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## A RECENT DISCOVERY IN MEDIÆVAL ARCHITECTURE

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UNDER an unpretending and matter of fact title, Mr. Arthur Kingsley Porter has made the most important contribution to the topic of mediæval construction which has been published for many years.\*

It is no small thing to have discovered the origin of the Gothic rib vault and this is what Mr. Porter has done. Since the works of Viollet-le-Duc and Choisy, no contribution of the same significance, to the general topic of mediæval construction, has appeared. The discovery in question is a supplement and an addition to the results of these distinguished authorities, of which no student of mediæval architecture can afford to be ignorant. It is fortunate that the little book in which this discovery is modestly announced and triumphantly demonstrated, can easily be read in a single evening.

\**The Construction of Lombard and Gothic Vaults.* By Arthur Kingsley Porter. New Haven. Yale University Press. London: Henry Frowde. Oxford University Press. 29 pp. 63 illustrations. \$2.00 net.

Incidentally, and yet more than incidentally, as it will presently appear, the original home of the rib vault is definitely established to have been in Italy and more narrowly in Lombardy, whereas the most distinguished living French antiquarians have assigned its invention to France, and more narrowly to the Ile-de-France. In this department of the subject Mr. Porter has not only supported the conclusions of Rivoira, as regards the precedence in time of the rib vault in Italy and its influence on northern Europe†, conclusions which have been widely contested, but he has also verified these conclusions by a mass of new testimony from a number of hitherto unpublished and unnoticed early Lombard churches, which are now, for the first time, rescued from obscurity.

In a double sense the early history of mediæval vaulting has thus been placed on a firm foundation. Its original home and local derivation are established beyond further debate and in

†*Lombardic Architecture. Its Origin, Development and Derivatives.* Translated by G. McN. Rushforth, M.A. London, William Heineman. New York, William Helburn, 1910.



Fig. 4. Church of San Nazaro at Sannazaro Sesia (Province of Novara). Ruined interior of the nave, showing compound piers, with shafts which supported a rib vault built without solid centering. Dating 1040. This is eighty-five years earlier than the first rib-vaulted nave in the Ile de France.

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Fig. 3. The groined cross-vault in Italy, built without solid centering, on skeleton diagonals. Vault, in crypt, S. Maria del Solario, Brescia. Dating about 1120.

face of opposed theories which have been championed by the most influential living antiquarians of France. This, however, is a necessary corollary of another demonstration, viz., that the rib vault was invented in Lombardy as a means to the construction of a vault without a solid timber centering, and that the rib vault was borrowed from Lombardy by the French churches which immediately preceded the French Gothic *for that reason*.

Not only was the manifestly desirable economy of timber and labor in question here, an economy especially advisable in view of the fact that the timber and labor were otherwise wasted on a purely temporary device, but the local features of Mr. Porter's demonstration point to the conclusion that the original invention was an absolute economical necessity in the territories where it was first employed. In other words, the rib vault was invented where timber was not to be had, or where the ultimate price and difficulty of getting it, were practically prohibitive of its use. Back of all this lies the undoubted and already known fact that vaults can be constructed without solid timber centering by the use of the rib vault, that they actually were so constructed in the Gothic period, and that the typical Gothic cathedrals could never have been built, if solid timber centering had been the necessary pre-

liminary to their construction.

It is taken for granted that the readers of *The American Architect* are agreed that the Gothic is a vaulting style and that no analysis of its history or dominant traits can pay the slightest attention to the timber-roofed churches which were built during its vogue. It is also taken for granted that these readers are agreed that the rib vault is what made the Gothic possible and that the history of the rib vault is the basic history of the Gothic. These points are, of course, taken for granted by Mr. Porter.

He begins by pointing out that when the rib vault originated in the Romanesque period, the builders who employed it did not know that it would be developed into Gothic. The Gothic was impossible without it, but the Romanesque builders did not know that there was going to be any Gothic. Why then did they employ the rib vault and ultimately use it exclusively in the transitional churches which mark the

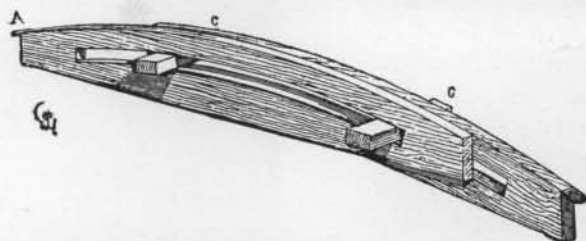


Fig. 1. The cerce; used in building rib vaults without solid centering. From Viollet-le-Duc's *Dictionnaire Raisonné*, article "Construction," Vol. IV, p. 106.

first steps toward the Gothic? This question is complicated by the following facts: first, that the groin vault was often employed exclusively in very large and important Romanesque cathedrals: (Speyer, for instance), second, that the groin vault was frequently employed in churches which also used the rib vault; and third, that the groin vault, and not the rib vault, was originally the only form of cross vault with which the Romanesque builders were acquainted, whether in Italy or in France.

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order to answer this question, Mr. Porter first quotes and then disposes of the two principal explanations which have so far been universally accepted as accounting for the rib vault. It is generally said, for instance, that æsthetic considerations favored it and that it was used because it was more artistic in effect than a plain groin. But this, as Mr. Porter points out, is only true of the developed and perfected rib vault.

The earliest rib vaults were heavy, clumsy and ugly. (Figures 5, 8.) (Many of these primitive rib vaults, be it remarked, have been personally found, dated, and published, for the first time, by our author.) It has therefore to be conceded that the contemporary groin vaults were more artistic in effect than the earliest rib vaults which displaced them. Another and a universally accepted explanation is that the ribs concentrated and took up the thrusts of the intermediate vaulting and were therefore devised as a means of concentrating thrusts.

But here Mr. Porter shows that the Italian builders, who are supposed to have purposely concentrated these thrusts, took no pains to resist them after they were so concentrated. In fact they were so indifferent to the problem of thrust that they almost wholly neglected it, to the very great detriment of these same buildings. Our author also shows that the joints of the groins served the same purpose as the rib, as far as concentrating thrust is concerned, because the surfaces of the vaults were generally domed so as

to bear on the groins. As to durability and strength there is no great preference as between the two systems, although some advantages must certainly be conceded to the rib, aside from its importance as a centering. On the other hand the comparison of both systems in numerous instances, where both kinds of vaults were built in the same church, shows that the groin has stood the test of time as well as

the rib. The present accepted and universally taught explanations for the use of the early rib vaults are thus evidently untenable, when the subject is examined.

In contrast with these explanations, Mr. Porter's has already been briefly mentioned, and his proofs have now to be rehearsed. They rest on the admitted fact, as developed by Viollet-le-Duc and Choisy, that solid timber centerings were not employed in the typical Gothic buildings. Timber centerings were confined to the ribs; from these ribs the vaults were constructed by doming (or

arching upward) the courses between the ribs, which thus were self-supporting arches on their own account, as soon as a given course between two ribs was in position. A single movable and expansible piece of centering (a cerce; Figure 1) was used in laying these successive courses, and even this was dispensed with up to a certain height of the ribs, as related to their intermediate and increasing width. (See Figure 10, which shows a change in the size of the masonry blocks at the point where the cerce began to be used.)



Fig. 5. The rib vault in Italy, built without solid centering. Sexpartite vault in S. Pancrazio, Corneto-Tarquiniæ. Dating about 1160.

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If the Gothic builders used the ribs as a means of vaulting the spaces between the ribs without timber centering, it seems a self-evident proposition (as soon as some one has suggested it) that the ribs were originally invented to serve this purpose. But it is exactly this self-evident proposition which has never been developed by the standard authorities. Mr. Porter is himself an involuntary witness on this subject,



Fig. 6. The rib cross vault in the nave, associated with groin vaults in the aisles, both built without solid centering. S. Savino, Piacenza. Consecrated in 1107. Naves were not rib-vaulted in the Ile-de-France until 1125.

because he published in 1909 a history of the origin and development of mediæval architecture.\* This work is a very complete summary, up to date, of the results of the standard authorities on the history of mediæval vaulting. The wholly original side of the book is its unparalleled series of bibliographies, including an enormous number of monographs on individual churches, and its combination of a popular

\**Mediæval Architecture. Its Origin and Development.* 2 vols. New York. The Baker-Taylor Co. 1909.

summary treatment, in the body of text, with these bibliographies, and with a critical account of the individual monuments, in small print, for the use of special students (in the form of appendices to each chapter). This earlier book is therefore a combination of the methods of a popular compendium with those of a work of special research and it furnishes, moreover, by its bibliographies, as well as by quotations, a voluminous list of authorities for the statements in text. We shall not find, however, that any of these authorities, or Mr. Porter himself, at that date, had offered the explanation of the rib vault which now appears so obviously to be the only true one; after the proof has been furnished, viz., that it was devised as a means to economy in timber.†

The materials for this proof have been gathered, since 1909, by a laborious study, largely of hitherto unknown or neglected Lombard churches, many of which were sought for after the first clue had been found and which supplemented the original suggestive idea in material points. Among these churches are those of Sannazzaro Sesia (1040, see Figure 4) and Lomello (c. 1025). These have already been published in independent monographs by Mr. Porter, in the Italian archæological journal *Arte e Storia*. The vaulted churches of Corneto Tarquinia have also, for the first time, been subjected to critical study and rescued from antiquarian neglect (Figure 5).

Among the corroborative proofs of the general thesis is an analysis of the early rib vaults of France, showing that their peculiarities, and their evolution in the direction of Gothic traits, are all to be explained by the simple principle of the effort to economize in timber centering. But the rib vault was employed in Lombardy about eighty years before it was borrowed by France. Italy had previously learned from Byzantine art the construction of groined cross vaults, with a skeleton timber centering which was confined to the diagonal groins and the four bounding arches, the intervening vault surfaces being

†Mr. Porter had, however, at this earlier date, already reached the conclusion, in opposition to eminent French authority, and in agreement with Rivoira, that the French rib vault was derived from Lombardy. The considerations which he advanced on this head now acquire singular importance, as they are not repeated in the book under review. See p. 58, Vol. II and related portions of his earlier work.



Fig. 7. The groin cross-vault in France. Built with solid centering. North aisle Notre-Dame-du Port, Clermont-Ferrand (Puy-de-Dôme). Dating twelfth century.

arched upward (domed) and built with the use of the cerce (Figure 3). This system was available for aisles but not for naves, because the timber centering arches, under the groins, were too frail to support the weight of a nave vault pending its completion. The masonry rib, generally of brick in Italy, was therefore originally devised as a stronger and permanent centering. As soon as completed, it took the place of the timber skeleton centering and fulfilled the same mission, with the necessary additional strength (Figures 4, 5, 6).

A remarkable illustration of this phase of the given evolution is the fact that the Lombard rib-vaulted churches only use the rib in the naves and that they continue the use of groin vaults in the aisles, in which the ribs are never found, evidently because they were not needed where the skeleton timber centering had the requisite strength. (See Figure 6, where groins appear in the aisles and ribs in the nave). In France, on the other hand, where the

system was borrowed, after the evolutionary stage was passed, both the aisles and the nave are rib-vaulted, wherever the rib was introduced into naves. Other interesting proofs for Italy are obtained by Mr. Porter from a study of the vogue of the masonry vault in a given locality as related to the scarcity of timber. In the territory of Como, for instance, where timber was abundant, there is not a single vaulted church of the Romanesque period. In the not far distant territory of Milan, where timber has always been scarce, and must have been especially so when roads were bad, and territorial feuds and wars were constant, brick vaulting was general, and here the evolution of the rib vault occurred. By similar reasons the remote and isolated development of vaulting at Corneto-Tarquini, south of the Maremma, is again explained (figure 5). According to Mr. Porter's conclusions in this direction, not only the use of the rib vault, but even the use of vaulting, as opposed to that of

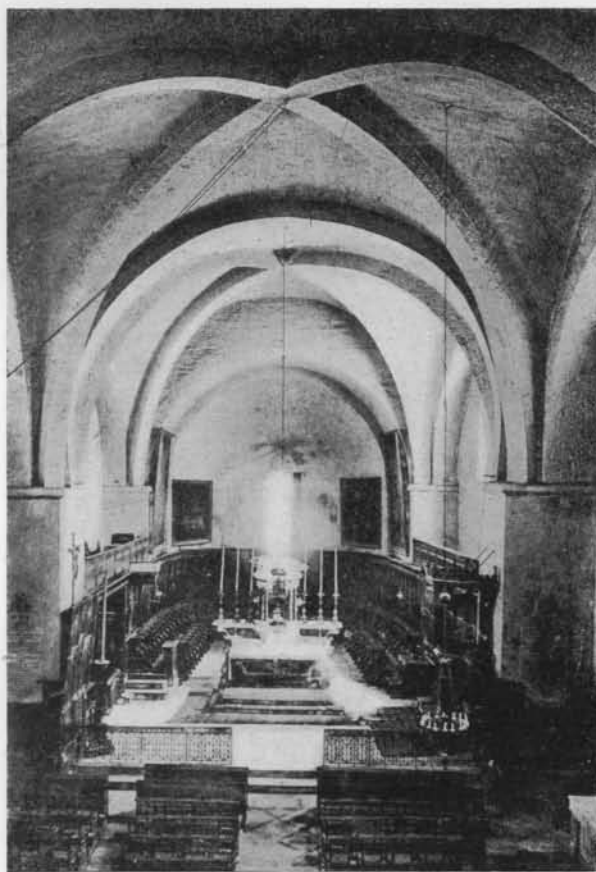


Fig. 8. The rib vault in France, built without solid centering. Cathedral of Fréjus, dating about 1100. Probably the earliest rib vault in France erected over a nave.

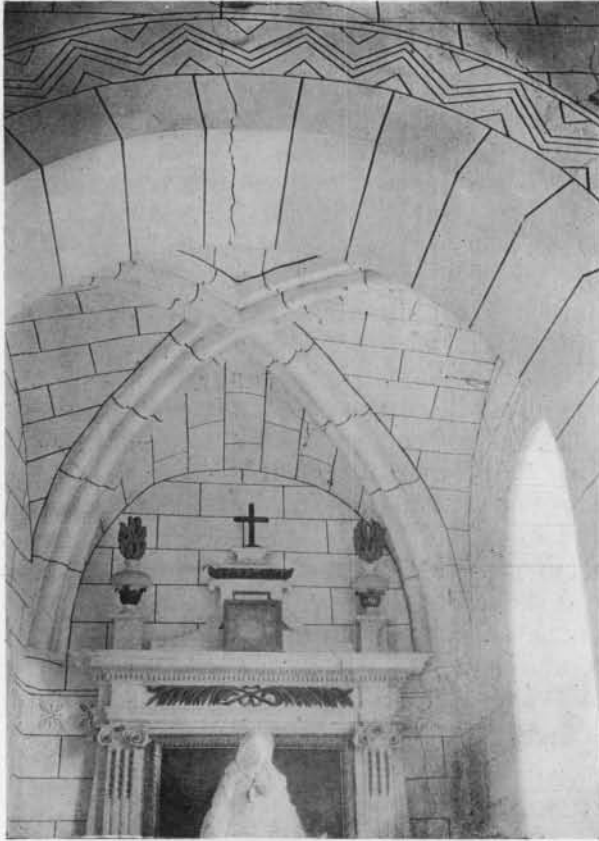


Fig. 9. The rib vault in France, built without solid centering. Sts. Gervais-et-Protais, Rhuys (Oise); vault of eastern chapel, dating about 1100. Said to be the oldest rib vault of the Soissonais.

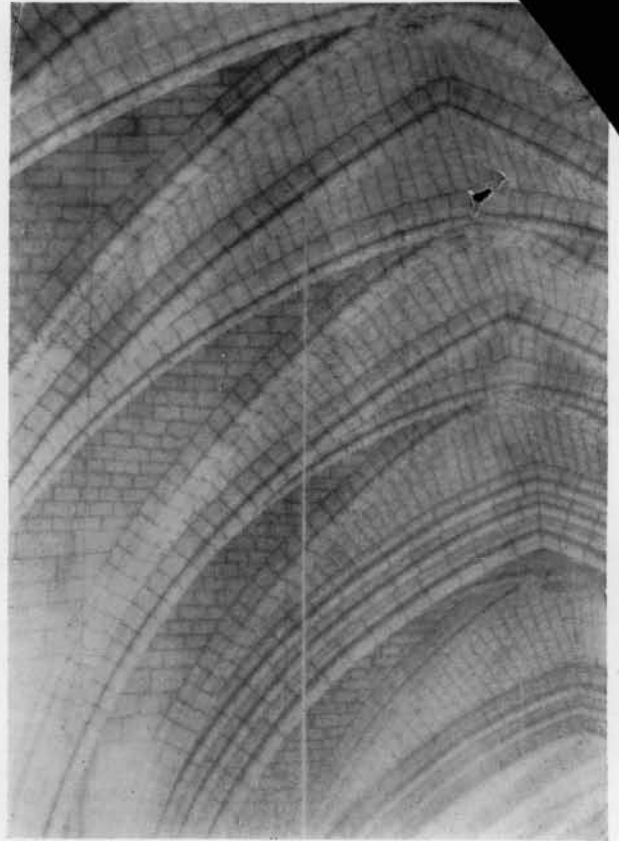


Fig. 10. The perfected rib vault in France, built without solid centering. The change from large to small blocks, seen at the lower left hand of the picture, marks the point where the use of the cerce began. The courses are made narrower in order to diminish the weight resting on the cerce. Cathedral of Soissons, nave, dating about 1212-C. 1230.

timber roofing, was mainly determined in Italy by considerations of economy in timber.

Our author is careful to point out that solid timber centering was used, under certain conditions, for rib vaults, at later dates than the first introduction in France. He quotes later Gothic examples where solid centering was certainly used and gives the reasons for these occasional and exceptional cases. As regards Italy, he also rehearses the history of the decline and ultimate relative disuse of Romanesque vaulting, and of the rib vault in Lombardy, and he shows that the higher development of the rib vault is only found in France during the formative period of the Gothic.

Whereas an almost total dearth, or prohibitive scarcity, of timber is proven to have been the rule in the Italian localities where the rib vault was first invented (so that the first invention was really a compulsory necessity when vaulted naves were

in question), a broader view of the question is needed for France, and here the relative economy of timber used for the skeleton centering of masonry ribs, as contrasted with solid timber centering for entire vaults, is held to be the initial and primary explanation.

The following points have to be especially considered here. The Byzantine system of building domed groin vaults over aisles, or in crypts, with a skeleton timber centering confined to the circumscribing arches and their diagonals, was not known in France until it was introduced from Italy at about the same time with the rib vault. Its use in France at this time, or later, was wholly exceptional. (For facts and explanation see pages 15, 16, and 21, footnote, of Mr. Porter's book). Thus the French had been using solid timber centering even for groined cross-vaults before they borrowed the rib vault from Lombardy. As for other primitive vaulting

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plans in France, viz., those of the continuous barrel vault and of the transverse barrel vault, they could not be erected without solid timber centering.

Another consideration is still more cogent. The evolution of the Romanesque mediæval church was not an evolution in which improved methods of vaulting were applied to churches of the same size, or of the same simple plan, which are found in those of older date in which the improved methods were unknown. There was a constant growth in the average dimensions of the larger churches and a constant growth in their complexity of plan. Now, when a groined cross-vault has to be built, it is, of course, uneconomical to use a solid centering even for a small vault, and it is much more difficult and much more wasteful to use solid centering for a large one, but it is still *physically possible* to do it. But when the trapezoidal plans of the vaulted spaces in ambulatories and choirs are in question, the construction of a solid centering is *physically impossible*, because the most expert geometricians, could not project in advance the varying curva-

tures, twisted surfaces, and spherical complications (increased by the doming) of the vaulting surfaces, so that they could be moulded into the surface of a solid timber centering, to say nothing of the prohibitive expense of such an effort. Thus the rib vault was not only an economy, it was also a necessity, in the evolution of the later plans of the French Romanesque into the transitional plans of the French Gothic (Originally there was no other Gothic).

For the many features of transitional Gothic and therefore of later Gothic, which are due to an ingenious economy of the timber centering, Mr. Porter's little book must be consulted. It may be said on this point, not only that he has made a significant special discovery, but also that he has inaugurated *a new method of approach* to the study of mediæval construction in general. This new method cannot be neglected by his fellow searchers after truth. It is based on the common-sense theory and the now universally accepted theory, of the existence of an evolutionary sequence in history. This method is bound to triumph. "*Tout s'explique, rien ne se divine.*"



## THE RECLAMATION OF THE "BACK YARD"

THE time-worn joke of the house and the varying styles of its front and rear, is in no way better illustrated than in the front of a city house and its back yard. We have frequently referred to the indifference shown by city dwellers to the appearance of the yards at the rear of city houses and it is with pleasure that we reprint in part and illustrate, through the courtesy of the editors, an article recently published in *Cement Age*, that illustrates the possibilities of reformation of these unsightly spots.

We read:—

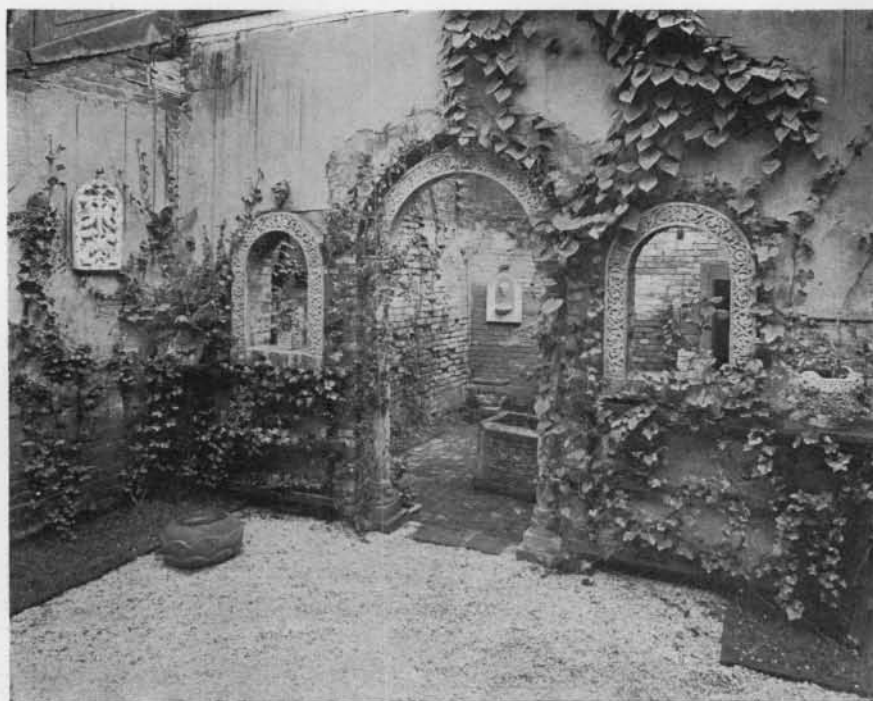
Merely because it is a custom, most people look upon the back yard or court of city and town houses as an appurtenance set apart for the ash can and the entrance and exit of the milkman and his kind. As a matter of fact, however, many of these small spaces, open to the sky and rain, could be easily transformed into attractive and beautiful little gardens or retreats, as is suggested in the accompanying photographs. In days gone by the back yard shown was of the customary type, wherein reposed broken boxes and other

trash. The property fell into the hands of the Arts and Crafts Guild, 235 South 11th Street, Philadelphia, and the transformation followed. Nearly all of the changes effected represent a proper use of concrete.

To improve the appearance of the back yard grass plots were introduced and gravel walks laid out. Concrete columns surmounted by an arch of ornamental concrete work resulted in the doorway between the two courts. The arched windows were treated in the same fashion omitting the columns. Wall ornaments, urns, flower boxes and columns, exact reproductions from Byzantine originals and the Renaissance period, were placed as shown. The old walls were stained with color. The decorative scheme has not been fully developed as yet, as much more will be done in the way of training vines and planting flowers.

Simple gravel walks, like old-fashioned lattice-work, are difficult to beat when it comes to an environment of turf and shrubbery. And it will be found, in looking at these two pictures, that the plain and economical gravel walk fits in admirably with the concrete.

Coming back to the concrete features of the court it will interest readers to state that a new decorative process has been applied to some of them. It consists of an inlay of bits of gold and glass, the latter of the color and texture of enamel, which are placed in the depressed parts of ornaments or borders especially suitable for this purpose. In some patterns the concrete thus becomes the background and also the outline for mosaics in dull colors combined with gold.



COURT IN REAR OF ARTS AND CRAFTS GUILD HOUSE, PHILADELPHIA

