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The Architectural Exhibition at the Brooklyn Museum

By WM. H. GOODYEAR, M.A., Curator of the Department of Fine Arts

Hon. Member Society of Architects of Rome; Hon. Member of Edinburgh Architectural Association; Hon. Member Royal Academy of Fine Arts of Milan; Hon. Academician Royal Academy of Venice; Corresponding Member American Institute of Architects

FOURTH PAPER

IN my introductory article (August 4, 1909) the general subject-matter of the Brooklyn architectural exhibition was stated to be the asymmetry of mediæval building. The purpose of the exhibition was stated to be the examination of the question, how far this asymmetry is due to accident, decay, or carelessness; and how far it is due to other causes, among which the following were mentioned: the imperfection of instruments or of methods, to which some inaccuracy, without actual carelessness, was natural; the traditional continuance of classic and ancient systems and methods in which curved lines, leaning surfaces and asymmetric measurements are already known to have been intentional; the praiseworthy and artistic sense which did not strive for a formal or mechanical accuracy as a standard of perfection in building; the conscious and intentional avoidance of mathematical symmetry for the sake of picturesque variety, and the study of optical effects, either in the direction of perspective illusion, or optical correction, or of optical vibration, resulting in an effect of life.

The effort of these articles is to show that the explanations of accident, carelessness, decay, and imperfect methods or instruments are insufficient to account for all the asymmetries of mediæval building, as has been usually (but not universally) hitherto supposed.

With this end in view my account of the exhibition was, in the first article, statistical and descriptive as to matter of fact. The second article (September 8, 1909) described the origin of the research and also included illustrations of some of the most important ultimate results as surveyed in the Cathedral of Pisa. These illustrations led the way to a third article which continued to describe the extraordinary asymmetries of this cathedral as being one of the main features of the exhibition, and as being the best special illustration of the collection, considered as a whole, aside from the widening refinement.

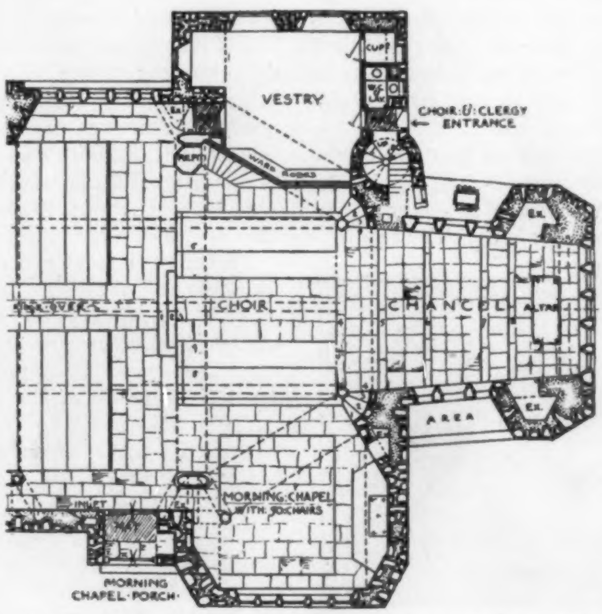

FIG. 1—PLAN OF ST. ANDREW'S CHURCH, ROKER, MONKWEARMOUTH

By MR. E. S. PRIOR. From the *Builder*, October 12, 1907. The chancel tapers from a width of 21 feet to a width of 17 feet, in a length of 26 feet

So far, two especially interesting phases of mediæval asymmetry which are illustrated by the same cathedral have not been mentioned. These are horizontal curves or bends and asymmetric plans. If examples of these are found in the Pisa Cathedral we should clearly find it of advantage to mention it. For whatever the philosophy of mediæval asymmetries may be, it is clearly desirable, in a brief sketch of the subject, to consider these asymmetries, as far as possible, as united in some one individual building. In so far as the philosophy of the subject may be complex, *i.e.*, in so far as various explanations may appear desirable for various facts, it is an advantage to find these various facts in a single given building, because the need of a variety of explanations is thus more clearly indicated. On the other hand, in so far as single or simple explanations may appear to cover a multitude of facts; it is also an advantage to find these various facts in a single given building, for here again the analogies between various differing facts are more easily perceived. In so far, also, as accident is presumed to be the most obvious and natural expla-

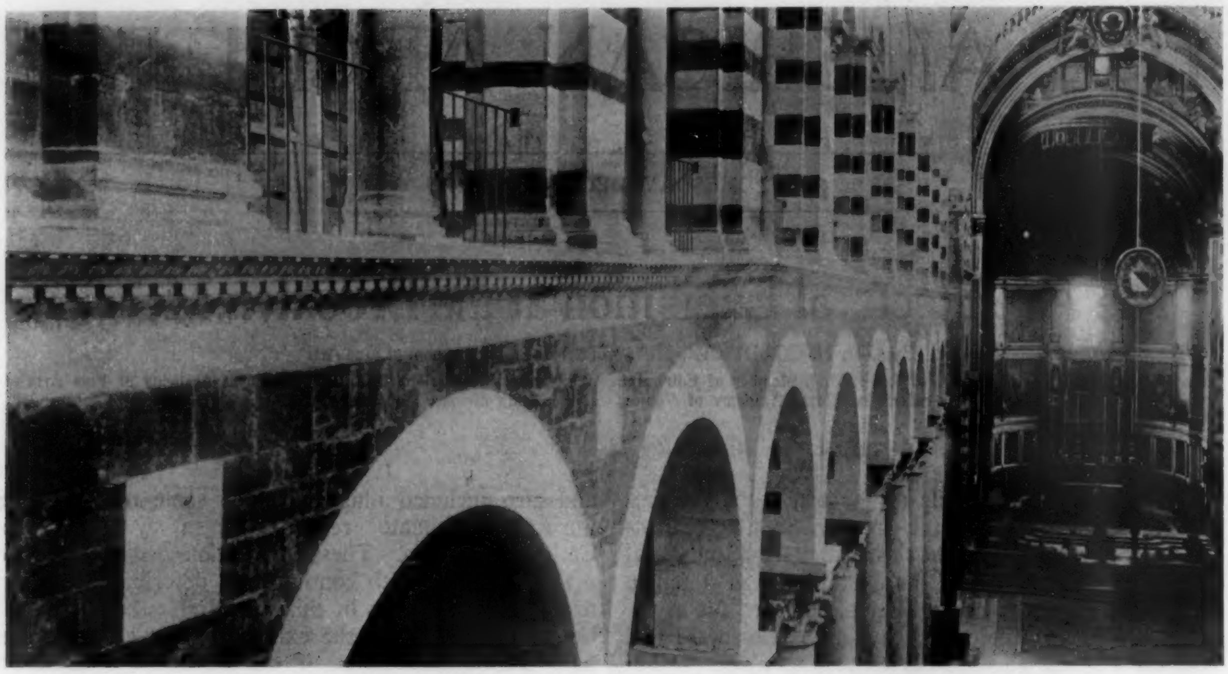

FIG. 2—PISA CATHEDRAL. BEND IN ELEVATION. NORTH GALLERY PARAPET

Survey in elevation and measurements in detail; see Fig. 3, second article, Aug. 8th. The parapet rises 0.78 from the west gallery in the first three bays and falls 0.93 in the remaining seven bays of the nave. For masonry jointing and construction of the bend, see Fig. 3 of this paper. This parapet also curves in plan with deflection convex to the nave For survey and measures see Exhibit 70, Brooklyn Museum Exhibition. For photograph of the curve in plan compare Fig. 9 of the opposite gallery where the curve is concave to the nave and against thrust. These curves in plan continue in the clerestory walls and have been photographed on the exterior at the level of the clerestory

nation of mediæval asymmetries, and this is the simplest explanation which can be offered, it is again of great advantage to study a single building in which a multitude of phenomena are found, for the improbability that so many various and remarkable accidents could have happened in one building has also to be considered.

Moreover, to the writer, who has published a very considerable number of memoirs, brochures and magazine articles on the given subject, it naturally appears desirable to offer something new on the (to him) familiar theme, or to place already published facts in some new light, or to add hitherto unmentioned or undeveloped arguments regarding them.

These are the reasons which lead me to describe the horizontal curves and the asymmetries in plan, of the Pisa Cathedral, in preference to selecting other examples from the very considerable number which are other-

FIG 3—PISA CATHEDRAL. FRONT VIEW OF THE NORTH GALLERY BEND IN ELEVATION

Showing the masonry jointing at and below the bend. That no settlement has occurred is also shown by the levels of the bases of the columns of the arcades as published in the survey, Fig. 3, second article

wise found in the Museum collection of architectural exhibits.

The subject of asymmetric plans was illustrated in my first article, but it was not debated as regards demonstration of intentional construction. As to such debate, the main necessity appears to be this: to publish some one asymmetric plan which is free from all the objections as to invalidity of proof which have been, or which possibly could be, urged.

Not only is this possible in the case of the Pisa Cathedral, but the choice of this illustration is also made desirable because the facts relating to the transepts have not been mentioned by me in previous publications, outside of the Edinburgh Catalogue and of my first reply to Mr. John Bilson, which appeared in the R. I. B. A. *Journal.** Both of these publications are necessarily unknown to a large majority of American readers.

Therefore I now proceed to mention that the two transepts of the Pisa Cathedral are delicately fan-shaped,† *i. e.*, their sides converge toward the nave, and with such close correspondence of measurements in the opposite transepts as to preclude any suggestion of accident. The width of the north transept at its junction with the nave is (feet) 56.78. The width of the south transept on the corresponding line is 56.60. Thus the builder's error on these widths, which were certainly intended to be closely equal, was only 0.18, or about 2¼ inches. The widths of the two transepts at their extremities on the north and south walls are, respectively, 57.88 and 57.63, the builder's error, as between the two transepts being 0.25, or exactly 3 inches. Thus the convergence of the east and west transept walls

* November 9, 1907.

† The survey is Museum exhibit No. 69.

toward the nave are, in the north transept 57.88 — 56.78 = 1.10, and the south transept, 57.63 — 56.60 = 1.03. These correspondences are conclusive as to intention.

If the purpose be inquired, the most obvious suggestion that presents itself is to inquire the purpose of now living or contemporary architects in similar asymmetric planning. For instance, the eminent English architect and critic, Mr. E. S. Prior, has recently built a church which has its chancel tapering in plan.* The lines of piers in the choir of the Cathedral of St. John the Divine, in New York, converge in plan (but the walls do not). A chancel at Methuen, Mass., also by Messrs. Heins and LaFarge, shows the same system as regards the walls.†

Mr. LaFarge and Mr. Prior can speak for themselves as to their motives. As for Mr. Heins, he was able, before his lamented death, to state his general point of view about architectural refinements in his article which treats of that subject in the *Dictionary of Architecture* (Macmillan), which was prepared and edited by Dr. Russell Sturgis. These references are suggested because my own purpose is to include in these articles as much fact and as little theory as possible. As to matter of fact, there is no escape at Pisa, and as to explanation it hardly matters, because it is so certain that an explanation exists, and because it is so certain that it makes very little difference in what words such explanation is expressed. Prof. Charles S. Hastings has recently said that "the discoverer of a definite *system* of variations from normal simplicity can infer the previous existence of design without troubling himself at all either as to the motives which stimulated the design or as to whether the end sought by the designer was attained or not."‡ Clearly the importance of proving the existence of a *system* before trying to explain it, is transcendant. That a *system* exists in the plan of the transepts is proven by the quoted measures. Having expressed myself at length in the Catalogue as to questions of motive, I will refrain from dwelling on that subject here.

We come now to the point that constructive horizontal curves, both in plan and in elevation, are found in various mediæval churches and cloisters which are represented in the exhibition. Here, again, the continued study of a single church, already shown to include other phenomena, offers great advantage. If certain constructive facts are proved to exist in a given parapet or wall, this establishes a preliminary presumption that other additional asymmetries in the same parapet or wall are also constructive, and such preceding demonstration also contributes a valuable parallel fact to be united with the additional facts when theories or explanations come to be considered.

For example, let us return to the bends in elevation of the gallery parapets at Pisa (Figs. 2, 3 of this article, surveys in AMERICAN ARCHITECT, September 8).*

These same parapets have also curves in plan, as shown in Fig. 9, and by the survey in the exhibition No. 70. These curves in plan continue in the clerestory walls and have been photographed on the exterior at the level of the clerestory.

Clearly, in describing such curves in plan, it is an argument to be considered that the bends in elevation are already proved to be constructive. This fact has never been questioned in publication, to my knowledge, and one conclusive argument has been mentioned in my last paper, viz., that the exterior stringcourses continue to rise toward the façade, whereas the interior parapets of the galleries bend downward on the same level. Photographic details of the masonry jointing are also published herewith (Figs. 3, 6).

We therefore now undertake to consider the curves in plan of these same parapets. They are parallel on opposite sides of the church; convex to the nave on the north side and concave to the nave on the south side. Thus, in the instance photographed (Fig. 9) it is evident that the curve is not due to thrust in the aisle vault,

* St Andrew's Church, Roker, Monkwearmouth. The plan was published by the *Builder*, Oct. 12, 1907. The chancel tapers from a width of 21 feet to a width of 17 feet in a length of 26 feet. There is a possibility that Mr. Prior's inspection of the mediæval plans which he saw at Edinburgh in 1905, may have suggested this design.

† This is the memorial addition to the First Church at Methuen, known as the Nevins Memorial Chancel. The chancel narrows in plan from 21 feet 4 inches, to 20 feet 4 inches, in a depth of 20 feet. Mr. Heins stated in a letter to me, dated April 15, 1898: "The idea was simply to avoid the harshness and monotony of exact rectangles. . . . . It seems to me that the effect in execution, while it is not noticeable as a distortion, unless pointed out, does make the chancel look less stiff and formal. You have so largely increased our information on the subject that I now feel safe in putting in many variations, in work of this sort, because they seem to me to make it vastly more interesting." The lines of piers in the choir of St. John the Divine converge 19 inches in a length of 57 feet. As quoted in the last article, Mr. LaFarge has stated that this arrangement was introduced, together with other refinements, "to avoid the banal aspect of mechanical regularity."

‡ *Architectural Record*, August, 1909, "Architectural Refinements."

* These are, strictly speaking, *bends*, and have not been quoted as *curves*. However, the bend of the south gallery gives the effect of a curve to the eye, even in the photograph (Fig. 3), and in actual vision the more distinct bend of the north gallery (Fig. 2) is not only seen as a curve from the level of the pavement below, but since this curve would be a normal perspective appearance in turning the head, so as to view the entire length of the parapet, *the bend is not even discovered by average vision* from the level of the pavement and is seen as part of the curve in perspective.

FIG. 4—PISA CATHEDRAL. CURVE IN ELEVATION OF THE NORTH CLERESTORY BASE MOULDING

This view shows the exterior of the wall which is supported lower down by the arcades seen in Fig. 2. The curve is best sighted by holding the view sideways and close to the eye. Another photograph is extant, taken close to the wall, which shows its curve in plan concave to exterior and corresponding to the curve in plan of the parapet below, which is convex to the nave

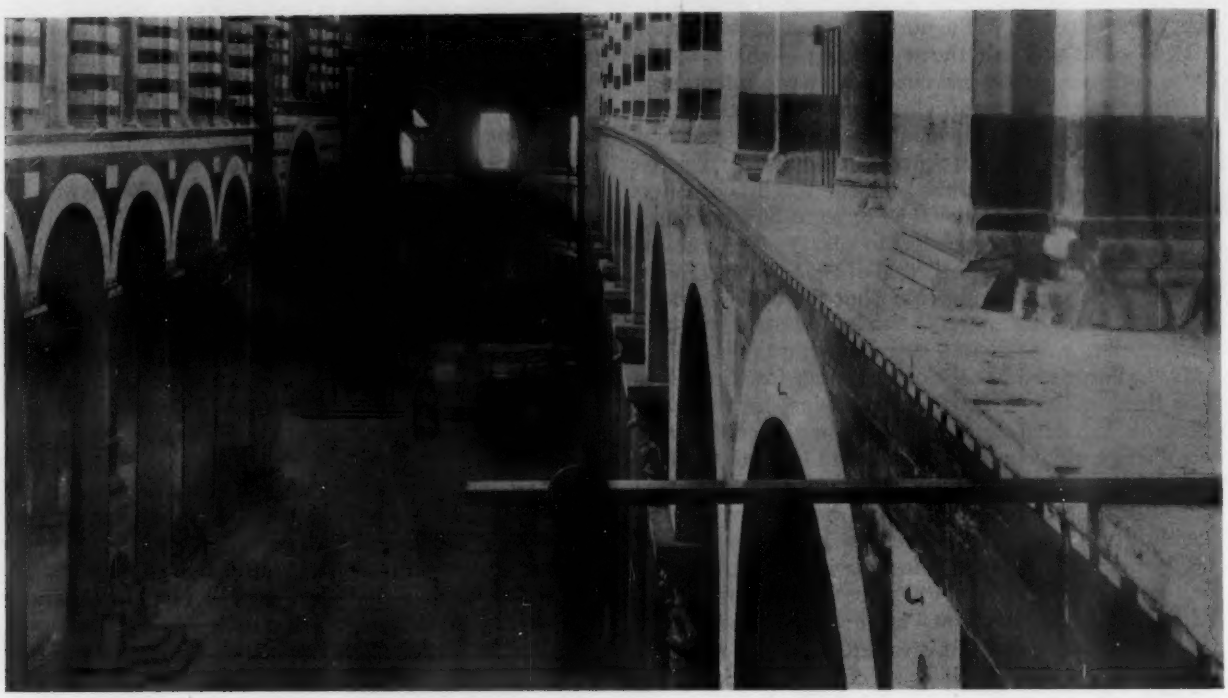

FIG. 5—PISA CATHEDRAL. BEND IN ELEVATION. SOUTH-GALLERY PARAPET

For survey in elevation and measurements in detail, see Fig. 2 of the second article. The parapet rises 0.83 from the west gallery in the first three bays, and falls 0.83 in the remaining seven bays of the nave. For masonry construction of the bend see Fig. 6 of this article. This parapet also curves in plan with deflection concave to the nave and therefore opposed to the thrust of the aisle vault. This curve is most conveniently sighted on the interior gallery side of the parapet and is there shown by Fig. 9

as the illustration shows the curve to be opposed to the direction of the aisle thrust toward the nave. The sceptic is thus reduced to the alternative of supposing that the same parapet has a bend in elevation which is constructive and a curve in plan which is not constructive, although he is also obliged to admit that thrust has not produced it. Otherwise he is compelled to challenge the proofs that the bend in elevation is constructive, which will involve him in other difficulties, not to mention those relating to the exterior stringcourse.

It is willingly admitted that belief in mediæval horizontal curves is difficult, but disbelief appears to be more difficult when the conditions are understood. Moreover, when we consider the arguments which have been so far advanced in publication against the existence of such curves, it is apparent that the given critics have an incomplete knowledge of some of the churches in which they are found. Thus it has been claimed by Mr. Prior, by Mr. Bilson, and by the Count De Lasteyrie, that mediæval curves in plan are due to the system of screening off successively completed sections of a given church for convenience of worship during the process of construction, and to the imperfection of the methods or instruments by which the continuance of a rectilinear construction beyond the screen was carried on. This argument overlooks the fact that the Pisan curves in plan are found in the gallery parapets, without appearing in the ground plan, and this is also true at Siena and at Orvieto.

This argument of certain sceptics has, however, some value for the contention that the specified curves in plan are constructive. It shows that experts find it necessary to assume some special cause for the existence of such curves, outside of the familiar explanation of thrust, and it also shows that such experts admit the ability of mediæval masons to build to a straight line under ordiuary conditions. It is almost superfluous to mention that this ability must be conceded. As a matter of fact, the strongest argument in favor of the constructive existence of curves and bends in plan is the very large number of contemporary and locally adjacent churches which show nothing of the kind, and which are strictly rectilinear; because the explanations of incompetence and indifference would thus be set aside if they were offered. It is thus of great importance to mention that such explanations have not been offered by the sceptics who have endeavored to cope with this subject as regards the question of curvilinear building.

A further instance of curves in plan in the Pisa Cathedral is found in the south wall. The oblique middle stringcourse of this wall is continuous in its slope, as appears in the photograph (Fig. 5, article of August 8). Thus it appears, even if the construction of this wall was interrupted, as might easily have happened, that it was completed, as regards the stringcourse, according to a predetermined plan. But this wall also *curves or bends in plan* to the amount of 22 inches deflection (Fig. 11).* How, then, can we suppose that the stringcourse is oblique by predetermined purpose and that the same wall bends in plan by accident? The suggestion of thrust or lateral movement is precluded by the fact that the deflection starts at the foundations, as seen in Fig. 11, and, higher up, the curve is opposed in direction to the thrust of the interior aisle vault.

The north wall curves in plan parallel with the south wall and therefore with deflection convex to the exterior (Fig. 12). This curve does not, however, start at the

* Measurement taken from survey in the Exhibition.

foundations, and therefore it might, potentially, be ascribed to thrust, or lateral movement, because convex to exterior. It is evident, however, that whatever explanation is adopted for the Pisan curves, it must be an explanation which is consistent with itself and which covers all of them, and thrust or lateral movement is certainly not that explanation. An explanation which would apply to the north wall and not to the south wall is insufficient. It must also be noted, although the curves in plan of the north and south walls are parallel, and although the curves in plan of the gallery parapets are parallel, that the directions of the two pairs of curves *are reversed,* as regards one another. The gallery parapet is concave on the south side to interior. The wall is concave to exterior. The gallery parapet is convex on the north side to interior. The north wall is convex to exterior.

To these facts must be added those which hold of the gallery aisle columns and their supporting parapets (Fig. 10). On both sides of the church the gallery aisle columns have pronounced curves of alignment, and it is apparent from the picture that there can be no question in either case of thrust or lateral movement. The curve shown in Fig. 10 is in reality an attenuated letter S or return curve. (Hogarth's "Line of Beauty.")

The south gallery aisle columns and supporting parapet are seen in Fig. 9, but not from a point of view which includes the curve in plan of alignment. This curve is parallel with that of the south gallery parapet (concave to the nave, about 5 inches deflection) and it therefore reverses direction, as regards the curve of the adjacent south wall. All the parapets of the transept galleries have well-defined true curves in plan, all convex to the center of the transepts. These might, potentially, be due to thrust of the aisle vaultings, but their case will probably stand or fall with the others (photographs and surveys in the exhibition).* Careful examination has been made for indications of accident and these curves were included in the examination made by the architect in charge of repairs and are included in his certificate, which appeared in the second article.

We now come to the curves or bends in elevation of the Pisa Cathedral. The actual existence of these curves being determined by photographic proof, as holding for the exterior clerestory base mouldings (Figs. 4, 7), it is only necessary to reflect that the surveys for the gallery bends in elevation and the photographs of these bends (Figs. 2, 5) represent the same walls a little lower down. The view is exterior in the one case and interior in the other, but the wall is the same. How can we admit the constructive existence of the bend in elevation below and deny the constructive existence of the curve or bend in elevation above?* Such a supposition must postulate a settlement of the masonry toward the two ends of each wall; at the transepts and at the façade; but such a settlement is impossible *between* the bend in elevation of the parapet and the curve above. Below the bend in elevation every square foot of masonry is accounted for. It is evident that settlement *never has* occurred below the parapets, and that it *could not* occur above them.

The curve in elevation of the north side second story cornice is also undoubtedly constructive, for the gradual elongation of the pilasters toward the center of the wall is easily seen in the illustration (Fig. 8). Moreover, the stringcourse which divides the wall horizontally and which is 2 feet out of horizontal, as described in earlier articles, is visibly straight, aside from a slight bend in the upward direction at the fifth arcade from the façade. If the curve of the roof cornice were due to settlement, the effects of that settlement would also appear in the stringcourse.

It thus appears that curves in plan are the general rule in the Pisa Cathedral and that thrust or lateral movement cannot be their general explanation. It also appears that the same parapets and walls which exhibit the curves and bends in plan also exhibit other deflections from the normal horizontal or rectilinear construction, which the severest tests of scepticism cannot prove to be accidental. Moreover, curves, or bends, in elevation are found in the upper portions of the same walls which otherwise exhibit bends in elevation lower down, which are certainly not due to movement of the building.

Thus the only possible explanation of these curved and bending lines, aside from that of intentional construction, would be that of incompetence or of an indifference to rectilinear building which would be equal to incompetence, but this explanation would be ridicu-

* Exhibit 70 is a survey which includes all the reflections in plan which are mentioned in this paper, both those which are illustrated in it and those which are not illustrated.

* It would be a more accurate terminology to describe these lines as bends having the effects of curves; see matter on this head later on.

FIG. 7—PISA CATHEDRAL. CURVE OR BEND, IN ELEVATION OF THE SOUTH CLERESTORY BASE MOULDING

This view shows the exterior of the wall which is supported lower down by the arcades seen in Fig. 5. The curve, or bend, is best sighted by holding the view sideways and close to the eye. Another photograph is extant, taken close to the wall, which shows its curve in plan, convex to exterior, and corresponding to that seen in Fig. 9, which is concave to the nave lous. There is no mediæval cathedral in Europe in which the perfection of the masonry construction is as remarkable as it is at Pisa, and this is true in spite of the numerous and obvious examples of the use of heterogeneous and borrowed irregular material. Moreover, the north wall is straight at the foundation, the façade is straight, the transept walls are straight, and innumerable cases of rectilinear building can be quoted for the Pisan district for the same period. Finally, the close correspondence of measures in the gallery bends in elevation, and the exact correspondence as to the relative point where the bends occur on opposite sides of the church, are proofs that no theory of careless construction can be considered as regards the bends in elevation. It will be remembered that the south gallery parapet rises and falls in exactly the same amount (0.83) and that the difference between the rise and fall of the north gallery parapet is only 0.15, or 2 inches (0.78 rise and 0.93 fall).

As an example of the general perfection of Pisan mason work and of the careful attention to minor details, may be mentioned the system of cutting the voussoirs of the arches so that the lower and upper arch lines are non-concentric. This is illustrated for the arcades of the nave by Figs. 3 and 6 and is also seen in the western crossing arches (Figs. 2 and 5).

The most plausible and natural explanation of the Pisan curves would be that they are derived by traditional practice from those of antiquity, just as the Roman horizontal curves may be presumed to derive from the Greek, and just as the Greek horizontal curves may be presumed to derive from those of Egypt. Nor would it be difficult to mention dates as to connecting links in the chain of evidence, which would show that the gaps in the surviving record are not as serious as those which occur between the now known and surviving monuments of antiquity.

For the moment, however, evidence as to construction is more important than theories as to historic derivation.

As to æsthetic explanations, there is not the slightest doubt that they can be immediately and easily suggested by those who admit the constructive facts. If differences of opinion were to exist on this point, it would be of no consequence, for even the purpose of the Greek curves is still a widely debated question.* (See note at top of next page.)

The general subject of mediæval curves is undoubtedly complicated by the lack of marked distinction and definite

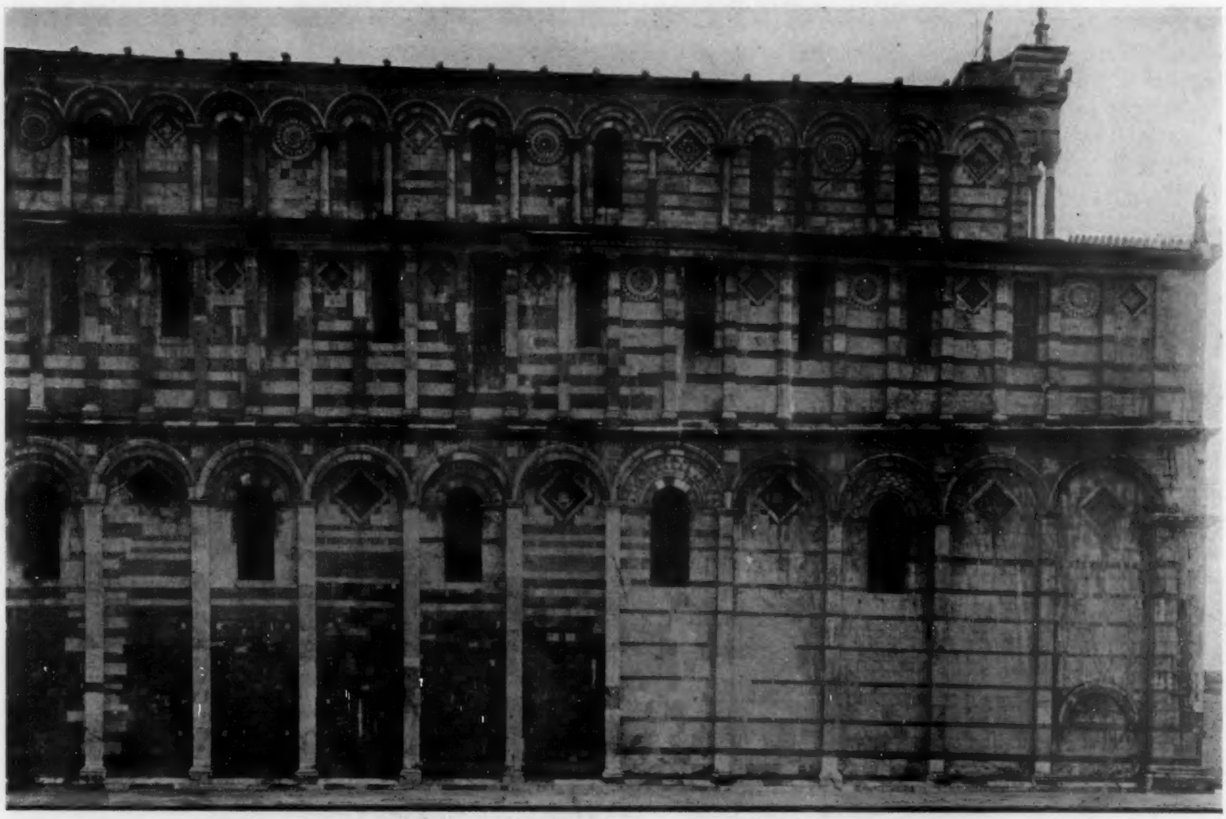

FIG. 8—PISA CATHEDRAL. CURVE IN ELEVATION. NORTH WALL SECOND STORY CORNICE

As regards the question whether this curve is due to construction or accident, it will be noticed that the pilasters of the second story increase in height toward the center of the wall and also that the oblique stringcourse bends slightly, at the fifth arcade from the facade, in the upward direction, whereas the cornice above bends downward Thus the theory cannot be suggested that a curve was caused by subsidence increasing toward the extremities of the wall. The appearance of a curve in elevation is exaggerated, optically, from the given point of view and position of the camera, by the curve *in plan*, convex to exterior *of the same cornice*, as seen in Fig. 12 and also in Fig. 6, third article, This view which shows eleven out of fifteen arcades of the north wall is also important as illustrating the sloping stringcourse, which is two feet out of horizontal, like its counterpart of the south wall (Fig. 5, second article). The view also illustrates the downward bend of the masonry stripes of the lower wall at the corresponding point where found in the south wall (Fig. 5, second article). This enabled the masons to construct the leaning angle pilaster with rectangular blocks, without breaking line with the stripes. The view also illustrates the leaning facade (Figs. 4. 6. 7, second article). It also shows the wedge-shaped blocks above and below the stringcourse by which its constructive slope is obtained. It also shows the change of alignment in the stripes of the second story, which made it possible to construct the leaning angle pilaster with rectangular blocks, without breaking line with the stripes. It also illustrates for the north wall what is shown for the south wall by Fig. 5, second article, viz. the departure of the line of the arcades from the line of the stringcourse beginning at the fifth arcade from the facade and the increase of width of the arcades from 9.06 (sixth arcade) to 11.16 at the facade. This arrangement is explained for both walls in the descriptive matter for Fig 5, second article

* See, for instance, my article on Professor Gustavo Giovannoni's discovery of curves concave to exterior in the façade of the Roman Temple at Cori, *Arch. Rec.*, June, 1907, and *Am. J. of Archæology*, Vol. XI, No. 2. The number of curves in plan, both concave and convex to the spectator, which are now conceded to exist in ancient buildings, among which the concave curves at Cori are the latest discovery, compel, in any case, an entire revision of the much-quoted explanation that the classic curves were intended to make the lines appear straight. This theory is definitely set aside by Prof. Giovannoni's discovery, because the curves at Cori tend to increase and not to correct an effect of concavity. The measurements, which were sent in by Prof. Giovannoni for my own publications were subsequently revised when his formal surveys were published in the *Mittheilungen des K. D. Archæologischen Instituts*, Rome, 1908, Vol. XXVII, pp. 109-130. For the correct measurements the latter publication must be consulted.

separation between *curves* and *bends,* because a bend is more easily presumed to be accidental, whereas a true curve is only exposed to the suspicion of thrust and must be presumed to be intentional, whenever that suspicion does not apply. On this head it may be said that strictly curvilinear horizontal lines are not even found in Greek architecture. The so-called horizontal curves of the Greeks were actually built in straight lines, with a series of bends at obtuse angles, which give the effect to the eye of a curve. For instance, in an approximate length of 100 feet the east and west fronts of the Parthenon exhibit horizontal curves, so called, which are constructed as follows: The so-called curves of the stylobate are built in six straight lines, with five bends, and the so-called curves of the architraves are built in seven straight lines, with six bends. It is not probable that the mediæval curves are more delicate in construction than the classic curves, but many of them are not less delicate, as judged by ordinary vision, *i. e.,* the bends are not perceptible to the eye and are actually seen as true curves after every effort at accurate vision has been made. In other cases closer attention, or careful sighting, shows a bend where off-hand vision shows a curve. An example of this is offered by Fig. 2, of the north gallery parapet at Pisa, which represents the true appearance, as it would be seen in accurate sighting *from the position taken by the camera.* On the other hand, this same bend, as seen from the floor of the church, will not only be seen as a curve, but even this curve will disappear as a curve in the building construction and will be translated by the eye into a curve in perspective. This amounts to saying that the parapets will be presumed to be straight, and this actually has been the presumption of thousands of observers and of hundreds of experts before the photographs and surveys of the Brooklyn exhibition were made known. No published record of the existence of these bends in elevation of the gallery parapets has ever been otherwise made, and there is no evidence, at present, that they have ever attracted any notice or attention. From the pavement of the church, and from most positions in the galleries, these bends are practically invisible, strange as this assertion may seem when Fig. 2 is examined.

In concluding this account of Pisa Cathedral it is suggested that the reader should review the three articles in which its asymmetries have been described, and consider their remarkable number and variety, although many have not been mentioned for lack of space. On the theory of accident, or of incompetence in masonry construction, it would naturally hold that many other Italian mediæval churches ought also to exhibit all or most of the accidents which have been described; but while many churches exhibit various features which have been described at Pisa, some occur in one and some occur in another, and no other church exhibits them in the same variety of combination, excepting St. Mark's at Venice. It is well known that in order of time the Pisa Cathedral is the first of the large cathedrals of Italy, and that in artistic and architectural importance it has, for its own period, no rival excepting St. Mark's. How is it that all these accidents should have befallen this particular cathedral which was, notoriously, and still is, obviously, the most carefully built cathedral of its time? How is it that *not even one* of these various accidents has befallen the cathedrals of Florence, of Bologna, of Milan, or many other churches which might be named? How is it that the variety and number of the accidents, generally speaking, decrease as regards the Romanesque period with the decrease in importance, in size, in reputation, and in cost, of the given Italian church; and how is it that they decrease in variety and number, as regards the sequence of dates, until they disappear entirely at the opening of the Renaissance period, with very rare exceptions? These considerations are, in fact, the most convincing of all.

They demand, perhaps, a passing reference to St. Mark's at Venice. As regards the systematic employment of asymmetries, I do not believe that St. Mark's was originally inferior to the Pisa Cathedral, although its exterior has suffered sadly from modern repairs. But as regards the separation of the systematic asymmetries, *by modern study,* from those which were inherent in the use of heterogeneous materials, decorative and otherwise, St. Mark's is a much more difficult church to study. Its *native masons* were far inferior to those of Pisa, although *its architects* were not, and

FIG. 9—PISA CATHEDRAL. CURVE IN PLAN. THE SOUTH GALLERY PARAPET, ON THE INTERIOR SIDE, LOOKING WEST

The same curve, concave to the nave, is found on the outer side of this parapet, *i.e.*, on the side photographed for the bend in elevation in Fig. 5. The amount of deflection is about 5 inches (survey in exhibition, No. 70). A corresponding parallel curve in plan, therefore convex to the nave, is found in the north gallery parapet. The curve here shown is opposed in direction to the thrust of the aisle vault below. The parapet of the aisle columns seen on the left of this picture has a parallel curve in plan (survey in exhibition, No. 70). The exterior south wall, also partially seen in this view, has a curve in plan in reverse direction, which begins at the foundations; see Fig. 11

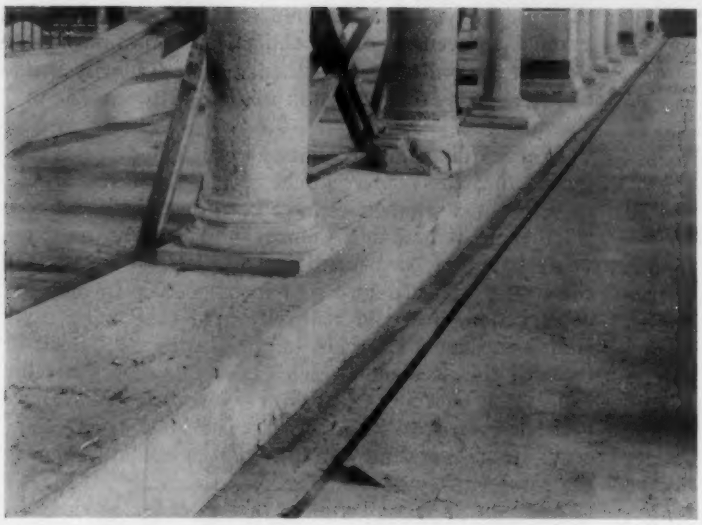

FIG. 10—PISA CATHEDRAL. CURVE IN PLAN NORTH GALLERY AISLE COLUMNS AND SUPPORTING PARAPET, LOOKING WEST

The curve, as here seen, appears to be convex to the north side, but it has a return bend in the direction toward the east, not apparent in the picture (survey in exhibition, No. 70). It thus takes the shape of an attenuated letter S, otherwise known as ' Hogarth's Line of Beauty." The curve in plan of the north wall, convex to exterior (Fig. 12) is well defined at this level and continues up to the cornice of the second story. The curve in plan of the gallery parapet seen on the left of this view has already been described as convex to the nave

the building methods were less careful and less accurate. Hence, the separation of irregularities incident to free-hand methods, and to the individual initiative which was habitual with mediæval masons, is much more difficult at Venice. To these difficulties must be added others supposed to be inherent in the foundations of Venetian buildings, not especially difficult to deal with in reality, but provoking preliminary doubts which must be reckoned with and tenderly treated. For these various reasons, although St. Mark's as a work of art is certainly not inferior to the Cathedral of Pisa, it offers more difficult material for publication and for study. I have published a special Museum Memoir on this church, "The Architectural Refinements of St. Mark's at Venice." I have endeavored to make good, to some extent, by these articles the lack of a similar memoir for the Pisa Cathedral, a lack which has certainly not been caused by any want of interest in the subject, and which has been wholly due to the pressure of Museum routine duties.

A RECENT LEGAL DECISION

Owner's Liability on Contract Fraudulently Prepared by Architect

An architect prepared an instrument purporting to be a contract in duplicate between the owner of a lot of land and a contractor for the construction of a Turkish bath house on the land, in such a way that, by means of a fraudulent shifting of typewritten sheets, the instrument, when signed by the contractor, named as the contract price $33,721, and when signed by the owner, named as the contract price $23,200. The architect made all the payments for the owner and by repeated fraudulent misrepresentations prevented a discovery of the discrepancy between the two writings until the building was substantially completed. The contractor and the owner each acted honestly and in good faith, relying on the statements of the architect. The owner paid the price named in the instrument held by him, and the contractor sued him for a balance of $10,467.16. An auditor found that the market value of the labor and materials furnished by the plaintiff was $33,499, and that their total cost to the plaintiff was $32,950. He found also that the land and building had cost the defendant much more than their market value, and that the increase of the market value of the land by the structure which the plaintiff had put upon it was only $22,000. The court held that the plaintiff and the defendant were mistaken in supposing that they had made a contract for the construction of the building, because their minds had never met, but that, the labor and materials having been furnished to the defendant at his request and such request in legal effect not being limited to the amount of $23,000, which he thought was the price that he had agreed to pay for the completed building, the plaintiff could recover on a *quantum meruit* the fair value of the labor and materials thus furnished and the fact that the increase in the value of the defendant's property from the construction of the building was about $11,500 less than the value of the labor and materials furnished by the plaintiff had no effect upon the amount to be recovered.—Vickery *v.* Ritchie (Supreme Court of Massachusetts), 202 Massachusetts, 247.

ANNOUNCEMENT

The special number on Apartment Houses will be issued on December 22, 1909. An issue on Detached Dwellings will be published on January 5, 1910. These issues will be increased in size over regular numbers.

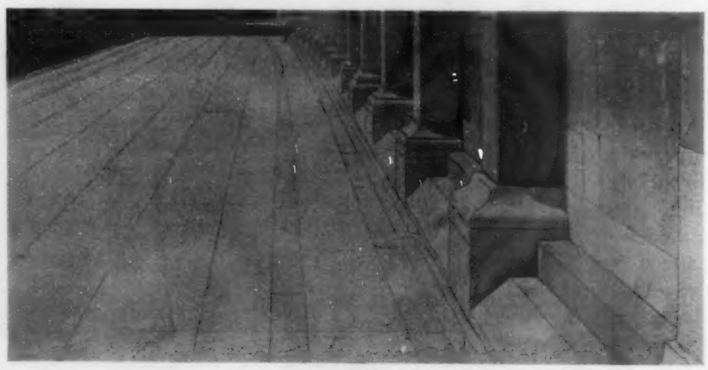

FIG 11—PISA CATHEDRAL CURVE IN PLAN OF THE SOUTH WALL LOOKING WEST

The deflection from the normal line is 22 inches, survey in exhibition No 69. It will be remembered that both clerestory walls have curves in plan which are parallel and which rise from the *level of the gallery parapets up to the roof line*, and that the north exterior wall, which is straight at the foundations, curves in plan at and above the level of the second story. Thus the curves of the exterior walls are parallel and the curves of the clerestory walls are parallel, *but the directions are reversed in the two cases*

THE PRIVATE PLANT PROBLEM

BY JAMES ROBERT MOORE

The problem of whether a private electric plant—or, as it is often called, an "isolated" one—will prove profitable as compared with the service obtainable from a public utility company's central station is one which is supposed by many to be merely a matter of size; but in the course of the writer's experience he has devised a lighting plant for a 15 x 60-foot store which paid for itself many times over before the building which contained it was torn down, and shortly afterward was able to successfully oppose the idea of a private plant for a group of buildings having a ground area of thirty thousand square feet—and that despite the fact that the necessary dynamos were to have been obtained at a nominal price.

The little store was on the Broadway site of the old *Herald* Building, which stood on the site of the St. Paul Building of to-day. It was occupied by Hudnut, the druggist, whose lease entitled him to all the high-pressure steam he could use, but he had to provide all of his own light. The place was so filled with columns, partitions and fittings that daylight never reached more than half way to the rear. As the establishment was open twenty-four hours a day for three hundred and sixty-five days in the year, the amount of artificial light required was something enormous for such small quarters; so that when the first illuminating companies were looking for possible customers, it would be difficult to say whether they or Hudnut were the most anxious to have the store lighted by electricity. But the druggist was a shrewd business man, and, if memory serves, the old United States Electric Light Company wired the premises for him without charge.

The total installation was thirty-six 16-candle-power lamps, for which the charge was a flat rate of something like $100 per month. After several years' operation a fire was discovered one day just as it had broken out around the cut-outs. No great damage was done, but this new possibility of electricity so frightened the management that the current was cut off on the following day, and gas burned until somebody conceived the idea of putting in a private dynamo.

The only available space was a closet under the stairs leading to the *Herald's* editorial rooms and entered through a door in the mirrors back of the soda fountain. This closet was about 5 feet wide, 8 feet long and graduated from 2 feet high at one end to 7 feet at the other. It did not take long to place a vertical steam engine at the high end and belt it to a dynamo in the low end, and to run a pipe from the boiler room to the engine and wires from the dynamo to the lamps; and the total cost was less than $700.

Not only was steam furnished by the *Herald*, but the license of its engineer covered the entire building, and Hudnut's apparatus was really looked after by one of the soda clerks who had grown up in the atmosphere of his grandfather's machine shop; consequently the only operating expenses were the little things which would ordinarily be considered incidentals.

The group of buildings referred to where a plant seemed undesirable was—and still is—Durland's Riding Academy, and its equipment consisted of about 1,000 lights, a large wagon elevator, a passenger elevator and a small ventilating fan.

Mr. Durland's son was then manager of the Sprague Electric Company, which brought out a new type of dynamos shortly after work was begun upon the Riding Academy, and for the sake of having so prominent and convenient a location for an "exhibition plant," they made a proposition which in itself was most attractive. But the only way that a place could be made for the machinery was by enlarging the boiler room, and that meant excavating solid rock and then installing heavy mains to carry the entire output of the plant some 300 feet to the centers of distribution necessitated by the arrangement of the buildings. The cost of those two items just about offset the "special rebate" on the dynamos. Moreover, the plant would have had to be large enough to supply the total equipment whenever the "ring" was in use in the evening, although that would occur for less than four hours on about 125 days per year, while at all other times only about one-tenth of the lights would be wanted, and yet more than three times that generator capacity would have had to be kept always running in order to operate the elevators whenever they might be required.

With the saving on the cost of the dynamos practically wiped out by the cost of excavating and of mains, thus leaving the total investment and the fixed charges quite normal, and with the load conditions preventing economical operation of the plant and necessitating a considerable portion of the apparatus standing idle most of the time, the proposition lost all of its attractiveness and was speedily dropped.

Although the conditions in the foregoing cases were as extraordinary as they were antipodal and probably will never be duplicated, their analysis discloses the key to the general problem.

In the first place, it is evident that neither the size nor the field of service, nor the quantity of equipment to be operated, have any direct bearing upon the question.

It is also apparent that the aggregate amount of current consumption—the "kilowatt hours"—will not decide the matter, for the maximum load at Hudnut's was less than the minimum at Durland's, and in both cases twenty-four hour service was required.

Utilization of the exhaust steam is not an absolute essential either, for it all went to waste at the drug store, and every bit would have been used for heating the riding academy during cold weather; and, although Hudnut's steam cost them nothing, they could have well afforded to pay a fair price for it—the intervals in which the plant paid for itself would simply have been a little longer.

With size, total consumption, cost of power and use of exhaust steam all eliminated, there is nothing left to compare—or should we say contrast?—except the variations in the demand for current—"the load factor." But in order to get at that we must determine the kilowatt hours.

That question is a simple one if we are to consider a building which has been taking street current for a year or more, for then the bills will supply the necessary data.

But in the case of a building not yet finished, or of one in which electricity has not long been used, the only safe guide is an intelligent comparison of the consumption in similar cases. The owner very rarely has anything to base his ideas upon except the quantity he needed when in smaller quarters, and he very naturally supposes that the central station people can tell exactly by simply referring to their records of the amounts supplied to other buildings of comparable size and usage, and undoubtedly they can. But I have yet to see an instance in any city where the illuminating company's estimate of the kilowatt-hours was not very materially exceeded in actual experience. Perhaps they are afflicted with sympathetic economy. At all events, the genesis of our problem is: Estimate a liberal quantity. Possibly it will not be needed the first year, or even the second; but there are buildings ten or twelve years old whose demands are still increasing.

Once the kilowatt-hours have been decided upon it is easy to calculate what the cost of street current will be, and we can also ascertain the load factor.

In almost every case the owner knows pretty definitely what the ordinary hours of business will be, as well as when there will be cleaners and watchmen on duty, but as we have already found him dangerously prone to overestimate the possibilities of rigid economy in the use of current, we dare not rely upon his ideas of the probable loads at various times. Nor is our central station friend in a position to give as much assistance, for his ordinary meters merely make a continuous record of the quantity, and it is only in rare and special cases that he goes to the trouble of attaching instruments which record the load fluctuations. Therefore, whatever data he may have is apt to be so sporadic and based upon such unique conditions as to be inapplicable to ordinary cases. But the owner's ideas of business hours, etc., will give a good clue to the normal load divisions of a day, even if we do not know pretty closely ourselves. Now, if we separate all of the current requirements into "steady load" and "intermittent load," and then carefully assign the proper quantity of each class to each of the "load periods" into which we have divided the twenty-four hours we will have a "load chart" from which we can deduce the maximum and minimum of steady and intermittent load for each period.

With this chart correctly worked out our problem becomes simply a study of ratios; and if we find that the hours of large demand equal one-third of the day's run, and that for at least three-quarters of the time the total range of intermittent load is less than one-half of the steady load, it is pretty safe to assume that a private plant will prove profitable in every instance where there are boilers or other apparatus to be operated, and where the exhaust steam can be utilized for any appreciable period. Of course there can be no hard and fast rule, as no two sets of conditions are absolutely identical, and any individual factor may be fully offset by some other one. In fact it is probable that each specific case possesses at least one abnormal factor which, if not neutralized by something else, would most emphatically decide the question pro or con, as was shown in the matter of attendance at Hudnut's, and even more clearly in that of first cost at Durland's. A still different illustration is found in the case of a factory building in which belting and shafting transmission was superceded several years ago by an electrical power equipment—lighting and heating being minor considerations and the energy devoted to them being negligible—and although the exhaust is wasted and the plant only runs nine hours a day, its average load is approximately two-thirds of its capacity. Practically none is "intermittent," the maximum and minimum are not very far apart, and the output of the establishment has been increased about 20 per cent. with absolutely no additional operating expenses, and at less than one-half the cost of street current.

Now, if we were to make up the load charts for our original pair of examples we would find that at Hudnut's the maximum load was required for more than half of the hours of every day, and the minimum was fully 50 per cent. of the total. At Durland's the maximum was only needed for a few hours on about one-third of the days in the year and the minimum was less than ten per cent. of the whole and at the same time was but one-third of the quantity that might be demanded at any instant. Therefore, the ratio of kilowatt-hours to the kilowatt capacity of the necessary plant was very high in the one instance and very low in the other, from which it is easy to see that the cost of street current for the small installation would be large in proportion to the fixed charges and operating expenses of its plant, while exactly the opposite condition would prevail in the other case. As soon as those ratios are indubitably determined for any specific set of conditions our problem is solved.

THE LEGAL RESPONSIBILITY OF AN ARCHITECT—PART I

BY HOWARD C. LAKE

Publicly professing one's self to be an architect is a representation of the possession of the requisite skill and ability. The public is, therefore, justified in assuming that one professing to be an architect has the qualities of mind, the training and experience which will reasonably fit him for the performance of the ordinary duties of an architect if entrusted to him.

It is our purpose here to consider briefly the liability of an architect for damages because of defects in his plans. Because of the presumption that he possesses the ability and skill required to practice the profession, an architect is liable for defective plans.

The general rule is well illustrated by a Wisconsin case where an architect sued the State for services rendered. Having contracted with the commissioners as an architect, it was decided that he should be held to reasonable skill as such, both in planning the building and in superintending its construction. He was, therefore, held liable for defects in his plans and superintendence resulting from his lack of reasonable skill and diligence, notwithstanding the adoption of his plans by the commissioners and the ratification of his superintendence by their acceptance of the building without objection. This was because the defects were patent

(*Continued on page* 244)

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CONTENTS

THE forty-third annual convention of the American Institute of Architects will be held in Washington, D. C., December 14, 15 and 16. From present indications, it would appear that the attendance of former years will be considerably exceeded. The value to the profession at large of these annual gatherings is becoming more generally recognized each year, and there seems little doubt that the time is not far distant when the attendance will closely approximate the membership of the Institute within a radius of one thousand miles, and include the more prominent members from all parts of the country. The subject which will be given the greatest prominence at the coming convention is announced as "Railroad Terminals." A topic of more general or more rapidly growing interest could scarcely have been selected. Within the last decade we have seen railroad buildings develop from mere shelters of the crudest type to structures rivalling in their architecture and conveniences buildings erected for any other public use. Terminals take their place as, probably, the most important of railroad structures. The railroads have in some instances performed, to a certain extent, the functions of a civic surgeon. They have demolished and cleared away the dilapidated and unsightly buildings in many of the worst section of cities and replaced them with modern, high-class buildings of unusual architectural merit. The result has been far reaching in the development and improvement of cities, architecturally and commercially. The men who have consented to address the convention on various phases of the Railroad-Terminal problem are peculiarly fitted by study and experience to speak on this subject and more authoritative utterances it would be exceedingly difficult to secure.

THE annual convention of the Architectural League of America will be held in Washington, December 11, 13 and 14. The arrangement whereby this convention is held immediately preceding that of the American Institute of Architects seems to be a most fortunate one. An opportunity is thus afforded for members who belong to both organizations to be present at a minimum sacrifice of time and travel. Moreover, there are certain educational questions of importance to both organizations that can be taken up at this time to general advantage. From every point of view, we believe the plan of holding these two conventions in the same city at approximately the same time, to be a desirable one, and we shall expect it to find favor with the delegates to this and future conventions.

THE illustrations of some of the ancient ruins to be found in Mexico, which appear in this issue, are believed to be of more than passing interest to the average architect. They give evidence of a knowledge of architecture and materials, combined with a remarkable facility in their uses, that may well engage the attention and study of modern designers. The chief quality of these old structures, is, perhaps, picturesqueness; but there is also a directness of construction and an ability to express the uses of the building which command admiration. There is undoubtedly much to be learned by a contemplation of the architecture of early times, aside from that of the ancient cities of Italy and Greece, so familiar to the members of the profession. A trip through the scenes of the early habitations of man seldom fails to furnish much of value and interest to any one whose vocation or pleasures lie in the direction of study of architectural forms.

THE destruction, by fire, a few days since, of "Idele," the famous Manor House, at Red Hook, N. Y., in which Chancellor Livingston lived when he administered the oath of office to President Washington, marks the passing of another Colonial landmark. The incident suggests again the thought to which we have given expression heretofore; that all of these monuments of Colonial days which merit preservation, should be measured, drawn and photographed for the education and pleasure of future generations. It is true that a considerable number of these buildings will be so perpetuated by virtue of action already taken, but there are still many examples unrecorded, which, in a few years, will have fallen into such a state of dilapidation and decay, as to be beyond the possibility of accurate measurement or record. If architects in general throughout the country would see to it that buildings of this character falling under their observation were preserved by drawing and photograph, they would render an undoubted service to their posterity.

(*Continued from page 242*)

to an expert, such as the architect professed to be, although they were not of a character to attract the attention of or even be discernable to the layman, such as the commisioners were. The court did not determine, however, whether the failure of the commissioners in their duty would, under any and all circumstances, excuse a want of reasonable skill or diligence on plaintiff's part.

To the same effect is a Nebraska case (Erskine *v.* Johnson) decided over two decades ago where it appeared that a contract had been entered into between an owner and contractor for the building of a home according to certain plans and specifications which had been prepared by an architect. The work was to be under the superintendence and control of the architect and performed to his satisfaction. It was found that a mistake had been made in the plans and specifications which necessitated changes, thus increasing the cost of the dwelling. The architect directed the contractor to make the changes in order to complete the contract. In a suit against the owner he was held liable to the contractor for such extra cost although the court remarked obiter dicta that probably as between the owner and architect, the latter will be liable.

Hubert against Aitken was an action to foreclose a lien for services as architects in preparing plans for and superintending the construction of certain buildings. A counterclaim was set up alleging that the plaintiffs (architects) were negligent. The apartment houses were to be heated by steam and the sectional area of boiler flues for the steam heating apparatus was largely in excess of the sectional area of the chimney flues designed to receive the smoke from the boiler fires. This entailed the cost of building new chimney flues on the defendant. The court held that the architects were bound to know how to proportion the chimney flues to the boilers and could not excuse themselves by proof that they conferred with the contractor for the steam heating apparatus and obtained from him the dimensions of the chimney flues. This decision was later affirmed without opinion by the highest court of the State.

If the architect is proved to have furnished defective plans, he cannot recover for them, and this, even though they have been accepted by his employer. An illustration is found in an English case where the architect recommended building on an unsuitable soil which he had examined and which, it was held, his knowledge and experience should have told him was unsuitable for the purpose. To the same or similiar effect is another case where an engineer was held negligent in not having examined the ground for the foundations of a structure. Because of his neglect, an error was made in his estimates, and no recovery was permitted for his work.

So, also, it has been held in Illinois in an action by an architect for services rendered, that a negligent or fraudulent contract disentitled him to payment, it appearing that he permitted a contractor to do poor work and furnish inferior materials.

In the class of cases which we have been considering it is incumbent upon the employer, who alleges defective plans as a cause of action for damages against an architect, to prove that the plans and specifications have been substantially complied with. This is the doctrine of a case in the highest New York court where a variance appeared involving the integrity of the mode of construction of the affected part (an arch in an opera house building), which was held so far material as to have possibly been the direct cause of the injury complained of by the owner. The architect, who had practiced in the metropolis for many years and had made a specialty of theater construction, was held not liable. It was held to have been error even for the trial judge to submit to the jury the question as to whether or not the variance did or did not cause the injury. The court stated that the owner was contracting for the experience and technical knowledge and skill of the architect and it was upon the infallibility of his own judgment that the architect relied when he made his guaranty that if the arch was constructed in accordance with his directions it would stand. The arch was not proved to have been so constructed.

So far in this article we have considered only the question of defective plans. There yet remains to take up the matter of care required in superintendence. Reasonable care and diligence is required of an architect who contracts to supervise construction work and to issue certificates thereon.

(*To be continued.*)

ARCHAEOLOGICAL RELICS FROM THE SEA

In 1907 a Greek sponge-fishing craft discovered, three miles off the coast of Madhia, between Sousse and Sfax, at a depth of about 150 feet, the wreck of a vessel some 100 feet long and 20 feet beam. The cargo of the sunken vessel consisted of 60 columns of white marble arranged in six rows, the columns being topped with Corinthian or Ionic capitals, and otherwise painstakingly and artistically carved. Furthermore, there were several statues.

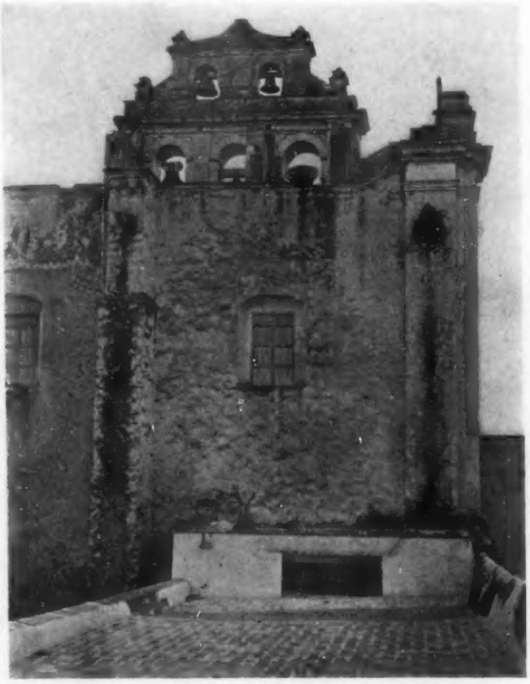
M. A. Merlin, Director of Antiquities, of Tunis, has advanced the theory that the vessel was an ancient galley which had left Greece, bound probably for Italy. Contrary winds had driven it on the coast of Tunis, where it foundered at a time which may be approximately placed at about the beginning of the Christian era.

The relics which have been brought to the surface from this ancient wrecked ship are undoubtedly of Greek origin. Several bronze statutes have been recovered. One of them, a figure of Eros, is thought to be a replica of the Eros of Praxiteles. There is also a Hermes of Dionysius, fragments of candelabra and of beds, also a statuette about 14 inches high, which might have served as a lamp, for the head is hollowed out to form an oil well.

The marble relics are more numerous than those of bronze. They comprise capitals of various decorative designs; drinking cups embellished with Bacchic bas-reliefs which remind one of the celebrated Borghese vase of the Louvre; statuettes, busts, and the like. One column which was brought ashore measures 13½ feet in height, and nearly 2 feet in diameter at the base.—*The Scientific American.*

The photograph above shows the old Spanish Church near the pyramids of San Juan, Teotihuacan.

Below is a view of the belfry of the old Church of San Angel, at San Angel. This is the section of Mexico that produces wonderful flowers and fruits and where orchards abound.

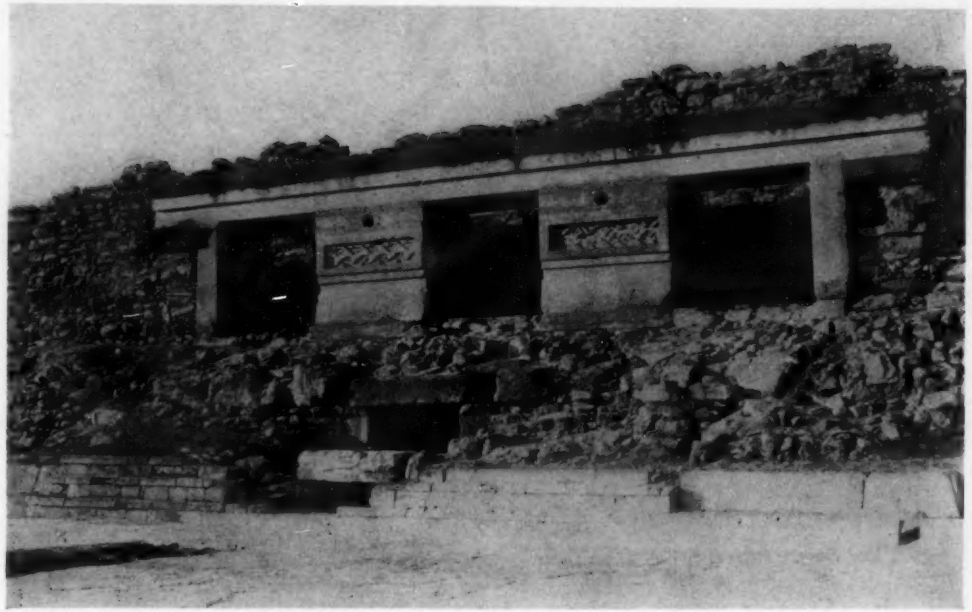


Concrete-encased sails from a storm-tossed ship, at the shrine of Guadalupe, near Mexico City. This curious monument was erected by the crew of a vessel to commemorate their delivery from shipwreck. In the middle distance may be seen the chapel erected over the sacred well.

Belfry on church at San Antonio, near the City of Cuernavaca.

VIEWS IN OLD MEXICO

PHOTOGRAPHS BY F. F. McARTHUR



These ruins comprise a number of buildings, mounds and subterranean chambers. The entrance to one of these chambers may be seen under the lintel marked with a cross in the picture at the left. The least preserved of all the buildings is the largest one, overlooking a cement-floored court. It contains a number of rooms, the most noteworthy being the Hall of the Monoliths, the entrance to which is shown in the picture below.

THE RUINS OF MITLA OR MICTLAN

These ruins are in the State of Oaxaca, in the southeastern part of Mexico.

If the visitor asks a native "How old is Mitla," the answer is "Quien Sabe,"—Who knows? This is as correct an answer as the most learned archaeologist can give. Of one thing we may be reasonably certain, Mitla was built before the Christian era:—how many hundreds or thousands of years is mere conjecture. No one knows by whom or when or how these stones were piled, nor does any one know where the builders went to. All traces of them have disappeared.

VIEWS IN OLD MEXICO—PHOTOGRAPHS BY F. F. McARTHUR

Like other ruins of prehistoric times, the visitor must pause to conjecture how these stones, tons in weight, were brought to the spot and elevated to their present positions. One stone alone, over the main entrance, and a number of feet above the ground, is estimated to weigh ten tons. All of these ruins are roofless. If they were ever roofed, and it is reasonable to suppose they were, every trace has long since disappeared.

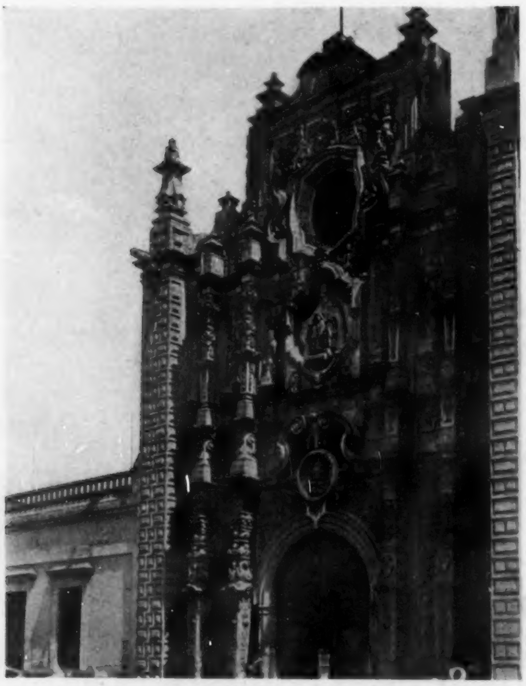
The picture above shows the interior of the Hall of the Monoliths, in the ruins of Mitla. This chamber is about one hundred feet long by twenty wide and in it are set, in one row, six monoliths, equidistant. Each monolith is three feet in diameter at its base and twelve feet high.

The walls of this Hall, as are the walls of all the rooms in these ruins, are of Mosaic, laid up of small hewn stones, fitted and put together without mortar or cement, as shown in picture at right.

VIEWS IN OLD MEXICO—PHOTOGRAPHS BY F. F. McARTHUR

An old doorway, in a church at Mexico City, erected in the early part of the XVI Century.

The picture below is the façade of a XVII Century church also in Mexico City.



Doorway of a church in Mexico City, dating from the XVI Century, shown above, while below is shown the interesting façade of a church at Cuernavaca, built by Cortez about 1529.

VIEWS IN OLD MEXICO

PHOTOGRAPHS BY F. F. McARTHUR

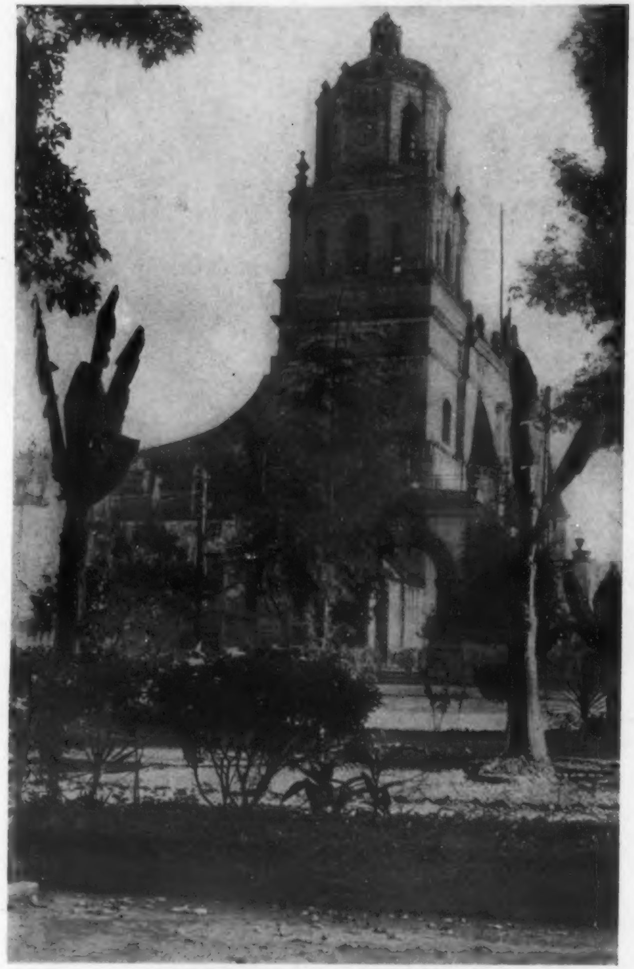
The photograph at the left shows the plaza at Guadalupe, with the cathedral in the background.

This cathedral is the central building of a number of churches and chapels, the entire group being called "The Shrine of Guadalupe," and is considered the most sacred shrine in Mexico.

The first church was built in 1532, and the others and the cathedral soon after.

The high altar shown in another picture is in this cathedral.

The picture at the right is of the Church of San Juan Bautista at Coyoacan, built in 1583.



VIEWS IN OLD MEXICO

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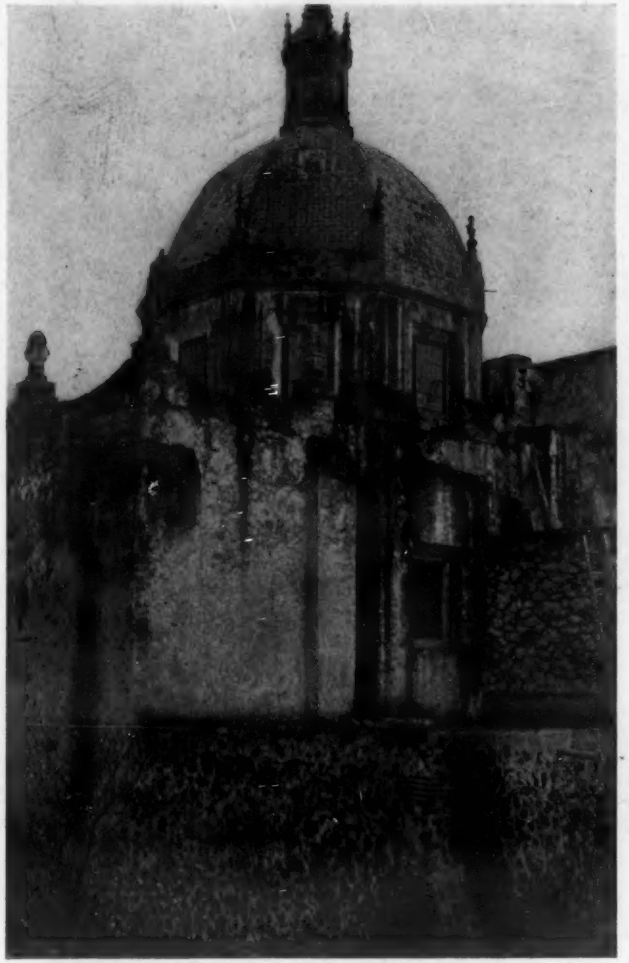

The photograph at the left is of the tower of the church at San Angel. A view of the belfry of this tower may be seen in another illustration.

The picture on the right is the church at the crest of "Saero Monte" (Sacred Mountain) in the City of Amecameca. Prior to 1894 the Passion Play was held at Amecameca, each year during Holy Week. The acted scene of the Crucifixion was near this church.

The church dates from the early XVI Century.

VIEWS IN OLD MEXICO

PHOTOGRAPHS BY F. F. McARTHUR

The photographs above are street scenes in the picturesque City of Guanajuato. This is a terraced city and every available spot on the hillside slopes has its adobe building. The variegated stone found in this neighborhood is used in the construction of the finest buildings. It has all the colors of the rainbow, but green predominates.

The pictures below are details of an aqueduct built by the Spaniards in 1603. The view at the left is one of the many shrines built into and along the line of the aqueduct, while the photograph on the right is of El Salto de Aqua (the fall or supply of water) and is the end of the aqueduct of Chapultepec.

VIEWS IN OLD MEXICO

PHOTOGRAPHS BY F. F. McARTHUR

The picture at the left is of the high altar in the cathedral at Guadalupe. The chancel is surrounded by a silver railing on a base of white marble. The three statues are of Carrera marble. The altar is built of marble, onyx, mahogany and ebony. The view at right is the altar of the church at San Francisco, Toluca, Mexico, which was founded in 1585.

The spire and portal shown in the photograph at left is of a church in Cuernavaca, built by Cortez in 1529, while the view at right shows the cathedral at Cuernavaca, also built by Cortez.

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