THE ABIDING LESSON OF GOTHIC ARCHITECTURE: ALL ITS BEAUTY AND INSPIRATION THE OUTGROWTH OF SOUND CONSTRUCTION: BY ERNEST A. BATCHELDER

"By suffrage universal it was built
As practised then, for all the country came
From far as Rouen, to give votes for God,
Each vote a block of stone securely laid
Obedient to the master's deep mused plan."
—Lowell.

IT IS not the purpose of these articles to attempt anything in the nature of a history of Mediæval industrial art. Within the limits of the space available little more could be done than to set forth in dry, uninteresting data the work of that period. There were many workers in many materials, widely separated as distances were necessarily computed in those days of insecure and inadequate transportation, laboring in different environments and under different influences. There is an abundance of literature on the subject of Mediæval history, the life and customs of the time, the development of its institutions, its architecture and its industrial activities. From this material and from personal observation and study it is the writer's intention to choose certain examples of work in stone, wood, iron, etc., and discuss them from a design point of view, how they were produced rather than why they were produced, and to tell the story in a way that may be of interest to the general reader.

Indeed, the question of how things were made, the study of constructive problems and the conditions under which they were solved, may after all take one nearest to the true spirit of the work. We are apt to see the craftsman of the past as a light in a mist, a vague blur without personality. A philosophy of art fails to reach him; a discussion of abstract ideals leaves him as an unreal factor in the background. We read into his work sentiments and emotions that would cause him to scratch his head in bewilderment if he were to hear them,—for his work, like all true creative art, was not conceived as a conscious message to future generations; it was merely an unconscious expression of immediate needs and convictions. It was a spontaneous development. The man at the bench did not stop to analyze motives; his interest was centered upon technical problems, how to secure a given result and meet definite conditions with the materials, tools and processes at hand. To really appreciate the beauty of nature one must turn to others than the poets for an interpretation of what we find. And to understand the spirit in which
Medieval industrial work was wrought we must push through the halo of romance and chivalry; through the abstract ideal of the philosopher, even through many of the aesthetic and sentimental motives that legend ascribes to the workers, and penetrate into the crooked narrow streets of the old-world town where the pigs roamed at will. The descent is sudden; but it is necessary if we wish to visit the workers in their shops and watch them as they hammer away at their trades quite unconscious that their product, or such scraps of it as time has spared, is to be reverently treasured under glass by a distant generation.

NOW the life and the thought of the thirteenth century have slipped beyond recall into the past. We would not, if we could, revert to the conditions of that day, nor can we hope to coax beauty back into the world by adopting its industrial methods. That art was vital, as few arts have been, because it interpreted so forcefully and clearly the thoughts that had penetrated into the lives of the people. We cannot by any conscious effort of thought put ourselves back into Medieval times; that is to say, we cannot look out upon the world through the eyes of the Medieval people, see things as they saw and understood them. Little enough remains of their activities,—here a church, there the ruins of a castle, again a little cluster of half-timbered houses huddled together in some byway where the current of modern life has passed them, a few manuscripts and utensils gathered into museums where we treasure them as priceless relics.

Scanty as are the remains, however, their art was so intimately related to their lives that we may know how they dressed and worked, how they fought and played; even the minute details of
daily life are wrought in stone and wood, iron and glass; but when we think that we are getting into close fellowship with the Mediæval worker, when his personality is almost within reach, he suddenly vanishes again. For in the presence of his greatest achievement, the Gothic cathedral, he slips away into the background, a vague figure, impersonal, more inexplicable than when we first began to make his acquaintance. Here is an expression of the thought that penetrated deepest into his life, and in its presence we feel only a sense of our own littleness and insignificance. It thrusts its gray old towers and pinnacles from out of the Middle Ages above our own petty affairs, and we are almost willing to accept the legends, the stories of wonderful miracles that cluster about it. For we who order our churches ready made much as we do our clothes and groceries, can never hope to understand the spirit that moved men to give of their time, money and labor to the construction of the cathedral, building it and rebuilding it on nobler and grander lines whenever fire or the wanton destruction of war razed it to the ground. Of the old town then clustered about the church we know there were dark, noisome streets, unsafe and unlighted at night, where plague and pestilence often found a breeding place, dingy houses and shops. And yet from these streets, so strangely at variance with the church, came those who wrought these miracles in stone, choosing one from their number as master builder, the rest voluntarily giving to its construction
and enrichment
the best of their
linear thoughts
and efforts. The
French cathedrals
were, in a peculiar
sense, the result
of communal ef-
fort. Nor was there
any thought for
fame, for very few
even of the master
builders are known
to us, and the
countless crafts-
men who labored
so industriously to give beauty to all the details of the fabric have
left no marks by which we may speak their names. It was all
for the glory of God, with an element of communal pride, a com-
bination of religious fervor and popular enthusiasm.

TO US the cathedral seems as stable and enduring as the hills
or as the cliffs that rise from the sea. It appeals to our imagi-
nation so strongly that we are loath to pry into more practical
questions of ways and means. We would rather turn to the poets
for an interpretation of why it was done than to those practical per-
sons who have clambered over the edifice with rule and compass to
tell us how it was done. And yet, in the plain recital of the means
adopted to maintain the stability of the structure is a story of absorbing
interest. We may then understand what a French writer of keen
insight meant when he said that the Gothic cathedral was more like a
modern engine than a building, in the sense that it was an active
thing, pushing, thrusting, filled with energy and requiring unceasing
attention to keep it in working order. And we shall come closer
to the builders when we examine the constructive problems that
confronted them, problems that had never been solved before;
when we study the conditions under which they worked in their
earest efforts to give beauty to the structure that was rising under
their hands. Here were simple stone masons and carpenters build-
ing as experience taught them and clothing their work with an interest
and beauty that were inevitable under conditions of true craftsman-
ship. And they left behind them the last word in constructive skill,
combining original thought and deep artistic feeling; but withal, a

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CATHEDRAL OF ST. NICHOLAS, BLOIS.

THE NORTH TOWERS OF THE CATHEDRAL AT ORLÉANS.

CATHEDRAL OF ST. ARMEL, FLOERMEL.

DISTANT VIEW OF THE CATHEDRAL AT CHARTRES.
CATHEDRAL ROSACE AT LE MANS.

THE ANCIENT TOWN OF CHARTRES, WITH VIEW OF CATHEDRAL.
FLYING BUTTRESSES OF THE COLOGNE CATHEDRAL.
"THE LOVELY WELL": A SMALL GOTHIC STRUCTURE AT NÜRNBERG.
ANCIENT GOTHIC TOMB IN THE CATHEDRAL OF ST. SEBALDS, NÜRNBERG.
structure in which every feature is organic in character and may be traced back to its simple utilitarian origin.

The building grew as a plant grows. It was not all planned beforehand on paper to the last detail, with malice aforethought, like modern buildings. The master builder lived on the works where he was able to take advantage of every unforeseen circumstance that arose and apply new ideas that came to him as the building progressed. A large measure of the distinction that attaches to the result is due to the shrewd common sense and orderly thought of the "master maker of churches" and to the structural devices that necessity forced him to adopt in order to hold the building intact.

A n architectural "style" is very often spoken of as if it were a question of columns and capitals and moldings. There are many writers who leave us with the impression that architecture and building are two different things, telling us much about the "orders" and "periods," but little about the mechanical problems and constructive methods involved, as if these were of minor importance. If, for example, we compare the outward aspects of the temples left us by the Egyptian and Greek builders, many points of difference may be noted; likewise we may have resemblances in details and in the disposition of the ornament pointing to influ-
ences extending from one to the other. But there was little difference in the constructive methods employed. On the other hand, there are constructive differences between all of those buildings and the churches left by the Mediaeval craftsmen, differences in the use of materials and in the solution of mechanical problems, that place the latter in a class apart, a new principle, a new thought. And we have no sufficient clue to the radical differences in the ornamental "styles" until we have studied closely the development of construction, for in each case the ornament was a logical outcome of the structural principles employed. If the Greek builders had discovered and developed the new type of construction, even though they still remained pagans, their ornament would have undergone a complete and inevitable change. Incidentally, there is a grim, pathetic sort of humor in the effort that one finds here and there of an architect of the Renaissance struggling to redress a Gothic Cathedral in a conventional garb of classic ornament. It is difficult to believe that men could have so little understood the real points of difference. The result always looks, as some writer has put it, "like the dead branch of a tree suspended among the living branches."

This last sentence describes in a few words the essential differences. In all that preceded Gothic work the principle may be stated as dead, inert, inactive; in Gothic work it may be called alive, active. Constructively, the point may be illustrated by the simple pier and lintel, as shown in Figure One. If a horizontal is placed upon two verticals it is readily seen that there is nothing involved beyond the downward weight of dead material. The uprights must be sufficiently strong to support this weight. Of such character was a Greek temple with its wooden roof. But if an arch is built over the opening between the two uprights another problem must be faced, for an arch exerts a horizontal thrust or pressure as well as a downward weight. It brings to the problem the element of unrest. If the arch is not securely braced or held in place it will spread outward, some-
what as indicated by the dotted line. The Romans held their arches and vaults intact by so building them that the thrust would always be overcome by a dead weight of material.

NOW in direct contrast to this inert principle is the method so largely employed by the builders of the North. In fact, it is so primitive and obvious in its idea that none but simple-minded stonecutters would ever have puzzled it out. Why not securely brace the thing from the outside? And so in doing that which was most simple and logical, best adapted to the constructive problems that arose, they created a new style in architecture. Simple as the idea seems, however, it took many long years of patient work, many experiments, often disastrous, before it was perfected; for it leads to the active principle of construction, the nicely calculated adjustment of one thrust against another. A cathedral is no mere mass of stone; it is a veritable organism, alive with energy, pushing, straining. "Hold steady," one member says to another. "If you fail me we all go down together;"—and so, pushing this way and that as the builders disposed, the fabric has been held intact for seven or eight hundred years. The modern engineer can figure on paper exactly how it was done; but those men worked it all out through dearly bought experience in handling stone. There were many experiments and discouraging failures; but they dared to try, and try again, until the whole system stood complete. Applied to an arch the idea is of course inadequate; it was only when churches were built throughout with stone that the development of the outer bracing occurred. And in the perfection of the idea, what do we find? Essentially this:—A vast, immensely heavy, vaulted roof of stone poised high in the air upon slender piers, the powerful side thrusts of the vaults caught on the outside by flying buttresses and transmitted to other buttresses with their feet securely braced at the ground. There is no use for walls; the space from pier to pier is filled in with glass. One is amazed at the very thought of such a daring conceit of a building. Patience and brute strength were sufficient to build the temples of Egypt; but here are men playing with the laws of gravitation. Surely it is interesting to trace some of the steps in such development.

The earlier churches were built with wooden roofs over both nave and aisles (Figure Two). Constructively, they presented few difficulties; their walls were heavy with small windows above the lean-to roof of the aisle, with columns carrying longitudinal arches to separate the nave from the aisles. The first efforts of the builders to vault their roofs with stone were in the aisles where the vaults were comparatively small and exerted very little pressure. But the pres-
sure of a vault is steady and persistent; so the outer wall was strengthened with a simple pilaster (Figure Three). In time this developed into a real buttress of more pronounced form. Now the point to be noted is that we may already tell from the exterior of the building something of its interior construction, whether its roof is of stone or of wood. But this, of course, is a long way from that system which we know as Gothic.

IT WAS when the builders sought to discard the wooden roof and vault the larger expanse of the nave that the complications began. It may be presumed that the step was taken primarily to give a more enduring form to the building, for we know that the wooden roofs were often destroyed by fire or in other ways. The early struggles of the builders to grapple with this new problem afford sufficient material for a book of intense interest. There are numerous ways in which a vault of stone may be constructed; but the subject is one of too technical a nature to follow here. In their early efforts the builders threw strong supporting arches across the nave and built vaults of the old Roman form between the arches. To strengthen the walls against the arches on the outside, buttresses of the pilaster type indicated in Figure Three were built; but in later years these were found to be insufficient. The roofs threatened to fall and another type of bracing had to be devised (Figure Six). Another experiment is shown in Figure Four, one of the abbey churches at Caen. Here the walls are very heavy and the window openings are still small. In this church one finds an apparent clumsiness in the workmanship, too; but these men were feeling a way into new and undeveloped principles. They had no reference library to turn to; no collection of casts, photographs and picture post cards to help them. They were thrown upon their own resources and inventive skill. The roof of the aisle was raised enough to enable them to construct a long half-barrel vault against the outer wall to transmit the thrust of the big nave vault across the aisle to the strong buttresses and thence to the ground. Time showed this to be another mistake, for the vault over the aisle is too low to catch the full force of the pressure from above.

But about this time necessity compelled these persevering workers to complete another important structural device without which, even to this point in fact, progress would have ceased. It must be understood that to build a vault of stone, of the Roman type, a very expensive and a complicated framework of wood is necessary. Furthermore the vault when completed is very heavy and unwieldy, exerting powerful side thrusts. Again, with Roman mortar the vault was
practically a solid when completed, and we know that the Medæval builders had no such mortar; it may be that the secret was lost. So they attacked the problem in a different way and after many experiments devised a skeleton of stone ribs into which the roof proper was fitted and upon which it rested. And with this new device in hand they again forged ahead to the perfection of their system. The advantages were many, economically and structurally. It did away with much of the expensive preliminary work in wood, strengthened the ribs of the vault and divided the roof into sections so that a weakness in one part could be repaired without affecting the rest of the vault; it greatly diminished the outward pressure, and, perhaps most important of all, the skeleton frame of ribs, by sustaining the weight of the vault, enabled the builders to distribute the weight and the thrusts to definite points where they could deal with them in the most effective way (Figure Five).

Now, after more than one roof fell in from insufficient external support, the next step was to frankly adopt the primitive idea noted in Figure One, push above the roof of the aisle and throw a flying buttress up against the point where the pressure of the big vault was strongest. There was no precedent for such a unique constructive device; but it is ever a mark of genius to dare that which others hesitate to do because no one has ever done it before. They seemed to give no heed to the odd appearance that such a feature would inevitably give to the exterior of their buildings; it was necessary for the stability of the structure and that was reason enough for employing it,—and therein is the abiding lesson of Gothic architecture; the craftsmen always accepted without reserve the clue that sound construction offered them, giving to each feature such beauty as they could. In later years more sophisticated architects, hidebound to the “true style” and the “five orders,” deplored all of the above as a relic of barbarism and diligently strove to hide their construction. Not so the Gothic builders; once established the flying buttress was seized upon joyfully and given endless variations.

On its first appearance it was treated much as if it were a part of the roof itself (Figure Six). Then the forms changed; a pinnacle was added,—for beauty? Indeed no; for weight at a point where weight was needed. Again they accepted the clue and the pinnacles sprang upward into countless beautiful forms. The top of the buttress was scooped out to conduct water from the main roof, and a spout naturally appeared to throw the water away from the building in order that ice might not form on the walls. This feature in turn became a source of joy to the stone carvers and was wrought into all manner of fanciful gargoyles (Figures Seven and Eight).
CONSTRUCTIVE logic developed another feature that is always associated with Gothic architecture,—the pointed arch. Its origin, at least with the Mediaeval builders, was not from any aesthetic motives; clear-headed common sense brought it into general use. And here again it was a question of vaulting. A round arch vault has a very powerful side thrust; and moreover it will be noted from Figure Five that it is unsuited for the vaulting of oblong areas. As the height of a round arch is necessarily governed by its span, difficulties are presented which are done away with when a pointed arch is used. In the intersection of two pointed vaults the heights can be adjusted at will regardless of their respective spans. Once in use the pointed form of opening then extended to the windows and doors of the church.

With the pointed vault, the skeleton frame and the buttress system, the new constructive principle involved is apparent. It was not in those features alone, however, that the genius of the builders appeared. In the same logical way the west front was developed from a bare wall with simple doors and windows to the magnificent portals of Rheims. The spires of Chartres, before which one feels like taking a new grip on life, arose through many experiments from a simple belfry roof. And within the church, what one might call the nervous system of the thing is so organic that a near-sighted man may hasten to an examination of the base of a pier and know almost as much about the character of the structure above as the rest of us. For every molding and rib of the huge skeleton is articulated through the piers. Indeed, the pier seems more like a bundle of withes bound together than a single piece of masonry. And as the window openings were enlarged the glass workers filled the space from pier to pier with that hopelessly beautiful wealth of color, most of which, alas! has been shattered and destroyed. With an assured construction the stone carvers multiplied; from bottom stone to topmost pinnacle they wrought with a fertility of invention and imagination that never ceases to excite our wonder and admiration. In fact, there came a time when they were lost in the bewildering maze of their own fancies and staked their skill against the material in which they worked; it seemed more like lace on a delicate tracery of cobweb than stone. And therein came the inevitable decline. For the very life and vitality of a designer’s work ebbs away whenever he turns from constructive problems and endeavors to create beauty for its own sake.

To other craftsmen, workers in wood, iron and other metals, the church sent forth a call for the best that mind and hand could do. In succeeding articles it is the intention to follow some of the activities of these other craftsmen from rude beginnings to those achievements of wonderful beauty that in these prosaic days we treasure as priceless.