stalwart pines, lived a man noted for other things than generosity. The soliciting committee put off asking for his contribution until others had poured in and the church was a sure thing. Then they waited upon him and said: "Mr. Blank, we want that monster pine of yours for your contribution to the church. It will make an excellent sill; will you give it for your part?" "Give my best pine tree — give any of my pine? No, Sir. Not one of them shall come down." Nothing could shake this determination. In less than a week arose one of the heaviest storms ever known on that coast. And not one of those proudest pines in the man's forest was left; and the tallest pine, the one wanted for a sill, was riven from top to bottom by the thunderbolt. — *Lewiston (Me.) Journal.*

Woods of the United States. — The are 413 species of trees to be found within the limits of the United States and Territories, sixteen of which, when perfectly seasoned, will sink in water. The heaviest of these is the black ironwood (Condelia ferra), found only in southern Florida, which is more than thirty per cent heavier than water. Of the other fifteen, the best known is lignum vitæ (Guiacum sanctum) and the mangrove (Rhizophora mangle). Texas and New Mexico, lands full of queer creeping, crawling, walking and inanimate things, are the homes of a species of oak (Quercus grisea) which is about 1¼ times heavier than water, and which, when green, will sink almost as quick as a bar of iron. It grows only in mountain regions, and has been found westward as far as the Colorado desert, where it grows at an elevation of 10,000 feet. All the species heavier than water belong to tropical Florida or in the arid West or Southwest. — *Invention.*

Unearthing a Roman Monument. — An interesting Roman monument, says our Vienna correspondent, is being unearthed by order of the Roumanian Government. Prof. Tocilescu watches over the excavations. The ruin is called Adam Klissi by the people of the neighborhood, which is situated about two hours' journey from Rossava and fifteen hours from the sea. Field Marshall Moltke first described the monument in his letters from Turkey. Some of the beautifully hewn stones have been carried off by the peasants of those parts and used as tombstones in the churchyards. The ruins contained numerous interesting and well-sculptured reliefs, which have been placed in the museum at Bucharest. It is believed that the monument was erected in honor of a great victory gained by the Romans over barbarians north of the Danube. There is one inscription which points to Trajan, but there are many proofs that the monument dates from a later period. — *London Daily News.*

Monument at Granada to Commemorate the Discovery of America. — The Spanish Government has appropriated $50,000 for the erection of a monument at Granada to commemorate the discovery of America, which is to be celebrated with great splendor in Spain in 1892. The design for the monument is to be selected in a competition, limited to Spanish artists, and great freedom is left to designers in regard to treatment. The jury is to consist of the members of the Royal Academy of San Fernando. At the same time, and before the same jury, are to be presented designs for a triumphal arch, to be erected at Barcelona, in commemoration of the same event. For the erection of this arch the Government has also appropriated $50,000, but it is expected that the city of Barcelona, or rich citizens, will contribute enough more to furnish the structures with statues. — *Invention.*

Are Architects Country-bred. — A curious statement has recently appeared to the effect that the majority of a nation's painters are born in the country, while the architects spring from the metropolis. At first sight such an assertion seems plausible enough, and quite in accordance with the nature of things; but, as a matter-of-fact, the exact contrary is the case — so far at least, as London and Paris are concerned. In England sixty per cent and in Paris seventy per cent of the nation's artists were born in the capital. — *Philadelphia Telegraph.*

TRADE SURVEYS

A careful review of a host of trade, commercial and financial authorities develops some interesting and satisfactory inferences and conclusions concerning business prospects and probabilities. There are no disagreements as to facts among those who speak for the great industries and commercial and transportation interests. The volume of business, comparing it month by month with last year, is increasing. The volume of business in land sales and in real estate is increasing; in fact, the record of real estate conveyances and large land purchases surpasses all former record for ten months. Those who are posted in such matters assure those who want to know that a general enhancement of land values is near at hand, and for such considerations as these railroad construction has made land more in demand, manufacturing has expanded, population is spreading, agricultural employments are more remunerative, and there is more ease in pursuing them with better appliances. Prices for virgin lands have been recently marked up in many localities, and syndicates are helping along this upward tendency by seeking to control as much land as possible that is likely to be wanted for tilling, mining or lumbering purposes within the next ten years. There is no very accurate information yet published as to the extent of the mortgage indebtedness of the newer States, but whether it be great or small, whether it be at a standstill or is increasing, has very little to do with the future of the country. No loans were ever as wise or as productive as the farmers' loans, even though their contributions to money-lenders are measured by scores of millions of dollars per year. The demand for money to improve land simply means there is a corresponding demand for the products of the soil. So far, real danger from excessive unproductive investments has been avoided. Within a few days, large purchases of industrial properties have been made, one of four millions by English capitalists in Eastern Ohio iron properties. A four-million-dollar syndicate purchase is about to be made at Toronto. Manufacturers' associations have been recently formed in several large cities to promote manufacturing interests. One in Baltimore has been established with a capital of two million dollars, to be increased to five millions. In several large interior cities coöperative effort in this direction is cropping out. The Pittsburgh mill men have been suddenly obliged to face the difficulty and disadvantage of a return to soft coal. New sources of natural-gas supply have been developed in Kentucky and Ohio. Valuable coal-beds have been found in Tennessee, Alabama and Illinois. More rolling-mills and pipe-mills and railway-equipment establishments have been projected in the South, and will be built. Saw-mills are to be built along the Northern Pacific by a strong syndicate to stimulate industrial activity and immigration. Over five million dollars will be invested next year in Tacoma in new buildings. Rapid as has been the erection of new buildings for manufacturing and residence purposes, architects and builders cling to the opinion that next season will be more active. Their reasons are not susceptible of proof or disproof, but their isolated judgment is entitled to respect. One fact favors their opinion, viz, that the savings of the masses are growing rapidly, according to all the proof within reach. Habits of thrift and economy have of recent years spread among the masses, and the bulk of these earnings, as experience shows, goes into homes. This is especially true in New England. New York investors are already making preparations for heavy operations next year, and in Philadelphia this year's record of house-building will surpass the phenomenal figures of last year. Chicago is already feeling the benefit of the prospective World's Fair. The towns and cities between the Allegheny Mountains and the Mississippi River have improved vastly this year, especially those wherein industries exist in which the manufacture of equipments and building material is followed. Brick-yards, foundries, machine-shops, tool-works, saw and planing mills have been built all over these States in the effort to keep pace with the demand for enlarged manufacturing capacity and new homes for wage-workers. Only visitors through these localities can appreciate the extent and character and meaning of the great industrial upheaval, so to speak, in progress there. Another point worth passing mention is the demand for increased facilities between the larger cities of the Union, such as the demand for more facilities between Boston and New York, between New York and Philadelphia, between Chicago and various contributary points, and between Cincinnati, Indianapolis and other cities. A straw pointing in the same direction is the scheme to construct a two-foot pneumatic tube between Jersey City and Newark, which is to be extended to Philadelphia. Then there are a dozen tunnel schemes, one projected by the Vanderbilts under the Detroit River to shorten distance and time between New York and Chicago. Engineers are giving special attention to schemes of this character, and some of them involve outlays of several millions each. Questions of rapid transit in cities, of more expeditious railway services in cities, both as to passengers and freight, are crowding themselves onto the attention of railway managers, and radical departures in existing methods are likely to occur. The steady decline in the cost of electrical service is widening its uses, and just now schemes are under consideration for the duplication of several large electric-lighting plants. Electricians are enthusiastically pushing preparations for the application of that power to mechanical uses on a very grand scale, and some interesting announcements may be looked for in this direction within the next few months. The financial managers of New York, finally, assure the public that the banks will be able to protect all legitimate business interests. Railway bankers intimate that a strong speculative movement will develop itself among foreign dealers in American securities as soon as the leading railway systems effect the adjustments that are now in progress, which aim at a continuous and practicable harmony for the future, at least during and through 1891.

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

AMERICAN ARCHITECT AND BUILDING

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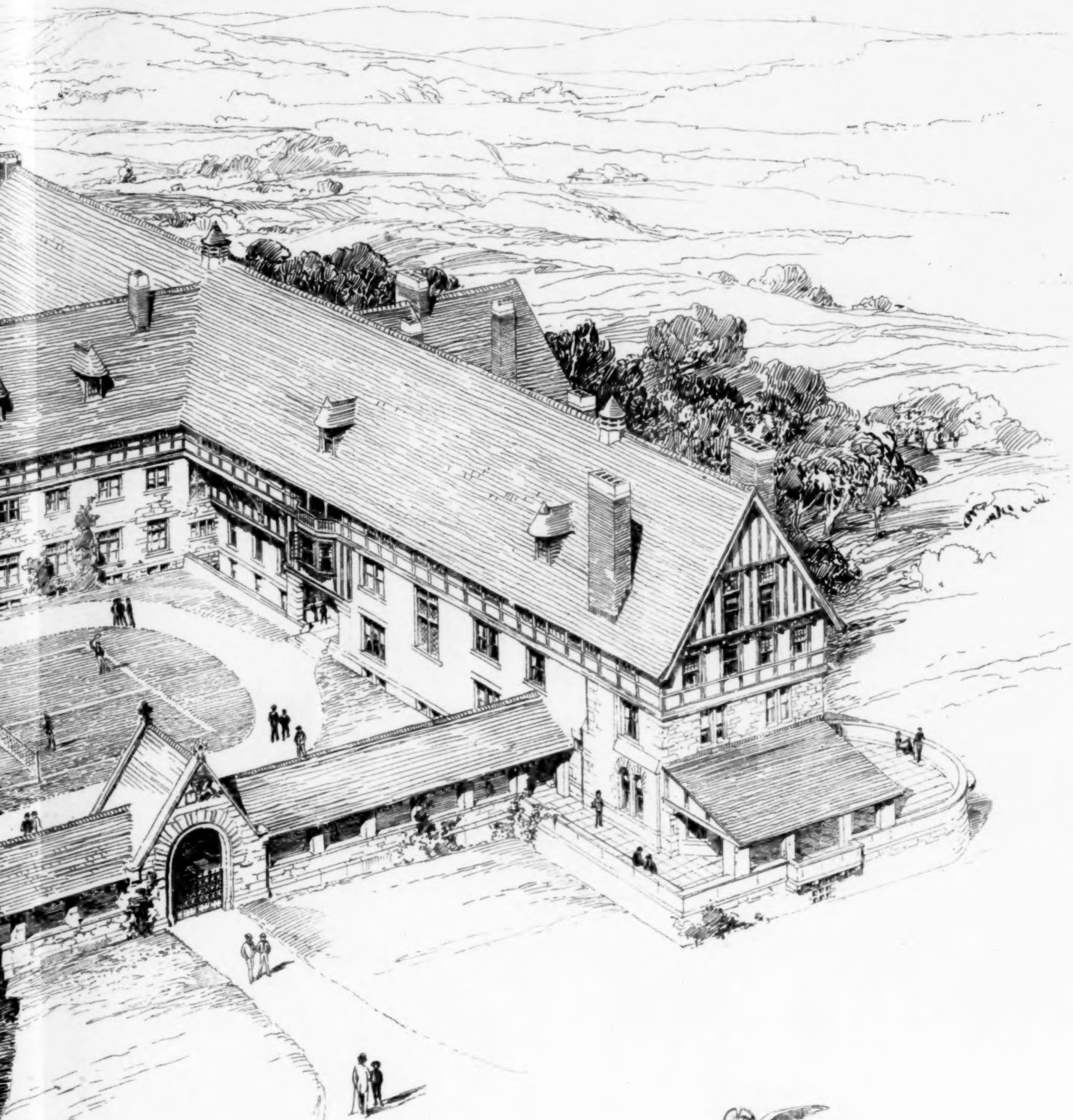

AGE QUOD AGIS

St Mark's School

· Southborough Mass ·

H. F Bigelow Arc't

1888

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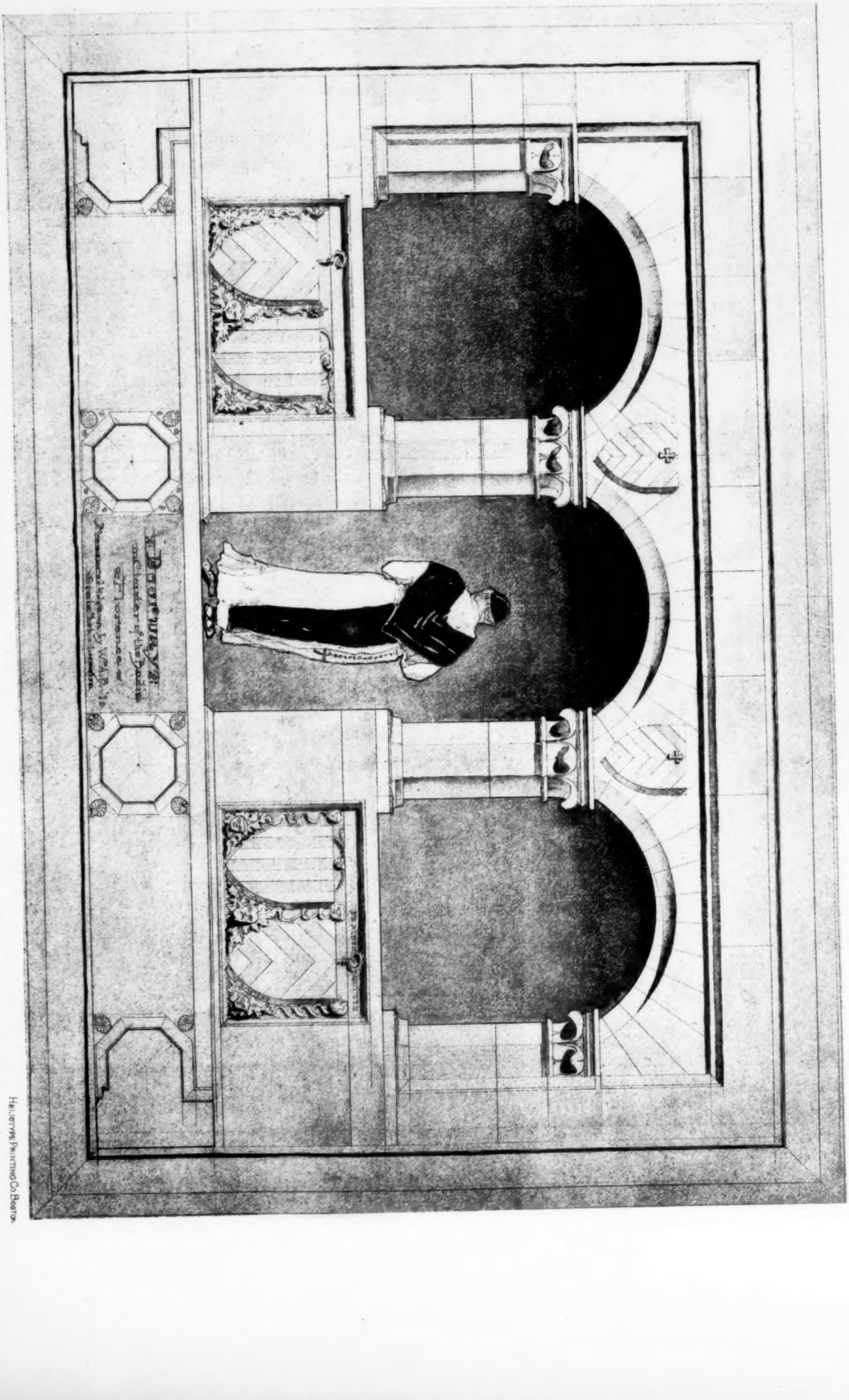

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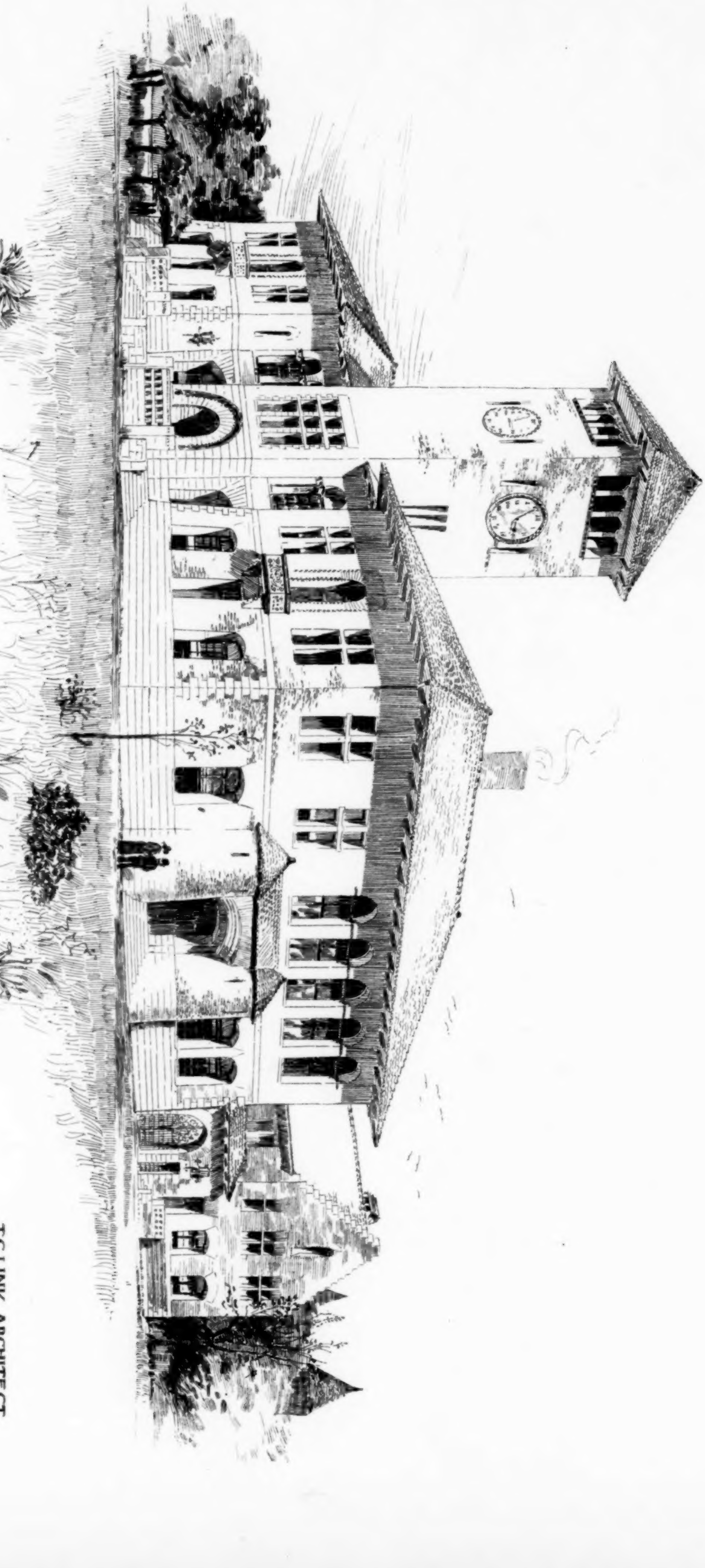

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