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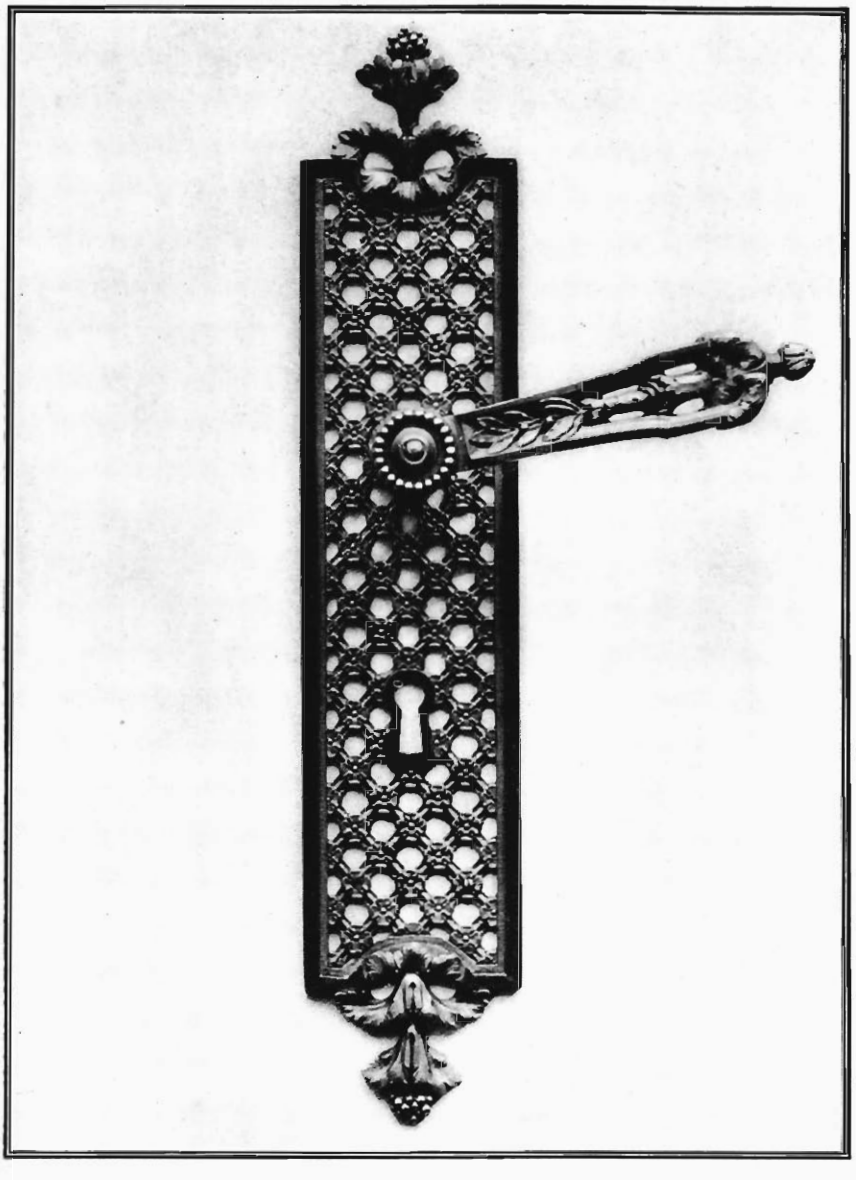

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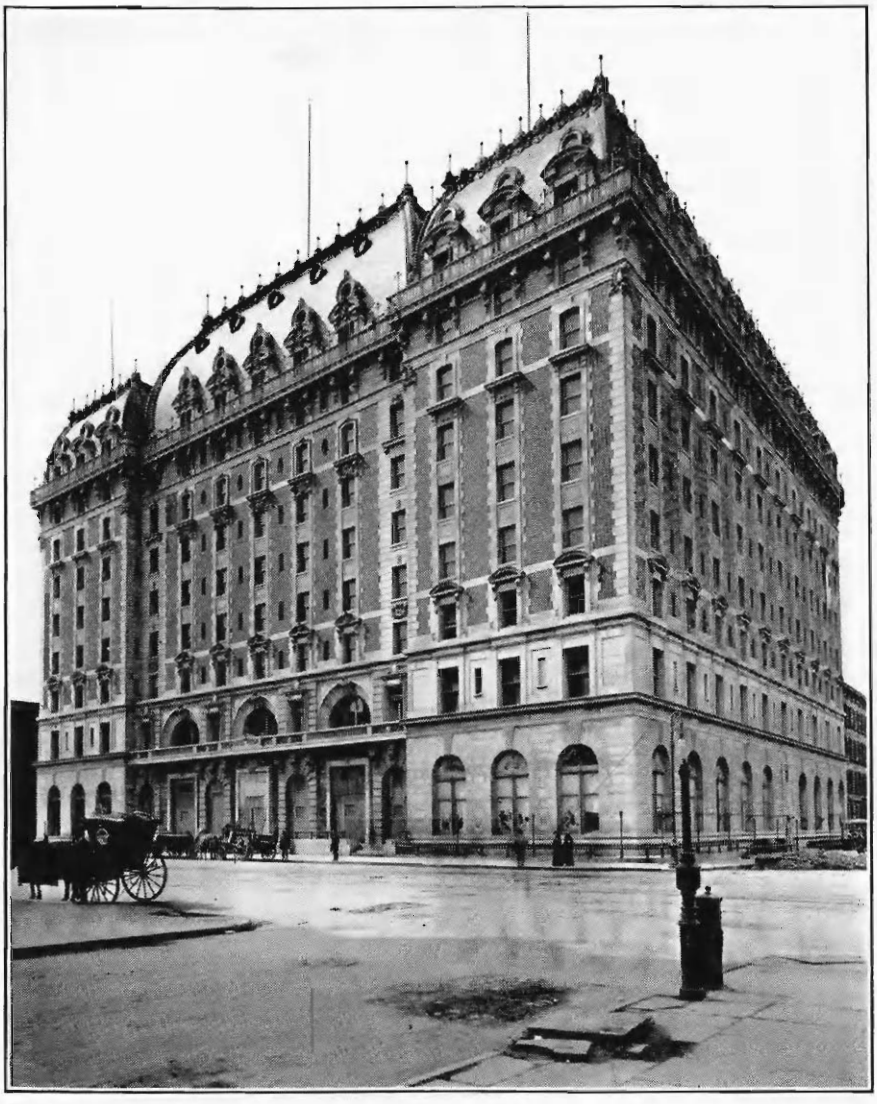

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ARCHITECTURAL REFINEMENTS IN EARLY BYZANTINE CHURCHES AND FRENCH CATHEDRALS.*

IN the Architectural Record for July-September, 1896, Vol. VI., No. 1, was published an essay on "Optical refinements in mediæval architecture," which was followed by a series of six papers under various individual titles, but all relating to the same general subject (the concluding paper of this series was published in Vol. VII., No. 3, for 1898).

These papers furnished the report of an investigation which had been undertaken by the writer under the auspices of the Brooklyn Institute of Arts and Sciences, and which was carried on, in Italy, between the months of May and October, inclusive, of 1895. The general results of this investigation were summarized in the preliminary report, having the above-quoted title, under fourteen headings, and from these announcements we will now draw attention to the following, which were the first three in order of mention.

The first announcement related to vertical curves in mediæval church interiors: "The construction of the piers of many mediæval churches in a delicate curve, sometimes leaning into the nave, sometimes bending back from the nave, and in either case making a delicate return curve to the arch of the vaulting." The second heading announced the existence of "a refinement analagous to the last-named, and probably the original and earlier form of it," viz., the survival in the Middle Ages of the classic entasis.

The third heading mentions: "A refinement possibly or probably derived from the first-named, and frequently connected with it; a leaning outward and away from the nave of the nave piers, in phases grading from an exaggeration of the backward bend, and continuing the curve, to others in which the leaning backward, or spread, of the nave piers is in a straight line and not in a curve."

For the sake of brevity this arrangement will be described as the "widening" or the "widening refinement" in the later mentions of this paper. An account of the motives probably underlying this refinement has been given in Memoir No. 2 of the Brooklyn Museum Memoirs of Art and Archæology.*

It was further mentioned in the preliminary report that careful attention had been given to the question whether accidental causes might not be a sufficient explanation of the phenomena, and that

*The illustrations of this paper are from photographs of the Brooklyn Museum Surveys, of the series of 1903.

*"The Architectural Refinements of St. Mark's at Venice," with 14 plans and 44 illustrations. Published by the Macmillan Company.

a negative answer to this question must be given. This question was also subsequently debated at considerable length in two of the following papers, which were respectively entitled, "A discovery of the entasis in mediæval Italian architecture," and "An echo from Evelyn's diary."

Observations in Italy.

As far as Italy is concerned all possible scepticism as to the refinements just described was laid to rest in 1901. In the Summer of that year additional observations were made, of a wholly convincing character, which bore on the announcements just quoted. Other observations which had previously been a matter of personal assertion were corroborated by photographs and measurements. Finally, certificates regarding the constructive facts in the two most celebrated Romanesque buildings of Italy were obtained from the Italian engineering experts who were respectively in charge of the Pisa Cathedral and of St. Mark's at Venice.

A review of some 3,600 words in length, by Antonio Taramelli, accepting the statements which had been published on behalf of the Brooklyn Museum Surveys, had meantime appeared in L'Arte, the leading art journal of Italy (Vol. III. for 1900). A review accepting the announcements for St. Mark's at Venice was subsequently published by Alfredo Melani, in the Gazetta di Venezia for November 9, 1903. Personal letters, of an approving character, were also addressed to the author of the reports, by Giacomo Boni, the excavator of the Roman Forum, who has been at various times associated with the repairs of St. Mark's, by Francesco Saccardo, one of the authors of Ongania's publication for St. Mark's, by Professor Pompeo Molmenti, President of the Venetian Academy and a distinguished authority on the history of Venetian and Italian art; by Baron Henry De Geymüller, the distinguished German architectural authority, who has edited the most recent edition of Burckhardt's "Cicerone" for Italy, and by other experts of distinction.

Under these circumstances it is sufficient to say for the observations in Italy regarding vertical curves and bends, and the system of diverging piers, that they have so far included some twenty-one Italian churches and cathedrals, most of which have been illustrated in one or more publications, and especially in Memoir No. 2 of the Brooklyn Museum Memoirs of Art and Archæology.

Among these twenty-one churches it would be possible to single out a few in which the observations might not be regarded as wholly convincing, from the standpoint of an engineering expert, but the following list may be regarded as a list of impregnable cases from

the standpoint of the expert in construction: St. Mark's and S. Giorgio Maggiore at Venice; the Cathedral and S. Lorenzo, at Vicenza; S. Ambrogio and S. Eustorgio at Milan; S. Michele, at Pavia; Ss. Pietro e Paolo, Bologna; the Cathedral of Borgo San Donnino; the Cathedral and S. Paolo Ripa d'Arno, Pisa; Sta. Maria della Pieve, Arezzo; S. Agostino, Orvieto; and the Cathedral of Trani.

Before speaking of churches outside of Italy it is important to rehearse the evidence for constructive intention in the instances mentioned.

St. Mark's at Venice. Certificate from the engineering expert in charge of the church in 1901. Unanimous concurrence of other experts in Venice, as far as heard from. The widening of the nave (nearly 3 ft. in amount) would have caused the collapse of the church, if it had been accidental. The widening effect of the left aisle is managed by inclinations of engaged columns against a wall which has the north vestibule on its opposite side. The widening effect in the north vestibule is obtained (on the given side) by leans of engaged columns, which incline against the wall in the direction opposed to that of the engaged columns in the left aisle. In other words, engaged columns lean against the same wall in opposed directions on opposite sides. The inclinations by which the widening is effected in the side aisles are repeated in engaged pilasters facing the transept walls, which are not exposed to thrust or settlement. The east and west leans of the transept system are found in the engaged pilasters of the north and south end walls of the transepts. The engaged pilasters in the angles of both transepts repeat the leans called for by the general system of parallel treatment, at points where such leans could not be caused by thrust or settlement. The north and south leans of the end walls of the transepts (which are not subjected to any thrust), lean out to an amount (of over one foot in thirty feet) which would have caused the collapse of the adjacent arches, if these leans were accidental, whereas these arches are all perfectly true and in good condition.

S. Giorgio Maggiore at Venice. Aside from the widening of the nave, the refinement is systematically employed in the piers of chapels in the side aisles which are not exposed to thrust. The widening is not produced by an exaggerated entasis, because the same entasis is found on both sides of each aisle, whereas the widening lean is only found on each exterior side of the aisle.

S. Lorenzo, Vicenza. The widening of the side aisles is repeated in an outward lean of the exterior accessible wall, having buttresses of homogeneous and contemporaneous construction with exterior perpendicular faces.

S. Agostino, Orvieto. The inside widening is repeated in exterior outward leans of the side walls, while the buttresses, of homogeneous and contemporaneous construction, have faces which lean inward against the walls.

Vicenza Cathedral. The vertical curves are found in the pilasters of the chapel walls which face on the nave and which are 25 ft. deep.

S. Ambrogio, Milan. S. Eustorgio, Milan. S. Michele, Pavia. The widening is carried out in the aisles by leaning pilasters, which face chapel walls of considerable depth, and which are at right angles to the line of thrust.

Borgo San Donnino. The widening appears in the apse, in pilasters which are not exposed to thrust.

Ss. Pietro e Paolo, Bologna. The widening of the clerestory walls extends to the points at which they are interlocked in the end walls, and where they are not exposed to thrust.

Pisa Cathedral. Vertical curves in the piers at the crossing. Certificate for constructive facts from Signor Annibale Messerini, engineering expert in charge of the building.

S. Paolo Ripa d'Arno, Pisa. Vertical curves in engaged pilasters at the apse which are not exposed to thrust.

Sta. Maria della Pieve, Arezzo. The widening system is carried out so as to include engaged pilasters which are not exposed to thrust or settlement.

Cathedral of Trani. The widening of the nave piers at the transept crossing extends from the pavement up. The thrust of the arch is inconsiderable, and it thrusts against transept walls of considerable depth.*

It may be frankly admitted that there is no impregnable constructive evidence to be offered for the following seven Italian churches: Cremona Cathedral (vertical bends bulging into the nave to the height of the aisle, with marked widening in the upper nave); Perugia Cathedral (piers leaning outward in straight lines from the pavement up); Arezzo Cathedral and Sta. Trinitá, Florence (vertical curves); Siena Cathedral (ruined portion, vertical bends, doubtful case); Cathedral of Aosta (not personally examined); Capella Palatina, Palermo (widening of the apse comparatively insignificant).

The following list mentions a number of important Italian mediæval churches which were examined in 1895 (some of them re-examined in 1901), and in which the refinements of the widening, or of the vertical bends and curves, have not been so far observed: Venice, Churches of the Frari and of Ss. Giovanni e Paolo; Ravenna, S. Vitale; Ancona, S. Ciriaco; Bologna, S. Petronio; Padua,

*All the buildings cited are represented by large photographs in the Brooklyn Museum exhibit, excepting Borgo San Donnino.

S. Antonio; Verona, the Cathedral and Sta. Anastasia; Milan, the Cathedral; Piacenza, the Cathedral; Modena, the Cathedral; Parma, the Cathedral; Florence, the Cathedral and Sta. Maria Novella; Lucca, the Cathedral; Assisi, the Cathedral; Siena, the Cathedral (completed portion); Rome, Sta. Maria Sopra Minerva.

The above list of negative results is confined to vaulted buildings, as the refinements in question would be unavailable in columnar basilicas, outside of the apse, unless they resembled the Pisa Cathedral and Trani Cathedral in having transepts with piers supporting arches which span the nave at the crossing.

It will be noticed that the observations in Italy for the refinements which are in question in this paper are very evenly balanced numerically, as regards positive and negative results.

As regards period there is no late Gothic church in Italy, and only one Renaissance church, which has so far been observed to show the given refinements. On the other hand, the list of observations with negative results includes several late Gothic examples.

If the negative results are compared with positive results for the Romanesque period, it appears that the positive results are obtained in several buildings of Romanesque period having great fame and distinction, such as St. Mark's at Venice; S. Ambrogio, Milan; S. Michele, Pavia, and the Pisa Cathedral. These may be contrasted with the less important Cathedrals of Modena, Parma and Piacenza, Padua and Ancona.

As regards buildings of distinctly Byzantine character, we have the splendid St. Mark's at Venice, on the positive side, as against the less important S. Vitale on the negative side.

The situation for Italy, as far as known, may then thus be summarized. No late Gothic examples of the particular refinements in question are so far known. Several early Gothic examples are known, among which Cremona Cathedral (if admitted as a constructive case) must be considered very important. The Romanesque churches giving positive results are more important buildings than those giving negative results. The most famous church in Italy is the only one known in Italy in which there are intersecting systems of vertical bends for both nave and transept. (In St. Mark's the details of the intersecting systems are elaborated with incredible ingenuity and persistence.)

The conclusions to be drawn from the above comparisons for Italy would be that the given refinements were gradually abandoned before or during the close of the Gothic period, and that they were introduced into Italy under Byzantine influence.

Observations which were undertaken in 1903 at Constantinople have confirmed the conclusion regarding Byzantine influence. Observations in France have much increased the list of early Gothic

cathedrals showing the given refinements, but they have not antagonized the conclusions regarding the later Gothic period.

Observations at Constantinople.

It is the special object of the present paper to give an account of observations which were made at Constantinople and in Northern France, during the Summer of 1903, for vertical curves and bends and for the phenomenon of constructive divergence, or widening of mediæval interiors in the upward direction. These observations will be offered as far as possible in the shape of photographs, with comments and descriptive text relating directly to the photographs.

Fig. 1.—Balaban Aga Mesjid, Constantinople; an undated small Byzantine church, with apse showing an outward divergence, in the lines rising to the arch, of 5½ inches in a height of 12 ft.; width at the pavement, 7 ft. This is an impregnable constructive demonstration for the use of the widening refinement. A short plumb-line hanging from a nail on the right side of the apse establishes the perpendicular. The surveyor's rod (6 ft. high), on the right, furnishes a scale of dimensions.

Fig. 2.—St. Mary Diaconissa, Constantinople; dating 599. View looking toward the entrance. The piers diverge in straight lines from the pavement up. There are plumb-lines on each pier (which are, however, not suspended for the entire height of the church). Surveyor's rod on the right (6 ft. high). It is apparent in this picture that a vaulting thrust could not have spread the piers in this fashion in straight lines beginning at the pavement. This case is palpably constructive. Height to the vaulting, 33 ft., widening at the arch, 16 inches; width at the pavement, 25½ ft.

Fig. 3.—St. Mary, Diaconissa, Constantinople. View looking toward the choir; showing vertical bends of a character which are palpably not due to thrust. Height to the springing of the vaulting, 33 ft.; amount of the bend on the right side, 11 inches. Total widening, something less than 22 inches.

This church has the plan of a Greek cross. The transept arms of the cross exhibit similar bends, which are transverse in direction to those illustrated, thus anticipating by four hundred years the arrangement found in St. Mark's at Venice.

Bends similar to those of St. Mary Diaconissa are found in Sta. Sophia, but permission to make photographs in this mosque could not be obtained. In the commercial photographs of Sta. Sophia the bends are concealed by the large shields, on which are inscribed the names of the companions of Mohammed, which are hung in the angles of the mosque. These bends could be photo-

FIG. 1. APSE, BALABAN AGA MESJID, CONSTANTINOPLE.

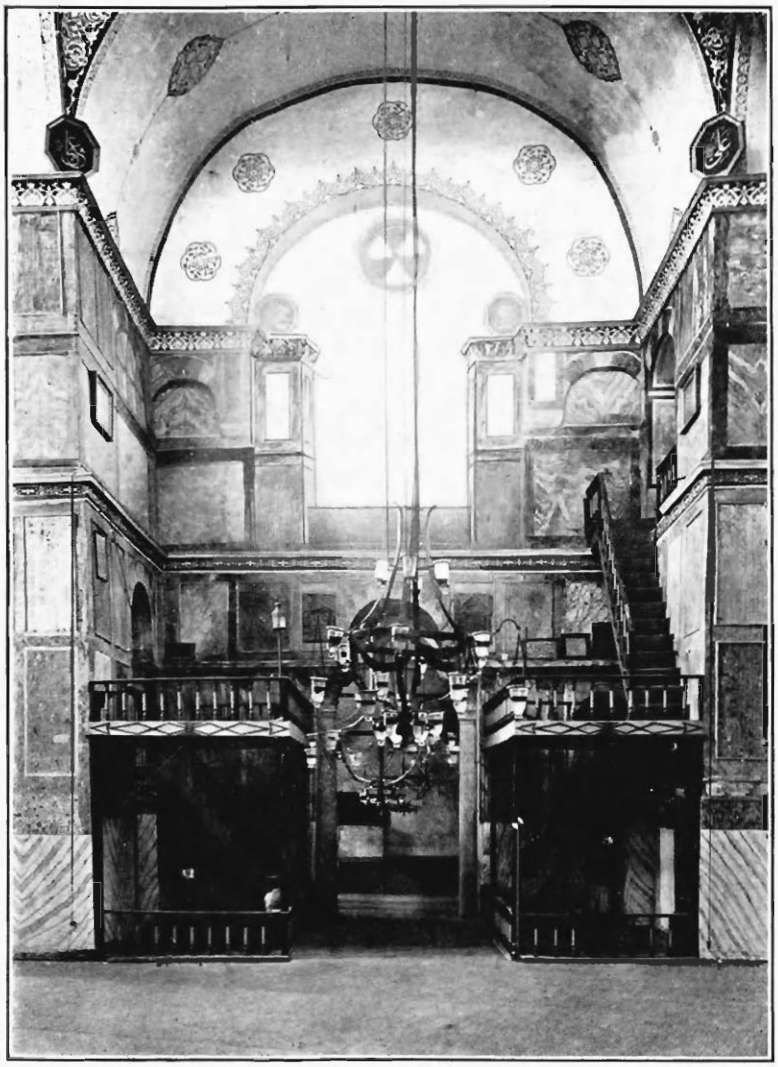

FIG. 2. ST. MARY DIACONISSA, CONSTANTINOPLE.

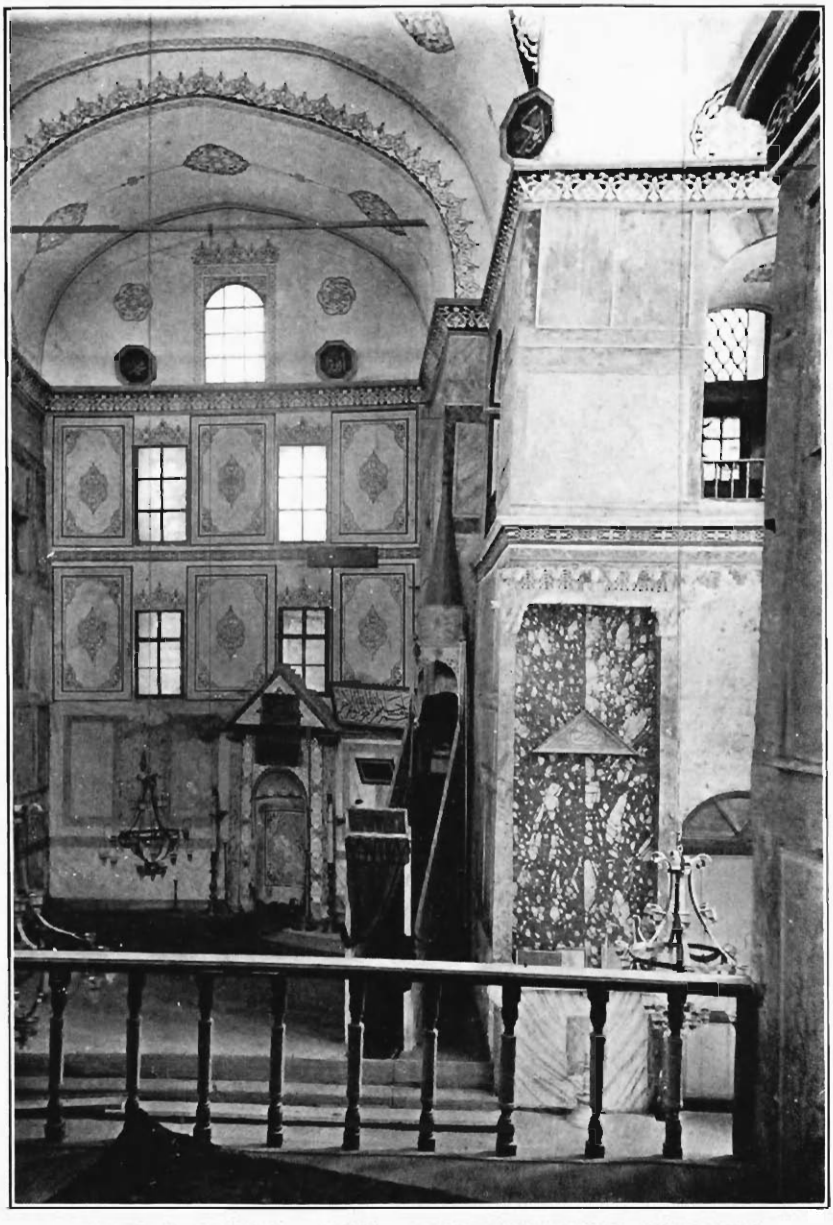

FIG. 3. ST. MARY DIACONISSA, CONSTANTINOPLE. FROM THE GALLERY, LOOKING TOWARD THE CHOIR.

graphed to great advantage from positions in the rear of the shields. Procopius, who wrote a description of the church in the 6th century, mentions that the building "rises from the ground, not in a straight line, but setting back somewhat obliquely."*

The Brooklyn Museum exhibit of enlarged photographs includes another Byzantine church at Constantinople, the Church of the Monastery of the Chorah (11th-13th centuries), which is quoted by Fergusson and other authorities as having furnished the model for the primitive façade of St. Mark's at Venice. This church also has the plan of a Greek cross, and also has two widening systems which intersect one another. The marble casing of the interior is well preserved.

As measured at the choir, the outward bends result in a widening of 9 inches in a height of 21½ ft., with a width at the pavement of 20 ft. The outward bend is partly effected by the inclination and stepping back of four courses of marble panelling, which are directly under the half-dome of the apse. The constructive arrangement of these panel courses is clearly apparent in the excellent enlarged photograph of this church, which is on exhibition in Brooklyn.

The photographs made in Constantinople include fourteen from St. Mary Diaconissa, four from the Church of the Monastery of the Chorah, and three from the Balaban Aga Mesjid. They establish, beyond dispute or cavil, the use of the widening refinement, both with and without vertical bends, as having existed in Byzantine architecture as far back as the 6th century of the Christian Era.

The results indicated by observations in Italy, and especially in St. Mark's, are thus definitely confirmed.

Observations in Northern France.

The following illustrations are selected from a large number of photographs which were made in Northern France in the Summer of 1903.

Fig. 4.—St. Jean at Caen. Two instances have been so far observed in France of the widening in late Gothic. One of these has been selected as an opening illustration for France, because it appears to show very successfully the artistic effect which was obtained and desired by the widening system. This effect is most easily appreciated in naves of relatively low proportions. In this church the system appears to be confined to the piers at the intersection of the nave and transept. By plumb from the gallery the second pier at the transept on the right was found to incline out-

*See p. 25 of Lethaby and Swainson's work on Sta. Sophia.

FIG. 4. ST. JEAN, CAEN, FROM THE CHOIR.

ward 5½ inches in a height of 35½ ft. The entire amount of widening is thus about 10 inches.

Fig. 5.—Choir of the early Gothic Church of St. Loup, at Chalons. Although this view is confined to the choir, the widening system is found throughout the nave. The widening at this point amounts to 13 inches in a height of 32 ft. The width between piers is 24 ft.

This view illustrates, like Fig. 4, the relatively infrequent cases in which the piers of the nave diverge in straight lines, beginning at the pavement. Similar constructions were otherwise found, in 1903, only in St. Thomas at Strassburg and in the church of the Monastery of Montierneuf at Poitiers.* Parallel cases in Italy, for piers diverging from the pavement up, are S. Ambrogio at Milan, the church of Sta. Maria della Pieve at Arezzo, and the Cathedral of Perugia.

The Curate of St. Loup gave the information that the architect in charge of the repairs of the church (M. Aubertin) is familiar with the constructive facts, and that he explained the system of construction as related to the feeling which designed the horse-shoe arch. The same suggestion of a feeling akin to that of the horse-shoe arch is found in the church of the Monastery of the Chorah at Constantinople.

Fig. 6.—The windows at the ends of the aisles of St. Loup at Chalons are built with mullions and exterior sides leaning off in lines which are parallel with the leaning piers. In Fig. 6 we see the window of the right aisle. The pier on the left is the one which is seen on the right in Fig. 5. A plumb-line is suspended from a nail on the right side of the window. (The pole by which the line has been raised to the nail is also leaning against it.) The pilaster to the right of the plumb-line leans off about 7 inches in 24 ft.

The motive of setting the window obliquely is obviously to avoid an over-conspicuous prominence of the primary leans, or to avoid such a contrast between perpendicular and leaning lines as would lead to the detection of the latter. Similar arrangements have been found in other French churches. The system of sustaining a parallelism of leans at all points where a perpendicular would conflict with them is carried out to a marvellous extent in St. Mark's at Venice, as shown by the plumbs which were published in Memoir No. 2.

The Brooklyn Museum exhibit includes two photographs for the left aisle of St. Loup.

The general system of the aisle arrangements in this church

*The Museum exhibit includes an aisle view from St. Thomas at Strassburg, in which the leaning pilaster faces a chapel wall of great depth.

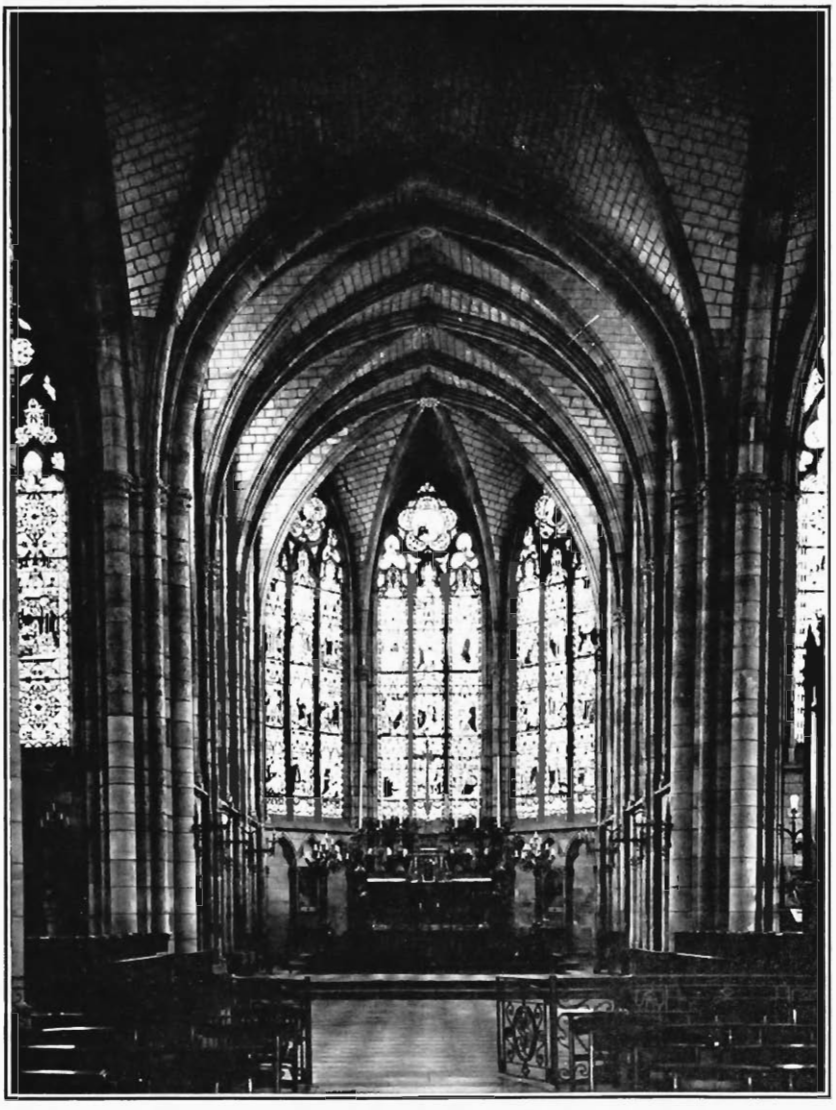

FIG. 5. THE CHOIR, ST. LOUP, CHALONS.

FIG. 6. THE RIGHT AISLE, ST. LOUP, CHALONS.

FIG. 7. THE LEFT AISLE, ST. ALPIN, CHALONS.

and the character of the constructive evidence which these arrangements offer is shown by the following illustration from another church in Chalons.

Fig. 7.—Left aisle of the early Gothic church of St. Alpin at Chalons. The plumb-line which hangs on the second pilaster records a lean of 4 inches in a height of 14 ft. This photograph is a very valuable one for constructive demonstration at a distance from the original monuments. By virtue of the small dimensions of the aisle the deflection is more than usually prominent, in relation to the size of the picture. The self-set task of furnishing obvious demonstrations within the limits of 5 x 7 prints, and even smaller reproductions, is a very difficult one when the average dimensions of the French cathedrals and the really inconspicuous character of these deflections are considered, and it is not often that such convincing pictures can be obtained, although the facts as observed in the churches themselves are frequently quite as convincing.

The picture is especially successful because the slant of the first pilaster happens to contrast in a very distinct manner with the adjacent perpendicular of the side of the photograph.

The fact that the masonry courses are all visibly horizontal is especially to be considered. If thrust or settlement had produced this deflection the masonry courses would dip downward to the left. The same horizontal arrangement of masonry courses is also found in the aisles of St. Loup, which otherwise resemble this view. The Museum exhibit includes a similar photograph for the right aisle of St. Alpin, and two photographs for the nave. The latter has a more delicate and less perceptible widening, but it is well defined notwithstanding. The divergence in the nave is connected with a bend.

Fig. 7 is obviously conclusive as to questions of settlement or thrust. There are three Italian churches from which constructive evidence of the same character has been published, i. e., churches in which there are chapel walls on the exterior side of each side aisle, which are opposed to the line of thrust, and of such depth as to make accidental movement of the masonry impossible. These churches are S. Ambrogio and S. Eustorgio, Milan, and S. Michele, Pavia, as previously mentioned.

Fig. 8.—The left aisle of Notre Dame, at Chalons. The plumb-line records an outward lean of 3¼ inches in 15 ft. The masonry courses of the pilaster in its upper portion and the fillet under the capital are inclined downward to the left. If the wall had gone over accidentally they would incline downward to the right.

The great importance of this photograph lies in its illustration of a vertical curvature, which is uniform in all the pilasters. In face

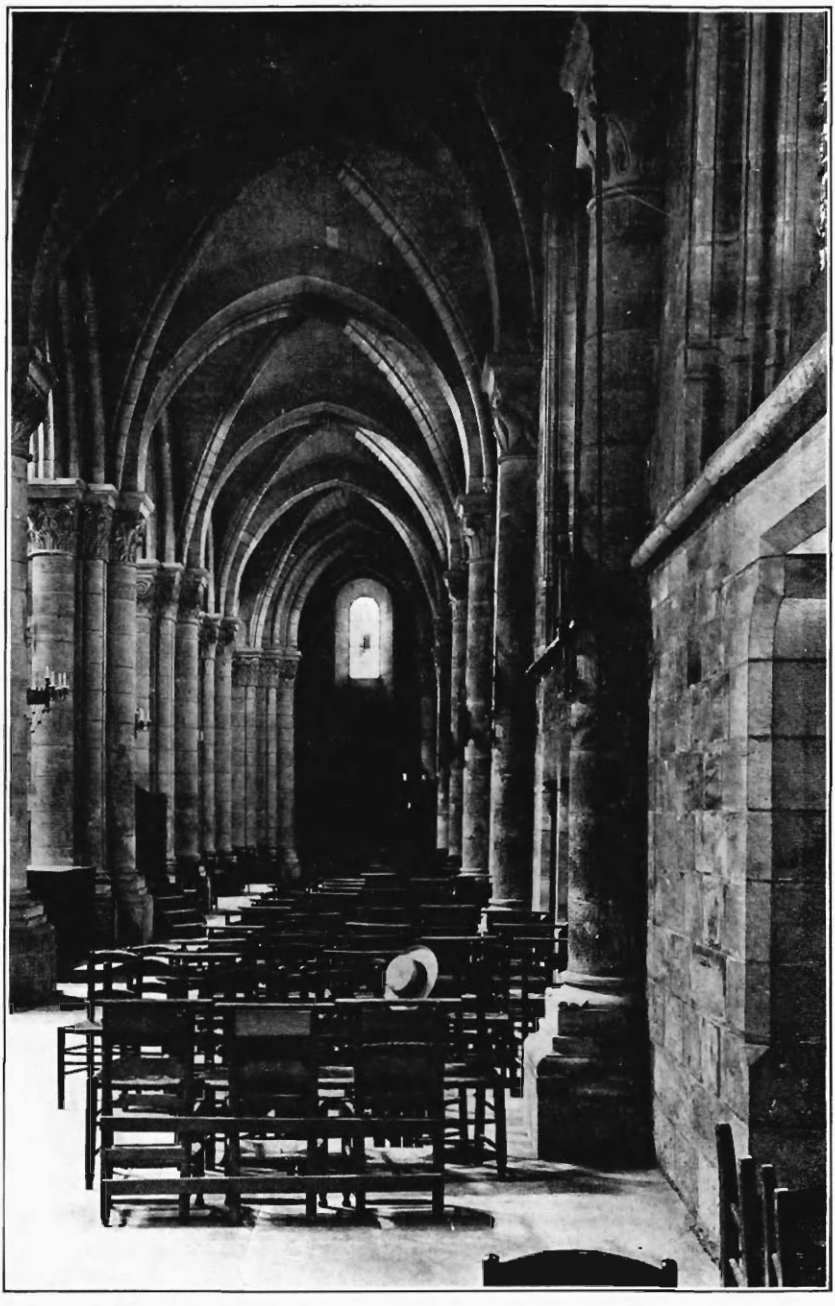

FIG. 8. THE LEFT AISLE OF NOTRE DAME AT CHALONS. LOOKING TOWARD THE FAÇADE.

of this picture it is wholly impossible to deny that a vertical curvature analogous to the entasis and directly related to it was employed in mediæval Europe. A similar observation and a similar photograph have been made in Fiesole Cathedral. Other instances of the mediæval entasis have been quoted in Vol. VII., No. 1, of the Architectural Record. (One of these instances, quoted in 1897, must be withdrawn, viz., S. Miniato, at Florence. The observation was made in 1901 that the pillars of San Miniato are covered with a very deceptive Renaissance stucco, in imitation of green marble, although the church itself is early Romanesque.)

The illustration from Notre Dame at Chalons shows the importance of wide observations and of many of them. In face of this picture the hypothesis that the vertical curves in the naves of French Gothic cathedrals are derived from the classic entasis by way of Romanesque classic survivals or copies seems highly attractive. Much new light on this subject may be expected from a wider examination of the French Romanesque. The observations of 1903 in France were almost wholly confined to Gothic buildings.

The nave of Notre Dame at Chalons shows delicate vertical bends.* The pilasters of the right aisle have the vertical curves, but do not incline outward. This is the only church so far found in Europe in which constructive leans are confined to one aisle. The explanation would naturally be found in a change of builders. The use of the widening in the aisles is not frequent, and it is clear that there were many builders who did not employ it in the aisles.

Fig. 9.—The Church of St. Quentin, from the choir. This photograph illustrates the most pronounced case of vertical curvature which has so far been found in Europe. At the piers on the choir side of the crossing the widening is 2 ft. (Width at the pavement 34 ft.) It is quite evident that the vaulting would have collapsed if such an outward spread had been due to accidental causes.

According to accounts given by the Sacristan, the recently deceased architect in charge of this church (M. Benard), who had presided over its repairs for thirty-six years, was well acquainted with the facts as being constructive, and attributed them to the *hardiesse* of the mediæval builders.

If any additional argument were needed it would be found in the arrangements connected with the system of vertical curves in the transepts, which intersects the system of the nave. This intersection is shown by the following illustrations.

Figs. 10, 11 (Church of St. Quentin), represent two adjacent

*This statement corrects the one recently made regarding the nave of this church in Museum Memoir No. 4.

FIG. 9. THE CHURCH OF ST. QUENTIN. FROM THE CHOIR.

sides of the pier at the southwest intersection of the nave and transept. This pier is the farther pier on the left, at the transept, as seen in Fig. 9. The face which fronts the spectator in Fig. 9 is the eastern side of this pier, and this is also shown by Fig. 10. Fig. 11 shows the south side of the same pier as having curves which intersect at right angles those of Fig. 10. The curves of Fig. 11 belong to the transept system, which is transverse to that of the nave. The same arrangement of intersecting systems of bends has been mentioned as existing in St. Mark's, at Venice; in St. Mary Diaconissa, Constantinople, and in the Church of the Monastery of the Chorah at Constantinople.

It is obvious that these intersecting curves imply very intricate masonry cutting in the stones of the pier. The facts are uniform in all four piers at the crossing of nave and transept.

It is inconceivable that any builder or mason could inspect these intersecting curves as they are seen in this church and attribute them to thrust. If the facts represented by these two photographs are perfectly understood, and if they are understood to be typical for all four piers at the crossing, it is not easy to understand how any architect can question the existence of constructive curves at St. Quentin. The facts are, however, already sufficiently apparent in Fig. 9. The curves and the widening are bound up together in this church. Both must be accepted or both must be rejected, and the only alternative here is to hold that a vaulting can spread ~~X~~ 2 ft. without collapsing.

The use of tie-rods may be noted in the nave (Fig. 9). I was not advised whether these were introduced before the time of M. Benard. The strengthening of the church by these rods was probably advisable, and it is extremely natural, in view of the great divergence of the nave piers, that this expedient should have been suggested at some time later than the original construction, possibly under the recent architect in charge.

Fig. 12 introduces another interesting feature of the Church of St. Quentin. The openings from the transept into the aisles are also constructed with a widening. Thus the nave piers bend slightly into the nave before they curve away from it higher up. This is seen in Fig. 9 as well as in Fig. 12.

On the other hand, Fig. 12 shows the vaulting-shaft on the left as bending slightly toward the perpendicular above the widening. The Brooklyn Museum exhibit includes four pictures in which these facts are found to be uniform. The return curve of the vaulting-shaft is more clearly seen in these other pictures than in the one here published. In this picture a portion of the vaulting-shaft is concealed.

A widening of the aisles in two directions is unusual. In the

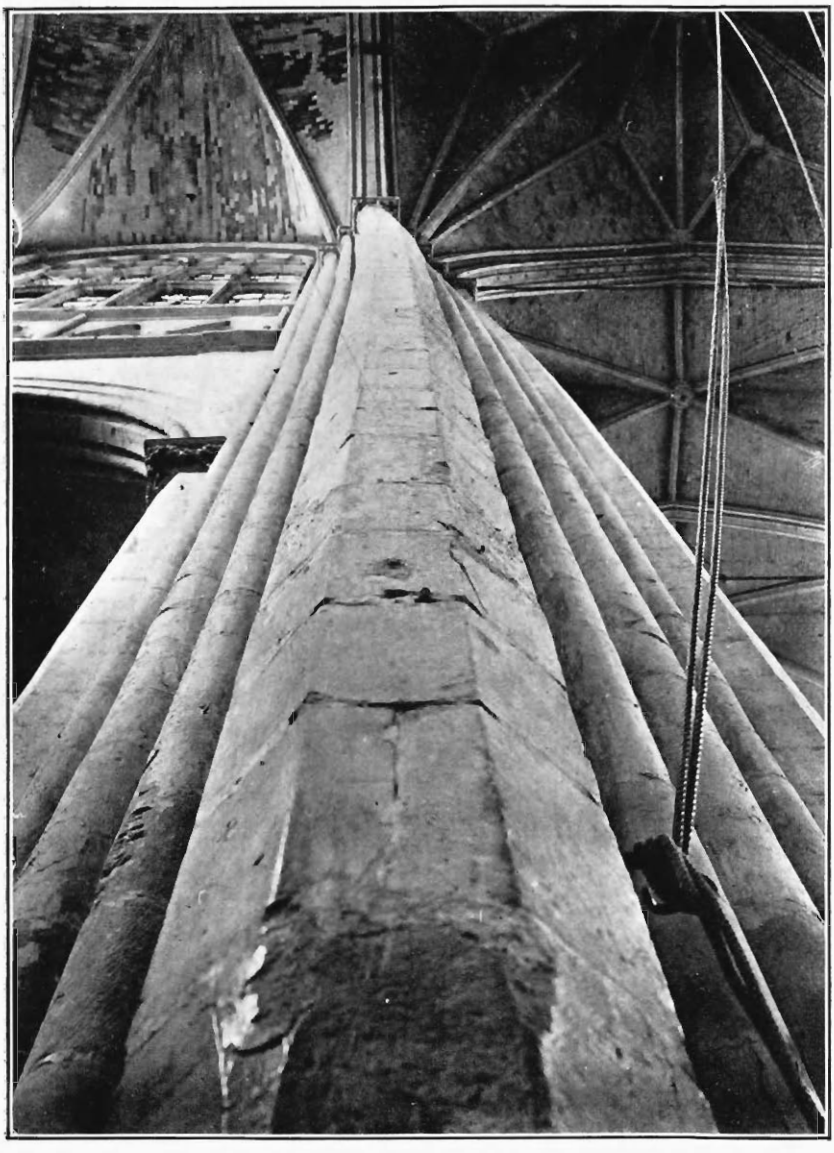

FIG. 10. THE CHURCH OF ST. QUENTIN. SOUTH-WEST CROSSING PIER, EAST SIDE, LOOKING UP THE PIER FROM THE GROUND TO THE ROOF.

(To see this picture correctly, hold it flat above the eyes and view it looking upwards.)

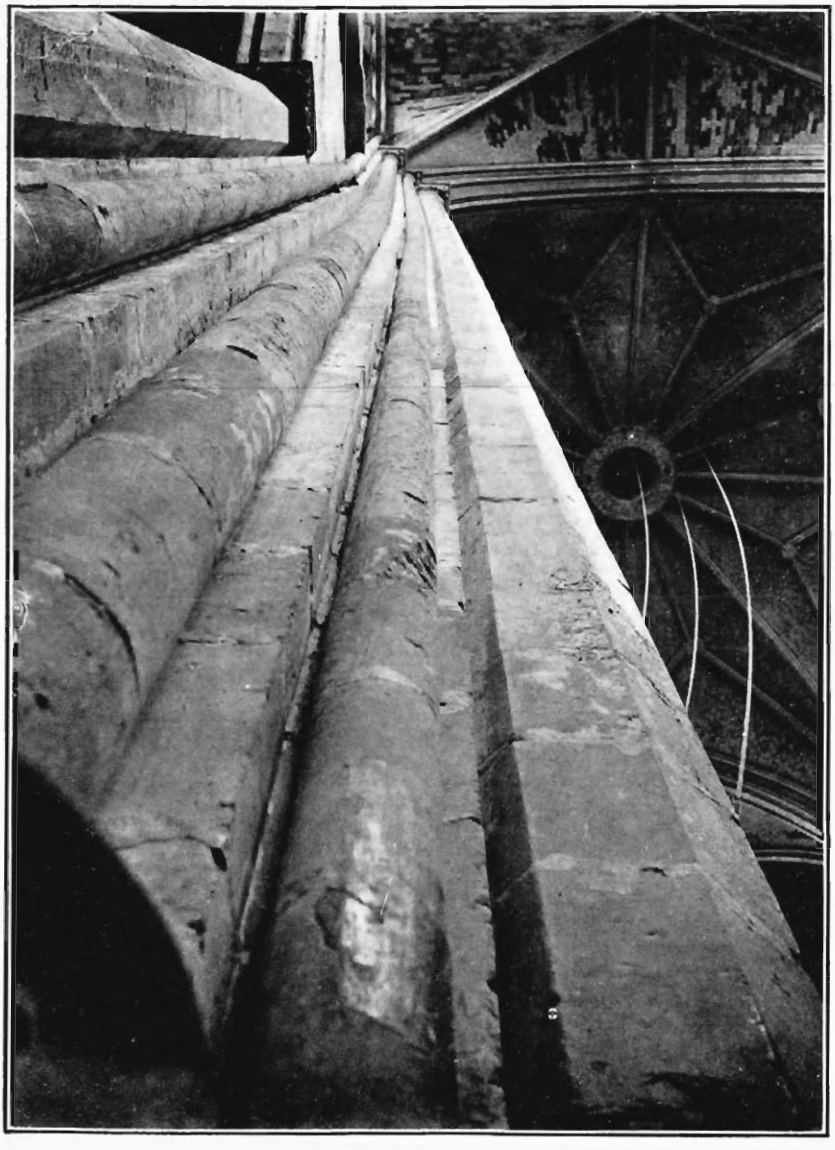

FIG. 11. THE CHURCH OF ST. QUENTIN. SOUTH-WEST CROSSING PIER, SOUTH SIDE, LOOKING UP.

(To see this picture correctly, hold it flat above the eyes and view it looking upwards.)

FIG. 12. THE CHURCH OF ST. QUENTIN, RIGHT AISLE. FROM THE CHOIR, LOOKING THROUGH THE TRANSEPT.

Italian churches which have been quoted for the aisle widening, the leans are only found on the exterior side, and this is also true of St. Loup and St. Alpin, at Chalons.

As regards the western portion of the Church of St. Quentin, it is in the opening from the transepts into the aisles rather than in the aisles themselves that the widening is found, but in the choir aisles the piers lean apart on both sides of the aisle. This is the explanation of the extraordinary and abrupt bends which may be noticed in Fig. 9 as existing in the choir. They are due to the fact that the piers lean into the choir as far as the capitals, whereas the vaulting-shafts and walls lean out above that point. The entire wall of the choir is twisted sideways, on both sides, in order to obtain the desired end.

It is a very frequent arrangement in French cathedrals that the widening is inconspicuous or wholly absent at the façade entrance, and that it gradually increases toward the choir. This fact may be observed in Fig. 9.

Conclusion.

The continuation of this paper in the next issue of the Architectural Record will describe other French churches and cathedrals having similar refinements. The general result of the Brooklyn Institute observations of 1903 may, however, be briefly stated here. Twenty-seven localities were visited, including Constantinople, Vienna, Strassburg, and twenty-four towns in France. In these twenty-seven localities, thirty-one churches and cathedrals were found to exhibit vertical bends and curves or vertical widening. In most cases the two arrangements were combined.

It is believed that all the instances described and illustrated in this paper carry their own internal evidence of constructive intention to the eye of the expert, even in the limited dimensions necessary in these cuts. Not less remarkable constructive evidence will be published for other French cathedrals in the continuation of these papers.

It could hardly be demanded by the most exacting critic that impregnable constructive evidence should be furnished for every building cited or illustrated. From the standpoint of historic probability and historic criticism it would be incredible that even one case of architectural refinement could be demonstrated to have existed in the Middle Ages as an isolated example. The existence of other cases would be presumed, as a matter of course, even if they had not been seen. Why, then, be over-exacting of constructive proof for every case which has been seen? One instance absolutely proven would involve the certainty that a

traditional practice of such refinements must have existed. And this is the only question which is at stake in this investigation.

That deformations due to accidental causes are found in many mediæval buildings is beyond dispute, but a vague insistence on the existence of such accidental deformations will hardly be considered as overbalancing or obscuring the evidence now being presented.

Wm. H. Goodyear.

(To be continued.)

On p. 135, 25th line, read 2 ft. in place of 4½ ft.