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A New Field for Architectural Practice. The accession of new territory in tropical countries by the United States will probably lead to the opening of an entirely new field for architectural design among American architects. In Caracas, Venezuela, where the American Manufacturers' Association has found a foothold and established a warehouse, the first effect was to cause the Venezuelan officials to be greatly attracted by American architecture, and resulted in an order for three cottages for the president of the republic and two members of his cabinet to be built at a fashionable watering place on the coast. These were followed by contracts for the erection of ten others, and then in turn a customhouse and city market, which demonstrates the impression made by the American design. This will in all probability be true in Porto Rico and the Philippines, and not only extend the market for American building materials but for architectural talent as well. The American Institute of Architects has already two representatives in our new territory, O. G. Traphagen, formerly of Duluth, being at Honolulu, and W. C. Smith, of Nashville (a director), who is an officer in a Tennessee regiment, at Manila. As other architects of equal standing are probably locating in these distant places, the problem soon to be presented to the Secretary of the Treasury, in the line of customhouse designing, should be easy of solution.

Exaggerated Reports Regarding Fires. The annual fire in a fireproof building has occurred, according to the daily press, and through the same discriminating source we learn that in consequence the "tall," that is to say the steel-frame, structure "must go." These veracious telegrams were sent out from New York as we go to press, before the opportunity for any but the most cursory examination has been made. It is supposed that the burning of a seven-story combustible building, filled with combustible material, would have some effect upon flanking fireproofed structures, but we have seen too many of such fires to believe that the bent beams and falling floors that were spoken of in the first dispatches can have been produced by the combustion of the materials used. There will, of course, be an official inquiry and an expert examination and report, and until this is forthcoming it seems to us that such extravagant statements, seemingly designed to destroy the public confidence in fireproofed structures and increase the number of those that are wholly combustible, should be withheld. This is particularly true when every fire of this character has demonstrated the inaccuracy of the first reports, and that fireproofing does practically fireproof, the exceptions being where inferior work has been done, through the owner's wish to cheapen a building, or some peculiar circumstance in its construction. There is no interest that should be so thoroughly supported by press and public as that tending to make buildings less combustible, and modern methods intelligently and carefully used are sufficient to make all structures of whatever height safe as far as structure is concerned, the incident of contents and convenience to the passage of smoke being regulated by subjective circumstance.

FOUNDATIONS.

BY FREDERICK BAUMANN.

FIRST of all, it is to be kept in mind that a building is supported by the ground upon which it stands erected. Since matter, under a natural law, is subject to compression, it is evident that the ground bearing a building is compressed. In common parlance it is said that a building settles. Good practice requires that this settling be equable throughout, also that it be kept within measured bounds.

LOADS TO BE DETERMINED.

A building may be said to consist of a number of integer parts, more or less independent of each other. These may differ widely in regard to weight. There are continuous walls, large piers inclosing narrow openings, small piers inclosing wide openings, independent columns supporting beams or holding up walls. The result is that the pressure exerted by the sundry parts upon the ground is very unequal, though in all cases in proportion to the load pressing upon the ground. It follows from this incontrovertible truth that the bases intended to sustain the sundry loads of superstructure must be carefully determined. If the soil is found to be of about uniform density, at least for the extent of a building thereon to be erected, as is mostly the case, there can be no difficulty in determining the areas of bases by the square foot. If one square foot of ground is good for a load "a," then ten square feet will be good for a load of "10 a," and so on, though this is but in a measure correct, as later on explained.

AREAS OF GROUND TO BE DETERMINED.

The science of preparing foundations involves two plain practical principles: A resolving of the superstructure into its integer parts, so that each may be considered an independent load consisting of the weight of each such part; and a determining of the amount of load safely to be put upon a unit measure of the ground to be loaded. It would lead too far to offer instructions as to the first principle; this may as well be granted as understood. But the latter principle offers itself to our view, since it leads at once to a consideration of the nature and constituents of the ground upon which a building is to be erected.

Rock.—Buildings founded upon rock are, proverbially so, well founded. Compression exerted upon this kind of soil, even by the extremest loads, is never of any practical account. It is only required to be thick and sound enough to allow no punching through.

Gravel.—This kind of soil is firm enough to bear, if the stratum is not too slim, a load of ten to twelve tons on a square foot of surface, without exhibiting palpable signs of compression.

Gravel and Clay Intermixed.—This kind of soil will securely sustain on a square foot from ten tons down to about three, in accordance with amount and kind of clay intermixed. The dryer the clay the better.

Sand.—This varies from fine gravel down to quicksand—the finest kind of sand mixed with water. It may, accordingly, be good for ten tons per square foot down to next to nothing. Dry sand is the best of its kind. If wet, care should be had to prevent escape of the water from under the foundations.

Clay.—The bearing capacity of clay is a rather uncertain quantity, from eight tons per square foot down to one or less. The dryest and most compact clay should be regarded as being the best. To its advantage, it may be found intermixed with gravel; to its disadvantage, with quicksand.

The diversity of soils teaches at once a necessity of a very careful examination of the ground on which a building is to be erected. Proper tests should be made in every important case, if not in all.

SETTLING CONTINUES.

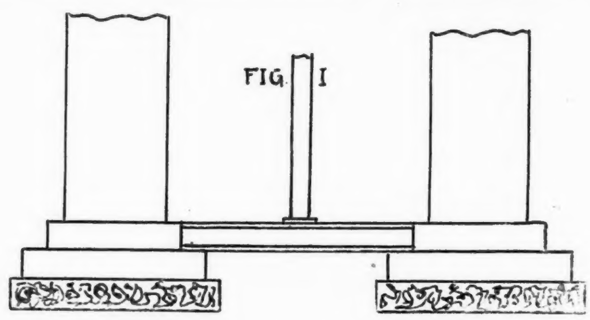
A building erected on compressible soil continues to settle after its completion. If it was erected during the course of a year, it may be considered as having completed about one-half of the ultimate ratio. The other half takes place during the next following two years. This is on the supposition that the area of bases is so adjusted as to limit the amount of ultimate settling to about three inches. In case bases are made with a broader spread, so as to limit the above amount to decidedly less than three inches, the time of settling is lessened, and a larger share of it takes place during the time of construction. And vice versa with a case in which the bases receive a narrower spread.

Where soil is of a decidedly yielding nature the load of superstructural work should be placed carefully upon the center of its base, which then, and only then, will retain its original level position, so that all upright parts will remain plumb. The greater the load per square foot, the more dominant this rule. The example later on given under Fig. 5 is a palpable demonstration of this truth. An experimental demonstration also may readily be had by putting a flat piece of cork of even thickness on still water. The surface will be on a level and remain so, under a load which is exactly placed over its gravity center. When, however, the load is shifted, the cork will dip more and more, until it slides off.

FOUNDATIONS ON CHICAGO SOIL.

In order to give a more thorough, I dare say practical, understanding of the science of preparing foundations, I will refer to the manner required to this effect in Chicago, as employed by thinking architects. The construction of modern tall buildings in particular has demonstrated the necessity of a strict and careful application of the principle first made public through my pamphlet of 1873.

Chicago was founded upon soil of more or less loose character, which overlies harder strata. Rock is found at a depth of about one hundred feet, there forming a kind of cauldron, the walls of which rise toward south, west and north. At Stony Island and at Western avenue they come to the surface; at the northern limit they remain about sixty feet below. The central part of this rocky cauldron is covered by a very solid mixture of clay and gravel, which at some places has a thickness approaching to twenty feet. This particular stratum is today called "hard pan," while formerly the blue clay overlying it was, in common parlance, so denominated. This upper bed of clay is to an extent permeated with water, and it yields to a pressure exerted upon it. It yields in proportion to the extent to which it is permeated with water—in other words, the softer it is. To an extent of about five hundred



feet from the lake, following it far north and south, the surface is covered with sand of a small grain, which grows still finer with the depth, where it becomes intermingled with clay. In this state it is popularly called "blue muck," yet it has been found to be, if confined to its place, more reliable in view of carrying loads than is clay, provided it is not overcharged with water, in which case it is worse than clay. (1.)

MATERIALS.

The materials generally used in Chicago foundations are too well known for especial consideration. In primitive times of the city common quarry stone was used, laid in cement mortar—worse than mere sand. The first heavier buildings erected prior to the introduction of dimension stone were based upon heavy oak planking laid upon the ground. Modern tall buildings are based upon piers constructed of iron rails, or beams, crossing each other, laid upon and interfilled with best kind of concrete.

ADEQUATE LOADS.

The amount of load put upon Chicago soil, clay, or sand or "blue muck," should not exceed 1½ tons per square foot. Under this load the average amount of settling will be about one inch during time of construction, if done within a year, to be followed by an equal (additional) amount during the next coming two years. Heavier loads cause a deeper impression into the ground, and a longer duration of after-settling, while lighter loads have a contrary effect.

Exception should always be had with ground which has been softened by extinct watercourses, or sloughs, and bases should be made wider. The Polk Street Railroad Depot stands, and the defunct Customhouse stood, upon ground of the kind. The fate of the latter has been widely ventilated through all the newspapers. My treatise on foundations, published in 1873, speaks of its foundations and predicts the fate of the then to be building. The central tower of the Polk Street Depot has sunk more than a foot below where it ought to stand, and the whole fine building is, in view of this fact, little better than a wreck. (2.)

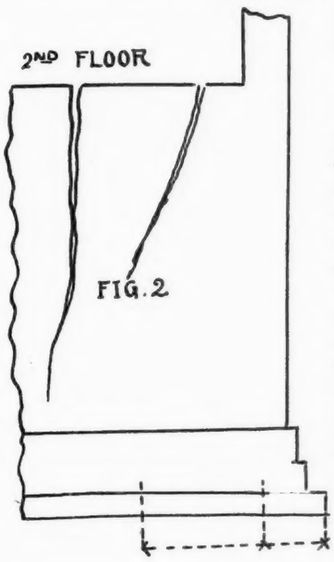


FIG. 2

RULES AS TO SETTLING.

It should be taken as self-understood that rules as to amount of settling can only be of an approximate character. It cannot be expected that, as already indicated, any ground will be of accurately uniform density throughout. This circumstance is enhanced by the fact that a compression of a spot of ground, as exerted by a building pier, is ever accompanied by what may be called a sheering strain against the walls of ground adjoining. The fact is, as may readily be conceived, that the smallest pier will exert the comparatively largest amount of sheering; and further that, in consequence thereof, the degree of resistance of the ground, for a given measure, is the largest for the smallest pier. Experience bears this out. Hence the necessity of express foresight in regard to the construction of very light piers, especially such as are not continued to the full height of building. Light piers should be supported by the adjoining foundations of main piers. Observe illustration, Fig. 1, given on opposite page.

In many cases it is possible to extend the area of bases and thus decrease the load per square foot. A favorable opportunity of the kind should never be lost. With residence buildings in particular, the load should never be more than one ton upon a square foot of ground. With many other buildings, however, it may be required to load the ground even far beyond the limit first given. This is most especially the case in regard to our modern tall buildings. The ground which they cover may not offer the area sufficient for a load of 1½ tons upon a square foot. It may be required to load it with two, even three, tons. The consequence, though not at once disastrous, has been to a measure discouraging, so that recourse has been had to piling the ground. (3.)

PILING.

Pile foundations have in fact become a rule for buildings of extraordinarily heavy construction. Piles fifty and more feet in length are driven down to and into the very hard pan first mentioned, which is so positively solid, as experienced by operations on the part of Gen. Sooy Smith, that the concussion of a 2¼-ton hammer from a lift of 3 feet 6 inches does not cause the pile to sink for quite one-half of an inch. More than one hundred blows are required to sink it to a sufficient depth into this hard pan. Since the permanent load to be sustained by such a pile is but thirty tons, or thereabouts, it cannot be deemed possible that, even in the course of endless time, this load can ever have the effect of pressing the pile farther down, even to the extent of a very slight fraction of an inch. Nor would it be right to assume that the pile itself may be shortened by the stress of its load. The strain upon each square inch of its sectional area is not by any means beyond 60,000 (the load in pounds) divided by 1,000 (a minimum sectional area of the pile), being 600 pounds — a load assuredly within the bounds of permanent elasticity of the timber. If, therefore, the facts anywhere show a settling of the walls built upon such firm substructure, the cause must be with its masonry. It will be found that this has undergone a compression of its mortar joints, a condition which never can be avoided where it is preferred to build the foundation walls — upon such piling — with rubble stone. Even with the best of cements and the best of workmanship, a compression of the mortar joints cannot be wholly overcome. In case the best of bricks are used, laid by the most careful mechanics on beds of the best kind of cement, it would not be warranted to fully depend on an absolute solidity of such foundation. Nor is there any necessity for it. No difficulty is offered in constructing the superstructure so that defects in it are wholly avoided. The foundation may settle without contributing the slightest injury to the superstructure, provided this is, as it ought to be, carefully constructed with regard to plain physical laws. (4.)

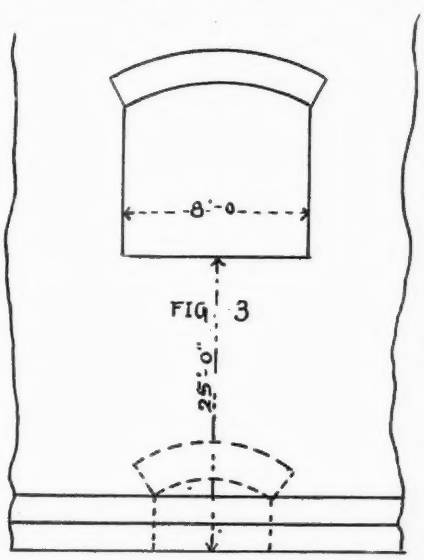


FIG. 3

WELLS.

Another mode of reaching the solid hard pan is offered by sinking wells down through the overlying soil. This also has been done in our city by Gen. Sooy Smith. The driving of piles causes a concussion which may have a tendency to disturb the ground below the foundations of a neighboring building to the extent of settling it. I say "it may" because it has not as yet been demonstrated that it really does. Where the excavation for an intended building extends sufficiently below the foundations of a building near by, the clay thereunder is being divested of the water contained in it, and it shrinks, with the effect of letting those foundations take a downward start, which subsequently is increased by the blows of the pile driver. Such was the result in regard to the wall of a large building on the opposite line of an 18-foot alley. It settled in all by about a foot. On the west line of the lot stands a very prominent building. Since its foundations do not extend beyond the depth of excavation made, it was considered extremely hazardous to drive piles in their vicinity. It was preferred to sink wells. To this end, timber sheetings were driven around steel rings to sustain the inward pressure of the surrounding soil, and the excavation made inside this sheathing nearly to the bottom of each section, when another section was driven, and so on down to the requisite depth, namely, to the surface of the hard pan. The wells were then filled with concrete, each of them built up solid with masonry. By this rather ingenious process foundations were obtained which not only carry the loads upon them with absolute certainty, but also left the adjoining walls entirely undisturbed. Any kind of ordinary foundation built alongside of it would have settled, taking with it, as it does in all such cases, the adjoining foundations. (5.)

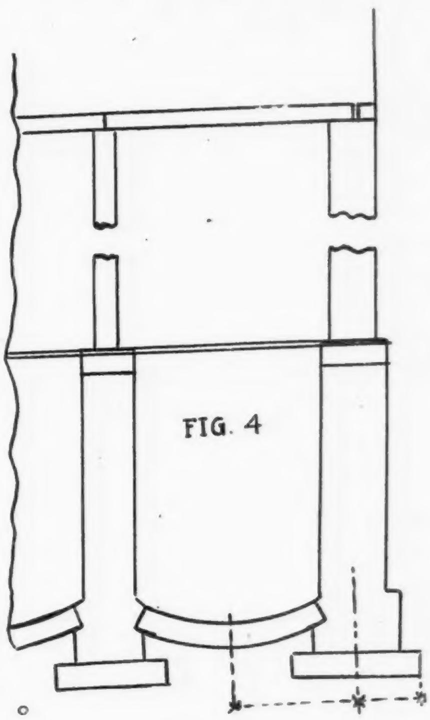


FIG. 4

ILLUSTRATIONS.

Fig. 1 exemplifies the manner of treating light piers, or mullions, located between main piers of a building. If set upon its own independent foundation it may — it will — not be heavy enough to press it down as much as will be the case with the main foundations. The consequences may be serious. (6.)

Fig. 2 illustrates a different, though related case. A dwarf wall is butting against a main wall therewith connected. Its foundations, as generally is the case, being too broad for equable settling with main wall, the result is that the ground underneath is pressed out of level, and that, consequently, the upright axis of main wall is thrust out of plumb, in an outward direction. Cases of the kind are very frequent. Defect is readily avoided by placing a board against the main wall at the very place of connection with dwarf wall. Through this device connection between the walls is put out of question; and since the foundation may be to a slight degree ruptured at the intersection, the main wall will remain in original position.

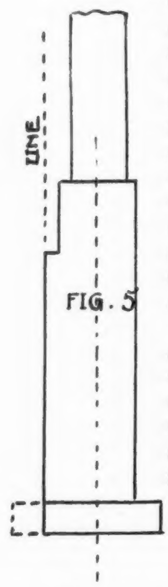


Fig. 3 illustrates the disastrous effect of what appears to be a very slight cause. A continuous wall extending upon a continuous foundation has far from its base, as shown, an opening. Though the proportion of load assumed by the wall is very slight, it is enough to cause the arch over the opening to become loosened, so as to allow some of its bricks to drop. This peculiar occurrence cannot be explained otherwise than by the assumption that the weight omitted above does act upon the foundation so far below, causing it to assume a slight curvature, which, in a measure, is continued upward to the place of the arch. Green masonry must, therefore, be regarded, like the ice of a sliding glacier, as a yielding mass which accommodates itself according to all conditions prevailing. In this case all damage is readily avoided by omitting, as shown, part of the foundation below the opening, and casting an arch over the gap, or applying an iron lintel.

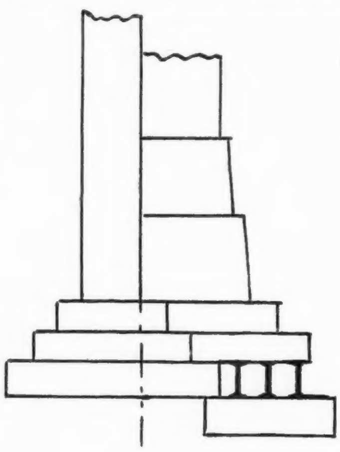


FIG 6

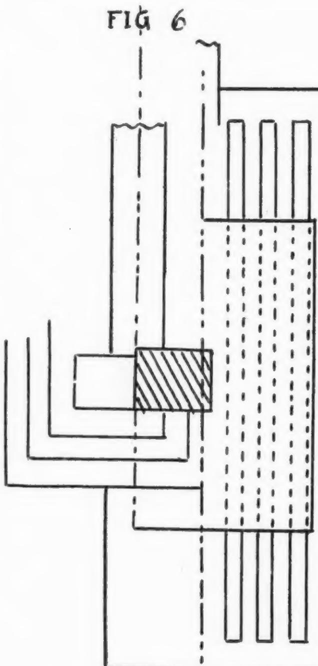


Fig. 4 demonstrates the effect of inverted arches in the case employed. The effect is that the corner pier is thrown out of plumb because the ground under its base is pressed out of level. The arch has, as intended, increased the bearing surface; but it has made, as indicated by the dotted lines, the exterior bearing surface beyond the pier's gravity line the smallest, with the inevitable result of throwing the pier over. In case the lintels are well connected, but loose at the extreme end, the entire front is dragged over. I have seen a number of cases of the kind in our city. If, on the other hand, the lintel at the other end is secured, or if the main story piers are broad and firm, the effect will be a throwing over of the basement piers, in case they project far enough above the ground, or are not firmly held by the ground packed against them. The result is the same where the entire front is built upon planking first bedded on the ground, and not reaching far enough beyond the lines to balance the end piers. The first two substantial buildings by me erected in young Chicago upon such planking resulted with basement end piers more than an inch out of plumb, because the planking did not reach far enough beyond the lines.

Fig. 5 exemplifies the manner of treating a wall which touches a neighbor's line of vacant lot. Though no damage is or could be done to the neighbor by projecting the base course beyond this line, objection, nevertheless, is raised in a number of cases. It is necessary, then, to set the wall off line, as shown. If circumstances prevent a placing of the wall centrally upon its proper base, this base should be narrowed in order to allow the center line of wall to come at least nearest to the center of base. It should be kept in mind that it is far preferable to let the wall undergo an overplus of plumb settling than to allow it to assume an outward decline. Many very serious results have come out in Chicago from carelessness in regard to cases of the kind. The laws of nature make imperative demands which must be obeyed.

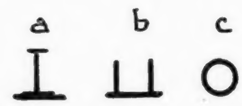


FIG. 7

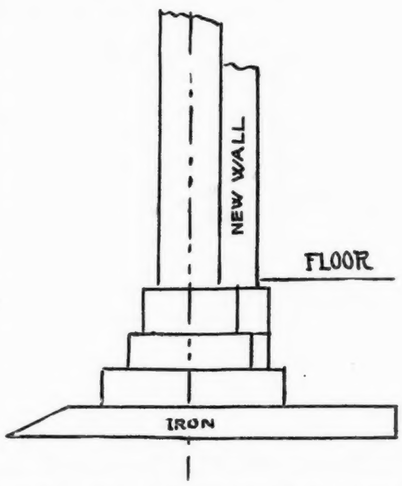


Fig. 6 shows treatment of a case where a heavy pier of a new building is placed against the pier of another building with party wall. Heavy iron beams, as shown, are placed upon dimension stone laid alongside the base of the old pier. Upon these irons, firmly embedded in Portland cement concrete, other dimension stones are placed, battering up to the pier proper. I thus succeeded in such case with a building extending many feet higher than the top of the old party wall. The unavoidable settling was by this means so far overcome that no visible signs of it made an appearance.

Fig. 7 treats a case where a heavy new building adjoins an existing party wall of insufficient solidity. In case the cellar of adjoining building can be entered, for purposes of tearing out the old and establishing a proper new foundation, the case is an easy one; but where this is impracticable, or not allowed by a stubborn neighbor, the wall may be subjected to a peculiar new kind of underpinning, accomplished by pushing irons under the base of wall, as shown in Fig. 7, by which means I accomplished success in several cases. In the first of these I employed heavy water pipes, 8 feet long, 7 inches diameter. They were applied at places about seven feet apart from each other, six to ten of them in each. An additional 8-inch wall was built, as shown in Fig. 7, connected with the old wall, and this joined wall was loaded by three more stories of new wall. The load upon the base was far more than doubled, and all this with positive success. But the iron tubes did not fill with soil as they moved forward; they rather pushed the ground ahead of them. Though answering in one case, they had to be rejected for others. They were made of cast iron, section "b," and answered well for the next two cases. In cases of a more serious character, however, I should resort to employing I-beams fastened upon bearing plates and pointed at front ends. They could readily be pushed forward by means of a hydraulic jack, while common screws were used in the cases first mentioned.

The irons, being kept from atmospheric contact, are, in all probability, not subject to destruction by rust; but the process is, nevertheless, not preferred in any case where the new wall, as part of a modern fireproof structure, serves principally as an envelope for its structural irons. Employment of the cantilever principle is here preferred.

ADDENDA.

(1.) When excavation is made in "blue muck" below the water line, the surface is found to remain hard and dry for a few minutes. This time should be utilized in applying the foundation material. If this is neglected the surface of the trench will be softened by the water oozing up. When by some deep excavation the water permeating the soil is abstracted from under the foundation of a neighboring building, though this is far enough away to be otherwise uninjured, it will undergo an injurious settling. The soil below it will shrink with the gradual loss of moisture. It is not exempt from the natural process experienced by every potter and brickmaker.

(2.) I am of the opinion that it is practicable to raise the said tower to its original level, and keep it there, by means of wedges.

(3.) In case piles are driven down into the very hard pan they serve like props laterally held firm by the density of the upper strata. In case they are not driven thus far down they lose their character of props. They are then mere compressors of the ground. It remains to be fully investigated whether in this character they answer the purpose. In case they do, it may be sufficient to employ only one pile (iron) for making the holes, pull it up and fill hole after hole with a hard substance.

(4.) It is indeed singular that such plain physical facts are left unobserved in regard to the most important buildings. It would seem to be of demonstrative value that I criticise here, in this regard, the construction of a very large and costly building in our city. Its basement windows are in pairs, divided by a narrow pier. The story next above has one large opening over each pair of windows. The little piers below them, being mere mullions, have comparatively nothing to carry. The adjoining main piers have a weight of far more than 100 tons. The foundations rest upon piles driven into the very hard pan. Settling was and is out of question. But the foundation walls, built with large rubble stone, extend some twenty-six feet high from the top of piling to the lower water-table. They are built continuous, sustaining alike the heavy and the light piers. The heavy piers exert a compression of the mortar joints between the rubble stone, to an extent of probably two to three inches (and this has been ascertained), while the light piers have no such tendency. Result: Disruption of the structure. A large number of the lintels over the lower windows are broken. In one case the rupture extends through the very string course. There is no telling what may become of the lintels as yet whole. And all this because the plainest common-sense principle was kept out of sight! A construction similar to what is shown in Fig. 1 would have obviated every difficulty, so that the most costly structure would not be wrecked as it is.

(5.) Wells are of old date in the city of Berlin, Germany, where a compact gravel bed extends from twenty to forty feet below the surface, and the overlying soil is rather loose and watery. The wells that I saw were 4 feet in diameter, built of brick with 10-inch walls. Their cavity was filled with rubble work.

(6.) I remember a case of the kind with an important building reërected after the great fire. Very light piers standing between main piers upon the former foundation of the building did not go down, but stood firm and ruptured the lintels above them. An item of nearly $20,000 for "repairs" was the result.

SOME PRINCIPLES OF FORM-DESIGN IN APPLIED ART.*

BY HUGH STANNUS, F.R.I.B.A.

ART may be defined as that branch of mental activity the intention and result of which is to make the material environment of life more pleasant. When the things and acts which constitute this environment are most pleasing to minds of most intelligence, then they are said to be "beautiful." The beauty may appeal through any of those channels of communication from the environment to the mind which are termed "the five senses," and may be beauty in sight, sound, smell, touch or taste. And, according to the particular sense it affects, it will be beauty in shape or form and color, sound, odor, taction, savor. Opinions are divided on the question — of the intellectual order in which these should have precedence; and they are here arranged on the principle of distance versus proximity, it being assumed that those senses which require *nearness* are more personal to the animal portion of the observer, and those which can be exercised on *distant* objects are appreciated by the intellectual faculties.

There is an art (or several arts) which appeals to each particular sense, thus: architecture, sculpture, painting, etc., to sight; poetry, music, etc., to sound; perfumery, etc., to smell; texture, to touch, and gastronomics to taste; but only the first three, which appeal to the sense of sight, are included in this present course.

A further subdivision is made between the art that is produced without special reference to the surroundings, which is independent, isolated, unapplied and sometimes heterogeneous or unsuitable, and the art which is made *for* its place and *in* its place, is applied, and should be homogeneous and appropriate. The former may be termed "independent art," and the latter is "applied art."

The independent arts are: Sculpture — when the examples are made, each for its own intrinsic beauty in line and mass, without reference to the positions that they may afterward occupy, but generally intended to be, each of them, the dominant feature of the collection or shrine. Some of these examples, like the Aphrodite of Knidos, the Nike of Melos, and the Apollo of the Belvedere, are among the noblest achievements of man. Painting — when, similarly, the pictorial artist shows his mastery over drawing, color and chiaroscuro, in subjects chosen to display those qualities without reference to or knowledge of any subsequent positions that may be dignified by the easel pictures (and here, again, it would not be difficult to name works which are immortal). Music — when the tone artist, feeling the throbbing of interwoven melodies, is impelled to score them without reference to any words; and so with the other independent arts — each of them is independent of any useful object and arises mainly out of the worker's joy in his powers.

The applied arts are: Architecture — when interesting variety, well-considered proportion, refined detail and expressive features are added to structures (as is so well shown in Fergusson's "History of Ancient and Mediæval Architecture," 1893, page 13, and in Mr. Statham's "Architecture for General Readers," 1895, page 17), which without such graces would be only building. Sculpture—when the relief frieze and panel are applied as the decoration of a cabinet. Painting — when the beauty of foliage is applied to a wall. Music — when the rhythmic beat of the military march is utilized to keep the soldiers in proper "step"; and so with the other applied arts — each of them owes its existence to the fact that it is *applied.*

This course is on applied art. Sir Edward Poynter, P.R.A., in his fine, scholarly and searching "Ten Lectures on Art," first published in 1879, has classified applied art into the two kinds which are here termed "form-design" and "decoration-design."

Form-design (or constructive design, as he terms it) "has its simplest expression in the form which a savage gives to the ordinary objects of his daily use; . . . to his hatchet, or to the rude vessels in which he cooks his food."

Decoration-design is seen "in the patterns which he cuts on the prow of his boat, or traces with a stick on his pottery, or the mud walls of his hut."

The *form* of an object, and the *decoration* of that form are often conceived together or simultaneously in the artist's mind, analogously to the close relation between the *plan* of a building and the *elevations* of the walls that inclose that plan. Practically, however, the plan for accommodation is first considered and the wall design depends upon it; and similarly, in art, the form (or, at least, the general mass form) is primary, and the decoration is secondary. Thus, a pot is (firstly) thrown on the wheel, in which operation it receives its form; and (secondly) scratching, painting or modeling is added or applied, in which operation it receives its decoration.

There are cases in which (*a*) the function of the object does not permit of decoration, or (*b*) the beauty of the form does not require any further addition; but these will be considered, generally, as they arise. For the present it will be well for the student to consider the two operations as distinct; and to deal firstly with *form*, and secondly with *decoration.*

In form-design the artist considers the design for the intended object, after the general conditions have been formulated according to the requirements of fitness (i. e., fitness to the function or intended purpose and use of the object, to the material of which the object is to be made with its capabilities and limitations, and to the particular construction or methods of joining together that he intends to adopt); and, always subject to these conditions, he adds, according to his artistic individuality or "taste," such further qualities as variety in the mass form, and proportion of parts to each other and to the whole object.

These two qualities — variety and proportion — when superadded to the fitness, are sufficient in themselves to render an object beautiful. Further artistic work may impart other qualities, e. g.: Richness, refinement, accent, etc.; but they are not absolutely necessary. One vase with variety and proportion superadded in the form, though without any decorative detail, may show a high order of beauty; while in another of bad form the faults may be a little disguised by judicious decoration, but they cannot be eradicated; and it will always be low in the scale.

The two branches of any treatise on applied art are: (1) the elements, and (2) the principles which govern the application of those elements. In the sister art of gastronomics, the cook manipulates and mingles certain ingredients according to certain recipes; and the student will perceive the analogy between the ingredients and the elements, and between the recipes and the principles.

The elements of form are the geometrical solids, e. g., the cylinder, prism, sphere, ovus, cone, hyperboloid, parallelopiped, etc., and many irregular forms which need not be particularized here.

The elements of decoration are geometrical lines and figures, ornament (see the author's second course of Cantor Lectures on "Artificial Foliage"), natural foliage (see the author's first course of Cantor Lectures on "Natural Foliage"); artificial objects (e. g., the garland, shield, festoon, tablet, etc.); parts of animals (e. g., the lion head for the waterspout, the lion leg for the footstool, etc.); animals and compound animals (e. g., the lion, gryphon, etc.); and, lastly, the human figure, which is the noblest of all. All of these, except the human figure, will be seen in Meyer's "Handbook of Ornament" (second English edition, Batsford, 1894).

A principle, in ordinary language, is the underlying universal consideration which governs conduct in daily life, e. g., the "Golden Rule." The essence or spirit of this is expanded, embodied and applied in detail to particular places; and this application is termed a by-law. It is further expanded in more detail for particular persons; and this is termed a rule of etiquette.

The principles in applied art are analogous; but, by an unfortunate looseness of idea, in some lists of principles, there has been no distinction made between the universal principle (that is right under all conditions) and the local law (that is limited in application, and subject to be suspended in operation by the higher); nor between these and the minor rule (that is applied only to the

*Lectures delivered February 14, 21, 28, and March, 1898, before the Society of Arts, London, Eng., and published in the *Society of Arts Journal.*

small details in their "personal" relation to each other); * and the undiscriminating dogmatism that makes the less of as much importance as the greater has caused a hostile feeling against all principles and a desire to "kick over the traces" in the restless and capricious search for so-called "novelty."

These principles are fitness, variety, proportion, sympathy, expression, etc. It is impossible, within restricted limits, to do more than mention their importance, and it may perhaps be more useful to the student if his attention is directed to the laws.

The function of any object or feature of an object is the intended purpose or duty that it is arranged to serve or sustain, e. g., the retaining of the stems in a *vertical* attitude by the flower vase, or the permitting of an *easy* flow of liquid by the teapot spout. Sometimes several functions are served by the same object, e. g., in the Greek water vase termed the hydria (the first sketch in Fig. 2), a vessel that (*a*) the women carried in a horizontal attitude resting in an annular pad on their heads, in going to the spring, hence its largeness and roundness of profile at the center of gravity (empty) near the widest part of the vessel; (*b*) was held by the women under the bubbling flow, hence the large and strong single handle attached to the neck; (*c*) had to catch as much water as possible, hence the wide mouth; (*d*) had to be lifted by each woman to her head, hence the two side handles; (*e*) had to be steady when carried in a vertical attitude on the head, hence the strong, wide foot; (*f*) had to prevent splashing as the woman walked, hence the contraction from the vase shoulder to the vase neck. So, also, in the oil vase, termed the lekythos (the second sketch in Fig. 2), the vessel was (*a*) small and suspended from the girdle, hence the small strong handle; (*b*) was used by the athletes for anointing themselves, hence the swelling out of the neck for the purpose of forming a cup (as shown by the dotted lines) from which the finger might easily extract a small quantity as required. The Greek vases of the great period are so perfectly beautiful in their form that the spectator is liable to overlook or not to appreciate the no less perfect fitness for their function.

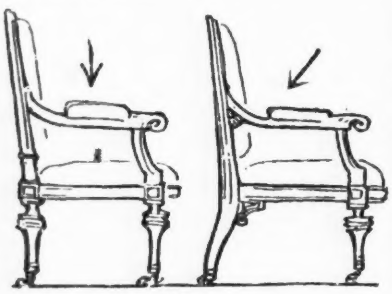


FIG. 1.

Objects are functionally designed when all the purposes or duties for which they are intended are properly considered and provided for. The quality that is thereby conferred upon the object is termed functionality.

The law of functionality is the first and the most important in applied art. It prescribes that the form shall be such as will best serve the intended purpose of each object. No desire for variety in bulk, curvature or texture may be permitted to interfere with this. Nor should *vis inertia* or indolent pleading of custom be allowed to prevent the student from searchingly considering each function of each part. And no amount of clever handicraft can atone for neglect of this primary law. In a competition for a foot-scraper to be executed in cast iron, some years ago, one of the models showed two cupids, about six inches high, holding a *piece of drapery*, like two maids shaking a carpet, against the upper edge of which the foot was to be scraped! The two cupids were very good examples of modeling, but the artist appeared to have overlooked the fact that the problem was not to model a cupid, but to design a foot-scraper. The result was ridiculous as a design and disastrous for him, and many of the objects that vulgarize houses result from a similar ignoring of this first and greatest law — functionality.

Disregard of functionality is shown in the sketch (the first in Fig. 1). The artist may have thought that the strain on the chair was only *vertical* (shown by the arrow), as it is on a stool or a seat without a back. But, when a back is provided, and the sitter leans against it, the strain becomes *oblique*, and this should be provided for (as shown in the second sketch). The first is from a set of chairs, beautiful in other respects, in one of the French palaces. Perhaps they have not been much used (now they are merely show objects). If they had to undergo the wear and tear of daily life, they would soon exhibit, in the loose joints and ricketyness, the neglect of the artist.

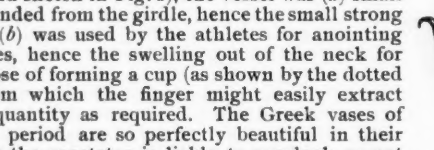


FIG. 2.

*See this beautifully expressed in "The Education of the World," by Doctor Temple (the present Archbishop of Canterbury), published in "Essays and Reviews."

Functionality includes considerations relating to the anthropic size, the ansation and the cleaning of objects, and also to the avoidance of injury to the user and of injury to the object.

Anthropic size is the average size of man as governing the size of the objects that he uses. Thus: that of the whole body is necessary for the opening space of doors, etc., both in height and width — the height of his breast is necessary for that of parapets, the height of his knee-joint is necessary for that of seats, the height of his hand is necessary for that of door handles and chair backs, the size of his hand for that of handles of doors, etc., the size of his fingers for that of teacup handles, etc., the length of his foot for the breadth of a stair tread, and the length of his down-hill step is taken for that of the stair riser and stair tread together.

Disregard of anthropic size is seen in the steps round the Parthenon and in other temples. The height of the riser and the breadth of the tread are too great; hence, in some temples, smaller steps of anthropic size were cut out or interpolated at the entrances. When the anthropic size is considered in a building — in the steps, the seats, the doors and other parts — then the spectator can better assess and appreciate the size of the building. The church of St. Peter's, on the Vatican Hill, at Rome, is an instance of the manner in which the colossal size of the building loses its impressiveness by reason of the colossal size of the details and disregard of anthropic size.

Ansation is important in all objects that are carried. The artist takes this into his thought, considering the number, position, attitude, etc., of the handles, and so making them characteristic and expressive features in his design. M. Viollet-le-Duc, in the sixth of his fine analytic and suggestive "Entrétiens," 1860, shows the arrangement of handles when a vase must be reversed for draining. Dr. Christopher Dresser, in his useful books, "The Art of Decorative Design," 1862, at pages 133 *et seq.*, and "The Principles of Decorative Design" (about fifteen years later), at pages 139 *et seq.*, has reasoned out the application of the handle in relation to the distributing of liquid from the vessel. Two sketches of Fig. 2 are adapted from his illustrations. The third sketch is for a *pipe*-spout water can, and the fourth sketch is for a *lip*-spout water can. In each case the center of gravity of the vessel (when full) is found as marked by the dot in the two sketches. A line (termed the delivery line) is drawn from this dot to the lowest point at which the liquid is delivered. From this dot and at right angles to the delivery line, a line (termed the suspension line) is drawn in an upward direction. When the distributing handle is on this suspension line then the vessel is most easily manipulated.

FIG. 3.

FIG. 4.

Disregard of ansation is seen in most teapots. All who have to pour out tea will have felt the great disadvantage of the position of the handles. Another example is shown in Fig. 3, in which the vase, described (among others) as being "in the highest sense *original* generally from admirable designs by the great artists of Germany," is furnished with attached extraneous pieces of ornament in such a manner that the would-be user cannot hold it to drink from, either by the side handles or the stem handle. The vase is shown in Fig. 4 with the ansation corrected. (It is necessary here to explain that this and nearly all the figures are from *rough sketches*, such as were made on the blackboard; and, beyond elucidating the law involved, make no pretension to be designs.)

All movable objects, which have to be lifted from one position to another, should either be ansated or be provided with some conspicuous knob or plain portion that may be grasped with efficiency and comfort. When the maid is uncertain what she should take hold of for the purpose of lifting the chair or pulling down the chandelier, then the artist is in fault. Cleaning, or provision for efficient and easy cleaning, is important in all objects that are used. The inside of the jug and face of the mirror will occur to everyone.

Disregard of this is seen in the elaborately chased chamber candlestick that becomes clogged with overflow wax; in the pot lug with neck too small to admit the hand (if the artist plead that the smallness of the neck gives character to his design and that he cannot do without it, then he has mistaken his vocation); in the carved mirror frame "decorated" by the swag festoons that overhang the glass, causing the leaving of dirty places or the risk of breakage as each weekly cleaning day comes round; and more examples will occur to every housewife.

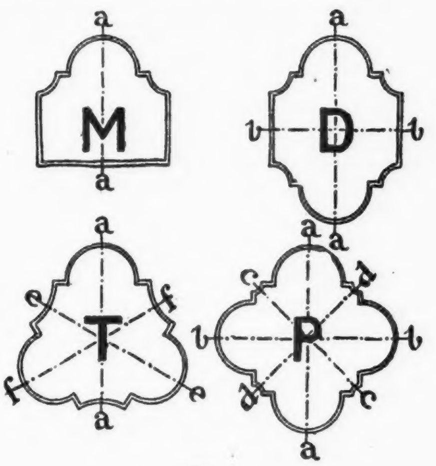
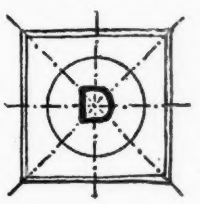


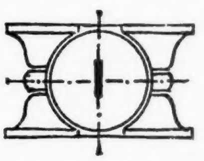
FIG. 5.

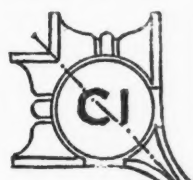
Injury to the user must be foreseen and prevented, by the avoidance of sharp edges and spiky relief work, and generally by the introduction of smoothness and softness, so far as is practicable, in all places within reach of traffic or use. Without going so far toward the other extreme as to provide padded rooms, the artist may yet take care, in these days of feverish hurry and rushing about, that in the moldings of passage-ways, etc., and in the metal fittings of doors, etc, there shall be no projecting blocks to bark the shins or skin the knuckles of the user.

Disregard of this will be seen in the chair back that tears the lady's dress by its prickly ornament, in the wrought-iron support to the wash basin that becomes entangled in the dress, in the screws of the door handle that are not "driven home," etc.

Injury to the object by the use must equally be avoided. An interesting example of this is seen at Pompeii, where the arrisses showing an angle of about 100° to 120° between the flutes of the Greek Doric columns were damaged by the traffic, and where, consequently, the flutes are filled up without cement, making facets only, with arrisses of 157½°, which are much more obtuse and therefore less liable to injury.







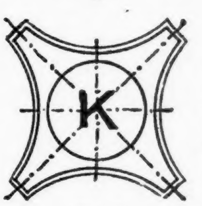


FIG. 6.

Symmetricality is the first of the group of laws which govern the conformation of objects or the attitude of animals. The term is derived from two Greek words which signify the quality of being *measured together*. Obviously, when the two halves of an object are designed in such a manner that in every respect each detail of the one half may be measured with the corresponding detail of the other half, then the object in itself is symmetrical in conformation. Examples of this are: in architecture, the Triumphal Arch and the Temple portico; in sculpture, the Osirid pier and the archaistic Antinous statue; in typography, the capital letters H, I, O T, etc. Among animals each quadruped or biped is divisible by an imaginary vertical plane passing axially through the body from front to back or from head to tail. Each detail on what is called the "right" side of the animal, be it eye, ear, leg, nail, etc., may be *measured* with the corresponding eye, ear, leg, nail, etc., on what is called the "left" side of the animal; hence these animals are said to be symmetrical in conformation. These animals, however, having volition and locomotory power, are constantly moving, and are symmetrical in attitude in only exceptional cases; quadrupeds or birds are never so in attitude, and man is only so when he stands at "attention" in preliminary military drill. At other times the standing man rests first on one leg and then changes to rest on the other, and this deviation from the stiff symmetricality of the recruit at "attention" is termed balance, which will be treated of later. The distances of the various details from the axial vertical plane are exactly the same on each side of it for each pair of corresponding details, hence the form of one side-half is the exact reverse of that of the other side-half. In the process of making a drawing of a symmetrical object the student (*a*) draws the one side-half; (*b*) makes a tracing in soft pencil of that, with the vertical axial line marked upon it; (*c*) turns over the tracing so that the axial lines coincide; and (*d*) thus transfers the other side-half *in reverse* of the former. This is a quick method of making the two side-halves to be the exact reverse or reciprocal drawing of each other, and is an economy of draftsmanship which is much practiced in pattern design. The act of turning over the tracing has conduced to the name "Trace and turn-over," by which it is generally known in that branch of decorative art.

The associated ideas connected with symmetricality are related to its prevalence in nature, its necessity in architecture, its expediency (i. e., not causality) in the careful arrangement of affairs in daily life — in nature, animals could not progress nor plants grow without it. In architecture, buildings could not settle down evenly on their foundations unless the side-halves were equal. In daily life it is associated with carefulness and accuracy; the judge who sits stiffly in the center of the bench, leaning to neither side and symmetrically attired, is an example.

The character of the object also governs the application of this law. Symmetricality, as adding a certain degree of dignity, is appropriate in objects of a monumental character which appear to require a premeditated treatment, e. g., the monarch's robes, the senate house, the chancel screen, the state carriage, the grand piazza, the city viaduct, etc.; but it is out of place in a peasant's shawl, a country cottage, a field hedge, a coster's barrow, a village green or an Alpine bridge; and the person who builds the double-fronted cottage with central portico is unconsciously committing the vulgarity of aping his superiors. Better that he should recognize the truth of the dictum, "The grand style to the great things and the homely style to the small things." The grand style is an ambitious effort to compete with the great, and the Hindoo artists avoid exact symmetricality from this feeling and their consequent desire to escape from the anger of the gods that would descend on their ambition.

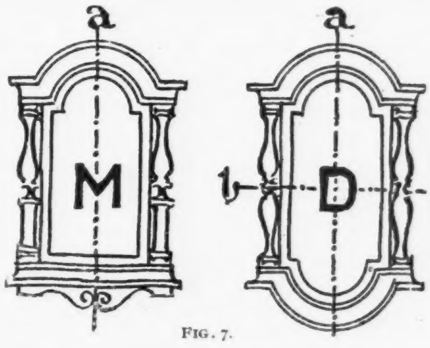


FIG. 7.

Increase of symmetricality is observed in objects and features which lie in horizontal surfaces. Divisibility by *one* plane, accompanied by the exact identity in size and design of the corresponding details on each side, has been shown to be characteristic of conformation in the higher animals; but there are examples among the lower animals which are divisible by more than one plane, e. g., the starfish, the sea urchin, etc.; and in the vegetable kingdom the greater number of flowers which lie in horizontal planes are polysymmetrical. It will be observed that of the flowers which have an erect attitude many of them, e. g., the papilionaceæ, have one vertical axis; and the greater number of those whose face or general surface is horizontal, e. g, the daisy, etc., are divisible by *many* vertical planes, excepting some, e. g., the cruciferæ, which are divisible by *four* vertical planes, and some, e. g., the liliaceæ, which are divisible by only *three* vertical planes.

The terms for the degrees of increase in symmetricality (i. e., in the number of axial planes or axes) are adopted from the Greek numbers. Thus in Fig. 5 the shape M is divisible by only one axis (a), and it is therefore termed monosymmetrical; the shape D is divisible by two axes (a and b), and it is termed disymmetrical; the shape T is divisible by three axes (a, e and f), and it is termed trisymmetrical; the shape P is divisible by four axes (a, b, c and d), and it is termed tetrasymmetrical or more often polysymmetrical. (The student is advised to fold a piece of paper cut to

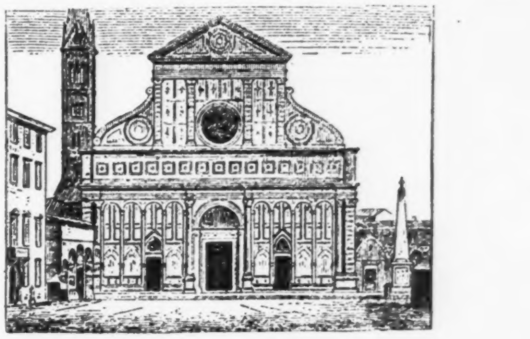


FIG. 8.

each shape, with the crease along each of the axes shown, and the various degrees of symmetricality will be seen.)

The application of this law to the plan of the capital in the three classic orders of architecture is shown in Fig. 6, in which **D** shows the Doric capital, **I** shows the Ionic capital, **C I** shows the

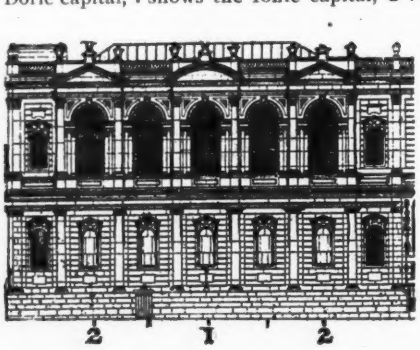


FIG. 9.

corner Ionic capital, and **K** shows the Corinthian capital. The Doric and Corinthian capitals, it will be observed, are *tetrasymmetrical*, and therefore may be used, not only along the front and flank of a building, but also at the corner where the front and flank meet. These two capitals have never been otherwise than "all-round" capitals, and no necessity for readjustment of their parts has ever arisen. The Ionic capital differs from them in being a "front and side" capital. In each capital, the two fronts show volutes carved in vertical planes, and hence they are termed the volute fronts of the capital; while the two sides show the coiling in of masses which are profiled, on the under surface, somewhat similarly to the double-bodied baluster, and hence they are termed the baluster sides of the capital. The normal Ionic capital is only *disymmetrical*. It can, therefore, be used along the front of a building which does not require columns at the flanks; but when it is applied along both front and flank, a difficulty is caused at the corner, owing to it being not tetrasymmetrical. An attempt to meet this difficulty was made in the Nikeapteros shrine, and, later, in the Erechtheum, and other temples, as shown at **C I**. In these corner capitals, the baluster sides respond to those of the normal capitals on the front and flank, and the volutes in front of these sides also correspond to the volutes of the normal capitals; but the outer volute on each face is bent out in plan, as shown, making a large horn-like projection at each corner of the building, that is not pleasing; and the rear volutes make a reëntrant angle, abutting against each other in such a manner that one-half of each volute disappears behind the other; and the result is a hiatus. If the later architects had "harked back" to the four-faced capitals of the Bassainaos, and had developed from that (in which the volutes are *conjoined* and *integral*), then the solution of the difficulty would not have been left till the temple of Saturn at Rome (in which the volutes are isolated and fortuitous). It must be regretted that, in the corner capital, the Greeks did not evince their usual æsthetic insight; and that the disasters of that insane Peloponnesian war prevented further artistic consideration of the problem.

FIG. 10.

FIG. 11.

The corner capital, it will be seen, is *monosymmetrical;* and that fact appears to have, hitherto, precluded a successful solution.

The application of this law to objects firstly depends on the attitude toward the horizon of the surface on which or against which they are placed.

Monosymmetry has been observed in nature to govern the form of objects that are *erect* in attitude. Hence persistence of memory or association of ideas may have led artists to design objects which were intended to be upright, whether in isolation or against a (vertical) wall, with only *one* axis, and that in a *vertical* attitude. It may be further observed that, in objects connected with walls and other vertical architectural features, the principle of sympathy seems to suggest that the verticality of the axis (i. e., of the object) will better consort with the verticality of the wall surface than if the axis were in any other attitude.

Polysymmetry (or any degree more than monosymmetry) has also been observed in nature to govern the form of objects in a *horizontal* or quasi-horizontal attitude. Hence, again, the effect of memory and of association will lead to polysymmetricality in ceilings and floors. And further, be it observed that objects and features on horizontal surfaces (which are approached in various directions and seen from many different points of view) will be less unsuitable in effect when the attitude is not strongly marked (because of the number of axes in different directions) than when it is conspicuous (because of its having only one axis). In Fig. 7, two sketches, for a mirror frame, to be fixed against a wall, are shown: **M** is monosymmetrical, having only the one axis (*a*); **D** is disymmetrical, having the two axes (*a*) and (*b*). It will be observed, for the reasons above given, that **M** is the more suitable for a wall feature; and **D** (without the balusters) would be more permissible as a ceiling feature; and from this example it may be deduced that disymmetry militates against the sense of verticality that should govern the application of objects on vertical (wall) surfaces.

The avoidance of secondary symmetricality in the wrong place is also important. When, in the front of a building, there is a

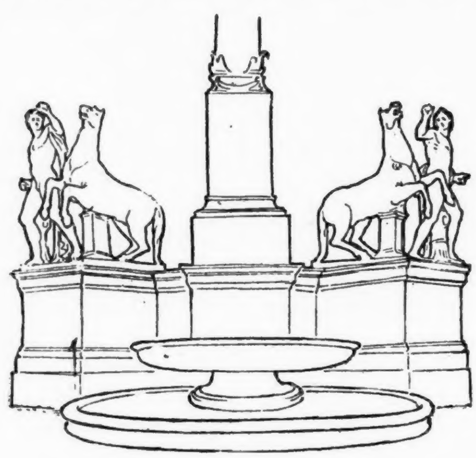


FIG. 12.

side entrance on each side of the central entrance, then the amount of importance to be given to their design should be in accord with their subordinate or secondary position. And it is nearly always possible to arrange that the secondary axes, thereby created, shall not be in the centers of the wings of the building. The church front in Fig. 8 is that added by Alberti to the older nave and aisles of Sta. Maria Noveall, in Florence. The distances between the doors were fixed by the axes of the nave and aisles; and were therefore part of the data of the problem. It will be observed that he has arranged the column at the flank of the central door and in immediate connection with it, and the similar column with a coupled pier at each end of the front, at such distances that the wing (or space between the columns) on each side is divided into four bays (which is an *even* number); and that the side door occupies the second bay from the center door. Thus each side door avoids being in the center of the wing. Had he—by reducing the width between the two columns that flank the central door, and by increasing the breadth of the end-piers—arranged each wing in *three* bays and placed the side-entrance in the central bay of each, then the secondary axes would have been more important than the primary axis, and the effect of the whole front would have been spoiled. As it is, it is a fine example of scholarly design, and well worthy of admiration and study.

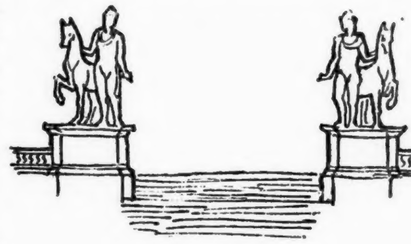


FIG. 13.

Disregard of this avoidance is seen in the front of the National Gallery, Trafalgar square, London, in which there is an *odd* number (three) of windows in each division of the wings; and as a result, the eye, in traveling over the building, is perplexed at finding so many central axes or axes of symmetry attracting its attention. Had there been an *even* number of windows in each division, the effect would have been less distracting. Another interesting instance is seen in the front of the People's Palace for East London, in which there is one primary axis of symmetry in the recessed center, and one secondary and two tertiary axes in each projecting end block; total, seven axes. The position of a feature also governs its treatment. When the feature is *axial*

(i. e., central), then it should be treated in a symmetrical or quasi-symmetrical manner; and when the feature is *unaxial* (i. e., at the side), then symmetricality should be avoided. It will be observed that where there is an axis of symmetry — there the eye rests, without seeking further; and where there is not symmetrical arrangement — there the eye does not rest but seeks for the center of the composition. Hence the "east window" of a church will be designed with an *odd* number of lights: 3, 5, 7 or 9; with a quasi-symmetrical figure in the painted glass of the center lights, and with an unsymmetrical figure, looking inward, in each of the side lights. And, to avoid symmetricality, the side windows will be designed with an *even* number of lights: 2, 4 or 6 (and the west windows may be designed with even 8 or 10).

(To be continued.)

ARMOUR INSTITUTE OF TECHNOLOGY.

IN the six years since the work of instruction began in this institution, much has been accomplished toward reaching the high standard originally proclaimed. While broadly philanthropic in its aims, it is not a free school, and its founder, realizing the importance of self-reliance, has conditioned his benefactions in such a way as to emphasize both their value and the student's self-respect. The scope of technical training, somewhat indefinitely defined at first, has crystallized to an extent that insures this educational institution a favored position among American colleges. The Armour Institute of Technology proper includes the following-named courses: A course in mechanical engineering, a course in electrical engineering, a course in mathematics and physics, and a course in architecture. A subordinate educational factor is the Armour Scientific Academy, which admits to its classes boys and girls who have completed the studies in the grammar grade of the public schools. It provides courses of four years, which prepare students to enter the Technical College of the Institute, or leading universities and colleges elsewhere. The instruction in the academy is under the immediate supervision of the dean of the faculty, and many classes are personally conducted by members of the college faculty. Included in the original plan of the Institute, and still under its direction or affiliated with it, are: The Department of Domestic Arts, the Kindergarten Normal Department, the Department of Music, and the Department of Shorthand and Typewriting. It is, perhaps, sufficient to say that the different departments are fully abreast of modern ideas, both as regards the personnel of the instructors and the plan of work outlined.

The School of Architecture, which, from its nature, demands more extended notice in these columns, was a part of the original plan, and its work is based upon certain underlying principles, to ignore which would be to invite failure. In the arrangement of the work in this department it is recognized that architecture is generically a fine art, yet so many engineering elements are involved that it must be treated both as an art and as a science. The genius of American institutions tends strongly toward the so-called utilitarian, but the combination of the great Art School at the Art Institute with the Armour Institute of Technology seems to blend all the essentials of a scientific, artistic presentation of this important subject. Situated as it is in a metropolitan city, where opportunities for a personal study of many buildings of a variety of classes are given, this school certainly possesses superior advantages in enabling students to come into close contact with the great object lessons so continually presented in the shape of architectural design and material construction. The Art Institute, with its treasure of beautiful creations, invites the student to a daily contemplation of art in its highest form, while on the other hand, he moves among the most modern and practical application of building materials to architectural design. Supplementing these daily object lessons an added advantage accrues to students from the fact that some of the best architects of Chicago give lectures on their specialties to the students in this course, and they thus form acquaintances with leading members of the profession, and this association is no inconsiderable element in the development of ideas.

SPECIFICATIONS FOR HEATING APPARATUS.

THE province of architects where specifications call for heating apparatus is illustrated by a contract which was entered into between an owner and a contractor, whereby the latter agreed to build for the former a hotel, and the articles of agreement referred to certain drawings and specifications as a part of the contract. This also contained a clause as follows: "Should any difference of opinion arise respecting the true construction or meaning of the drawings or specifications, the same shall be decided by the architect, and his decision shall be final and conclusive."

One of the specifications was as follows: "Furnace. The same to be furnished and set up at the designated place; a No. 14 Mott furnace, with the usual fixtures, furnished with cold-air ducts, etc.; for general heating of all the halls, café, offices, parlor and other parts, as per the plans prepared for heating. The furnace to be set up in the best possible manner, and so arranged as to give the best possible results, and on the floors the requisite warm-air registers as marked, the registers to be not less than 12 by 14, and to have an independent line for each register."

Out of all this grew a controversy as to whether it was the duty of the contractor to put in such apparatus. The contractor claimed a fulfillment of the contract without having put in the heating apparatus, and fell back upon a decision of the architect that he was not bound by the contract to put in any sort of heating apparatus. The trial court said about it that if the architect, under the authority given him by the contract, decided that it did not include an obligation on the part of the contractor to put in the heating apparatus, there would be no obligation on the part of the latter to put it in.

But the Supreme Court of Georgia, in reversing the judgment rendered in favor of the contractor, for error in the trial, holds (Mallard against Moody, 31 Southeastern Reporter 45) that the clause in the contract relative to the power of the architect did not authorize him to decide that the contractor was not bound by the contract to put in the heating apparatus; and that the architect's certificate thereafter, that the work had been completed according to contract, did not bind the parties as to this matter, the contractor not having put in the heating apparatus.

Under this clause, the Supreme Court maintains, the architect had power simply to pass upon the meaning and construction of the drawings and specifications. He had the power to decide whether the work done was of the character or quality mentioned in the specifications. The specifications called for one Mott furnace, with usual fixtures, etc. The architect had power to decide, had the contractor put in the furnace, whether it was the furnace required, and whether the usual fixtures, cold-air ducts, etc., were furnished according to the specifications, whether the apparatus heated the halls, café, offices, etc., and whether it was in accordance with "other parts as per the plans prepared for heating." He had also power to decide as to the materials used, and as to whether the furnace and fixtures were put up in a workmanlike manner.

In short, the court holds that the architect could construe the contract and decide what it meant, or determine the nature and character of the work or materials required, but he could not eliminate or abrogate any of its terms, as would be done if the specification as to the heating apparatus was agreed upon by the parties and became a part of the contract, and he were permitted to decide that the contractor was not bound to put in the heating apparatus.

OUR ILLUSTRATIONS.

Chest for Li Hung Chang. George Edward Harding & Gooch, designers.

View in Hall, Residence of A. H. Carr, Dayton, Ohio. F. M. Andrews, architect.

Gapstow Bridge, Central Park, New York City. Howard & Cauldwell, architects.

The President's House, Vassar College. Rossiter & Wright, architects, New York City.

Lower Stories, Commercial Cable Building, New York City. George Edward Harding & Gooch, architects.

Design for Fifth Avenue Office Building. Clinton & Russell, architects, New York City. Also Details of same.

House for Mrs. J. A. Hewlett, Lawrence, Long Island. Lord, Hewlett & Hull, architects, New York City. Two views in Hall are shown.

Residence of E. M. Thacker, Dayton, Ohio. F. M. Andrews, architect. The following views are shown: Exterior, View in Dining Room, Main Stairway.

House for E. T. H. Talmage, Bernardsville, New Jersey. Lord, Hewlett & Hull, architects, New York City. View in Hall and View in Dining Room are shown.

Chicago Architectural Club Competition for Fritz Wagner Prize: A Terra Cotta Column and Lintel with Wall Surface Above. First prize design, A Zoölogical Entrance, submitted by George R. Dean; second prize design, submitted by Axel Sandblom; third prize design, submitted by Birch B. Long.

This problem was one of the most instructive that has come before the club for solution. Its value in demonstrating how intimately facility of construction is connected with architectural design was recognized and that a designer should treat every material according to its specific qualities and emphasize its character. Thus the terra cotta column competition was a step in the right direction. Terra cotta is the most precious material within the architect's reach. It adds to all the good qualities of stone that of being fireproof, and is the only one which enables the sculptor to solidify his ideas without any other medium, and to perpetuate them for all time to come. And still this material has always been treated as a stepchild. Greek and Roman and the master of Gothic art had stone and marble at their disposal. Their architecture is a stone architecture. They had no skeleton construction, and did not look for a fireproof material. Their potters were able to make some terra cotta acroteria, but the achievements of modern science were necessary to make terra cotta architecture a possibility. The manufacturer of today offers this opportunity, and it rests with the architect to avail himself of it.

Designing in stone presents little difficulty and requires no especial study of the material, but no one can attain success in terra cotta architecture without a fair knowledge of its process of manufacture and a careful study of its peculiar qualities. The most conspicuous difference between the two materials is this: Stone can be cut and chiseled until it assumes the form and size required. Clay, however, must be dried and burned after it has been modeled. During this process of drying and burning it will shrink, and notwithstanding all precaution will shrink more or less unevenly, so that the exact size of the burned product or terra cotta cannot be predetermined. With this fact in view this competition was presented to the club. Its result was quite satisfactory, although most of the members were deterred from participating by the novelty and difficulty of the problem. Of the designs submitted that of Mr. George R. Dean was by far the most satisfactory. It is original, thoroughly practical, and exquisite in coloring. Decoratively it may be called perfect, although architecturally it might display more vigorous treatment. The second prize design, consisting of an octagonal column, rendered in pen-and-ink, is very creditable architecturally and well adapted for the material. The third prize design shows good color treatment and is more feasible, but will offer more difficulties for practical execution than the others.

It is to be hoped that more problems of this nature will be offered to the club. The draftsman, as such, is only too apt to look at the surface of things — the same as on his sheet of drawing paper. He should ever be reminded of the thousand and one things below the surface.

PHOTOGRAVURE PLATES.

Issued only with the Photogravure Edition.

A Colonial Residence.

Residence, Detroit, Michigan. Rogers & Macfarlane, architects.

Residence of L. S. Harris, Detroit, Michigan. Nettleton & Kahn, architects.

Residence of S. A. Griggs, Detroit, Michigan. Nettleton & Kahn, architects.

Residence of George H. Prentice, Detroit, Michigan. Rogers & Macfarlane, architects. Four full-page plates show the following views: Exterior, View in Hall, View in Library, View in Dining Room.

ASSOCIATION NOTES.

ST. LOUIS CHAPTER, A. I. A.

The St. Louis Chapter of the American Institute of Architects held its regular meeting and banquet at the Mercantile Club on November 28.

The Chapter has formulated a proposed law for the purpose of licensing all architects in the State of Missouri. This law will be similar in effect to the one now in operation in the State of Illinois, which is producing most excellent results.

This law is intended to limit the art of building to those who are especially trained for the practice of the profession, and with the ultimate object toward accomplishing the best results economically and practically, and to guard against endangering the lives of men through faulty construction.

This law will come before the State legislature for passage next January, and as the same is parallel in purpose to the law demanding the licensing of all practitioners of law and the various branches of medicine, therefore it is believed that the same will meet with the unqualified approval of our State legislature.

The law will not hinder anyone from continuing in the profession who is now practicing architecture. In the future, however, all those intending to practice will be obliged to pass the required examinations before the State examining board.

Mr. William H. Bryan, M.E., delivered a lecture before the Chapter on the subject of the "Best Modern Systems of Electric Lighting, Steam Heating and Elevator Appliances," which was followed by a general discussion by the architects.

Professor Johnson, of Washington University, described the results of his recent timber tests on columns and girders, as applied to the "Loring System of Skeleton Construction."

After a general discussion of the subject, and dispensing with the usual order of business, the meeting adjourned.

MOSAICS.

AN architect's certificate requires no stamp, unless by indorsement it becomes an order for the payment of money. An affidavit does not require a stamp, nor does a waver of lien.

MR. E. C. SHANKLAND desires to announce that he has withdrawn from the firm of D. H. Burnham & Co., architects, and has, in connection with his brother, Mr. R. M. Shankland, opened an engineering office under the firm name of E. C. & R. M. Shankland, at 816 "The Rookery," Chicago. As an engineer, it is needless to say, Mr. Shankland stands at the head of his profession, as it is probable that none other in this country has acquired as great a knowledge of the engineering problems in architectural construction.

THE eccentric in church architecture is the theme of articles in the daily papers of Hartford, Connecticut, and Buffalo, New York, each of the same date. In the Hartford instance the church is described as "modern French suggesting a skirt dance," and probably "designed as a joke by an eminent architect or by his office boy." In the Buffalo case the ridicule rather turns on the "architect," who designed an egg-shaped church similar to one built in England in 1874. If in these instances the limit of eccentricity has been reached, it is probable that the craze of the odd in architecture that seemed to have reached that point ten years ago will subside, and church and other building committees will select reasonable men to do reasonable work.

THE Archbishop of Canterbury, when he was bishop of London, was dissatisfied with certain arrangements in his palace at Fulham, and called in an eminent architect to advise as to alterations. The architect took time to consider, and when he finally brought in his plans and estimates, the figures were so great that the bishop relinquished his project "And now," said the bishop, "I shall be glad if you will tell me how much I shall pay you for your trouble in the matter." "I thank your lordship," was the answer; "one hundred pounds." The amount was disconcerting. "Why, sir," said the bishop, "many of my curates do not receive so much for a whole year's service" "That may be true, my lord; but you will remember that I happen to be a bishop in my profession." There was nothing more to be said, and the check was drawn.—*Newcastle Chronicle.*

NEW PUBLICATIONS.

STANDARD STEEL CONSTRUCTION: A Manual for Architects, Engineers and Contractors, containing useful tables, formulas and other information. Beams, channels and structural shapes made by American Iron & Steel Works: Jones & Laughlins, Limited, Pittsburg, Pennsylvania, and Chicago, Illinois. Revised by F. L. Garlinghouse, C.E. Price, $1.

Owing to the somewhat recent introduction and rapid adoption of steel for general construction, the above named work is a timely and valuable addition to the library of the architect or builder. Jones & Laughlins have recently abandoned making iron beams and channels, and regard their steel products as by far the more desirable, combining greater strength with less weight. The book gives very complete diagrams arranged in a manner calculated to facilitate ready reference, and the estimates given are based upon actual tests, thus making a safe, reliable basis for calculations. Illustrations are made of standard steel constructions in beams, channels and angles as adopted by the American Association of Steel Manufacturers, giving weights with tables of properties and safe loads; also giving tables showing properties, sizes, weights and strength of Z bar columns, a new steel product. While especial attention is directed to these tables, a variety of others of important character also appear, which will undoubtedly interest the practical and progressive artisan. Taken as a whole, the work seems to be a satisfactory and complete one. It is bound in leather, and of convenient size. A limited number of copies has been left with THE INLAND ARCHITECT for distribution, and will be given out, upon application, without charge.

BUILDING OUTLOOK.

Office of THE INLAND ARCHITECT,
CHICAGO, December 10, 1898.

Nothing short of annual summaries of building operations in the cities where such records are kept will enable the public to know how much more building has been done this year over last. The voluminous reports of building, real estate and other journals throw much light on current conditions, but do not furnish codified results. The statement can, however, be made that these and other sources of information, notably information derived from builders' exchanges, that the year now closing has been one of activity, measurable profit and satisfaction. It would be very easy to make a gloomy summary and to prove it by and out of the experience of many builders and manufacturers of building material. Not all building enterprises have succeeded; not all investments have been wise. But getting at the right point of view, there is reason for congratulation. What is of more moment is the fact that the basic conditions out of which lasting prosperity is derived are all in our favor. Those who are counting on greater work next year are not reckoning rashly. Manufacturers generally are busy. In most lines there is the promise of a large volume of work. The iron trade was never in such vigorous condition. Careful authorities are even apprehensive of a dearth of iron and steel because of the general expansion of business and the probabilities of a heavy export trade. The railroads are hauling more freight than ever. Rates have not suffered, and better conditions are in sight. The lumber manufacturers are all counting on stronger prices next year, but it is a question whether this anticipation will be realized. The mills have been busy. In some sections they are crowded. Both white and yellow pine are in better shape. Hardwoods are very firm and consumption is much greater than a year ago. Brick manufacturers have had what most of them regard as a good year, but competition keeps them out of some profits to which they feel themselves fully entitled. Small contractors are getting considerable work for the winter, and their purchases are felt. Woodworkers are not dull, and makers of machinery are come into a run of business which promises to continue. House building is not as profitable as in years past when built for sale. Recent improving tendencies in the industries are leading to numerous building projects in large and small manufacturing centers. Building and loan associations are prosperous and are spreading their healthful influences farther. Financial statements show a considerable growth in savings, in savings and other banks. The liquidation of individual indebtedness, especially in agricultural communities, is a matter of great import, and points to an early expansion of business from new demands of people freed from long, dragging debts and accounts. The effect of this independence will be visible in its normal efficiency in 1899. The reëquipment of railroads, shops, mills, factories, farms and all manner of properties has lately been entered upon with method, and this source of demand will be an important and an increasing factor in our industrial development.

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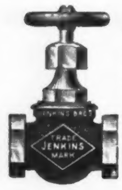

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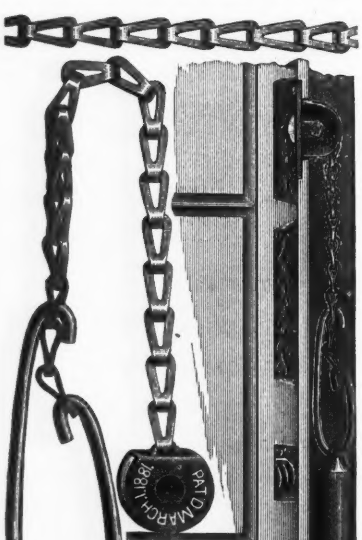

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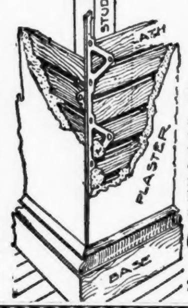

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Vol. XXXII. ADVERTISERS' TRADE SUPPLEMENT. No. 5

Valuable Publications Free.

Any architect can secure valuable books of reference without cost by sending for the catalogues of materials, etc., noticed from month to month in these columns. Large sums are spent on these catalogues, and they contain much practical information. Many are art productions. They may be obtained free on application to those issuing them. In writing please mention THE INLAND ARCHITECT, and oblige the journal and the dealer.

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J. E. R. CARPENTER, Architect, Columbia Bldg., Norfolk, Virginia.

THE MEXICAN CONSTRUCTION AND ENGINEERING COMPANY, City of Mexico.

W. ARTHUR THOMAS, 1211 Carnegie building, Pittsburg, Pennsylvania.

FREDERIC WILLIAM STRIEBINGER, Architect, New England building, Room 1215, Cleveland, Ohio.

GEORGE LOHMAN, Architect, 222 Houseman building, Grand Rapids, Michigan.

THE FRINK PATENT REFLECTORS.

The Frink Patent Reflectors are brought to attention by the recent publication of a new catalogue of these widely and well-known appliances. The firm, now located at 551 Pearl street, New York, has an experience extending over forty years in this special line, and has met with just that degree of success that invariably follows persistent and well-directed effort. The new catalogue is replete with illustrations and suggestions, and covers every conceivable condition into which the problem of artificial lighting enters. The firm will cheerfully respond to any inquiries along this line and is in a position to render valuable information on this subject.

IN PERPETUITY.

The shingle stain of the future is the stain that will not fade or wash off in streaks, is nonpoisonous and will stand all climates. Owners have learned by bitter experience the advantage of using a reliable article when their property is to be exposed to the elements. The manufacturers claim that a chemical analysis of various shingle stains has placed Dexter's at the head, and that when subjected to tests it has been the only one that has stood them satisfactorily.

The redwood shingle, so much in use on the Pacific slope, has a certain percentage of tannic acid which will produce a muddy effect with other stains. Too much stress cannot be laid on the importance of the architect's following up his specification and seeing that the stain is on the premises in the original packages of the makers. This is easy to do by communicating with the manufacturers, Dexter Brothers, of Boston, who are always ready to estimate the amount of stain required either for a dip or brush coat, and to keep the architect informed whether or not sufficient stain has been ordered.

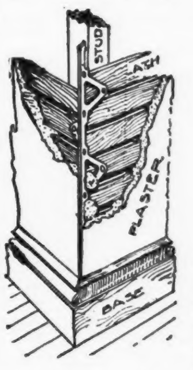
Many painters claim to be able to mix up a similar stain at one-third the expense. This cannot be done. Only the best ground colors are used in the composition of these stains, and the counterfeit stain will not hold its color more than six months before it has turned black or disappeared altogether.

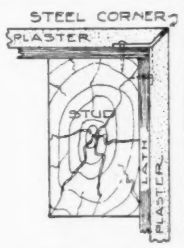
The best method of applying stain is to dip the shingles about two-thirds their length, because when the shingles shrink they will not show white between them, and also it acts as a better preservative. It is true it costs a little more to apply in this way, but it saves in the long run, and the stain on a first-class house is a small item compared with the result obtained.

Special colors are cheerfully compounded, and no extra charge is made for a shade not included on the sample slips. From Maine to California and Canada to the Gulf of Mexico these stains are in daily use, which is a testimonial in itself.

STEEL CORNER PERFECTION.

A practical and economical protection for plaster wall corners has been created. It is called the Woods' Steel Corner, and is manufactured by Gara, McGinley & Co., 23 South Seventeenth street, Philadelphia. It is a galvanized steel strip, with alternating right and left lugs along one edge for fastening it in place, the other edge being straight and forming the corner. This is nailed to the lath, brickwork or other construction, the lugs on both sides thoroughly bracing it. Embedded in the plaster, it permits of a miter at wainscoting or picture molding, and does not injure the wall decoration,





which has been one great objection to the many forms of wooden beads and strips. It confers neatness and strength to corners and is fireproof. It is also helpful to the plasterer in his corner making.

A prominent feature we see in Woods' Steel Corner is the price at which it is sold. From an economical standpoint it ought to pay the builder to use it in either low-priced or expensive building. It ought to assist him in cheap work, enough to pay for its use. It will always pay in good work. Without doubt this is correctly claimed to be the best and cheapest metal cornerpiece on the market. The illustrations show it as applied. The manufacturers are furnishing printed matter and samples to those interested, and the applications for same indicate that they have something which the building public are earnestly looking for.

THE PANCOAST VENTILATOR.

The Pancoast Ventilator Company, of Philadelphia, is apparently making a pronounced success of its improved ventilating appliance known as the "Pancoast." The main points claimed by the company are superior construction, unequaled efficiency, absolutely free delivery and perfectly stormproof. Testimonial evidence of the merit of this ventilator is abundant from architects and mill owners who have had opportunities for a practical knowledge of the effectiveness of these ventilators, to which the company adds its guarantee to give perfectly satisfactory results or refund the purchase money. In localities where there is no resident agent, the "Pancoast" will be sold at wholesale prices direct to the consumer. The sizes range from two inches to ten feet, thus insuring a compliance with the demands of any ordinary conditions. Any information as to prices, etc., will be cheerfully furnished by the company. Office, 316 Philadelphia Bourse.

TRADE NOTES.

THE Powers Regulator Company is placing a system of automatic temperature regulation in the operating rooms of the Chicago Telephone Exchange.

THE Powers Regulator Company has contracts for the installation of their temperature controlling apparatus in the following places: Model Basin building, United States Navy Yards, Washington, D. C.; Colby University, Waterville, Maine; new school building at Glencoe, Ill.; school building at Ida Grove, Iowa.

THE Powers Regulator Company is installing their system of automatic temperature control in the new addition to the State University buildings at Madison, Wisconsin; and also has a contract for the installation of their system in the office and manufacturing buildings of the Peruna Drug Manufacturing Company at Columbus, Ohio.

THE down-draft forges manufactured by the Buffalo Forge Company are typical of the latest developments in forge shop equipment. The smoke and fumes are carried away at once upon being generated through a system of underground glazed tile piping which connects to an exhauster. A separate blower furnishes the blast, or a combined blower and exhauster may be employed for the twofold purpose. The sales of these machines are by no means confined to this country, for the outfits have been furnished to a number of prominent European manufacturers. Among users of these forges are: the Quebec Central Railway, Montreal, Quebec; Ulster & Delaware Railroad, Georgia Central Railway, Cincinnati Street Railway Company, Morgan Engineering Company, Standard Oil Company, Peoria & Pekin Union Railroad, Big Four Railroad; Howaldswerke, Kiel, Germany, etc.

THE Magnetic Lampholder is a recent device put upon the market by Jenkins Brothers, of 71 John street, New York. The holders are for use where a direct-current incandescent lamp is used. They are supplied with a magnet which causes them to adhere to any piece of iron or steel in any position. It is not difficult to comprehend the many instances where this valuable yet comparatively inexpensive improvement in electric lighting will be utilized. In machine shops they can be placed exactly where it is desired to have the light shine. In boiler shops the torch can be laid aside and the electric light carried inside the boiler and affixed in any desired position. Its use eliminates many of the dangers attendant upon the use of candles or torches, and will undoubtedly be encouraged by the insurance companies. These holders are made for Edison, Westinghouse and Thompson-Houston lamps; the price is $1.50 each.

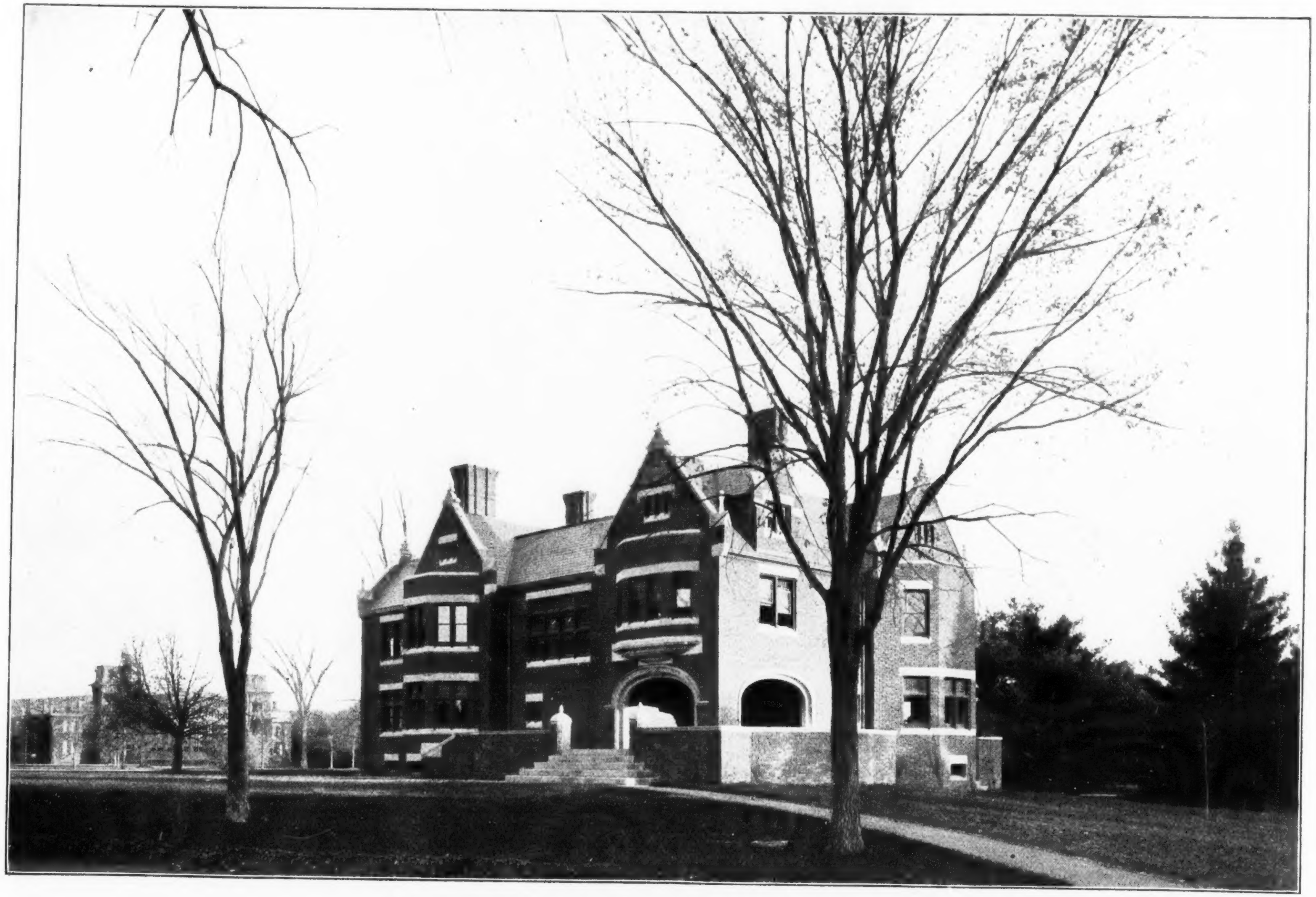
DURING the past summer the Joseph Dixon Crucible Company, of Jersey City, New Jersey, have added an extension to their pencil factory, 40 by 90 feet, three stories high. The same is driven by electric power from generator placed in the main factory. No expense has been spared in the equipment of this addition in the way of up-to-date elevators, furnaces, dry-rooms, etc. During 1899 various other additions will be built to the Dixon Company's very extensive plant. The Dixon Company was established in 1827, but during all of its more than threescore years and ten of busy life, no year has in any way equaled 1898 for volume of business; its plant has been running continuously, yet the company is behind its orders in all departments. As the Dixon Company's products go into every known field of industry — the ironworkers, the brassworkers, the printing trades, the stationers, the cycle manufacturers, the hat manufacturers, the paper mills, etc. — the rise or fall of the volume of business done by the Dixon Company may be taken as a very excellent standard or pointer on the condition of business generally.

VIEW IN HALL, RESIDENCE OF A. H. CARR, DAYTON, OHIO.
F. M. ANDREWS, ARCHITECT.

RESIDENCE OF E. M. THACKER, DAYTON, OHIO.
F. M. ANDREWS, ARCHITECT.

LOWER STORIES, COMMERCIAL CABLE BUILDING, NEW YORK CITY.

GEORGE EDWARD HARDING & GOOCH, ARCHITECTS.



THE PRESIDENT'S HOUSE, VASSAR COLLEGE.

Rossiter & Wright, Architects, New York City.

VIEW IN DINING ROOM.

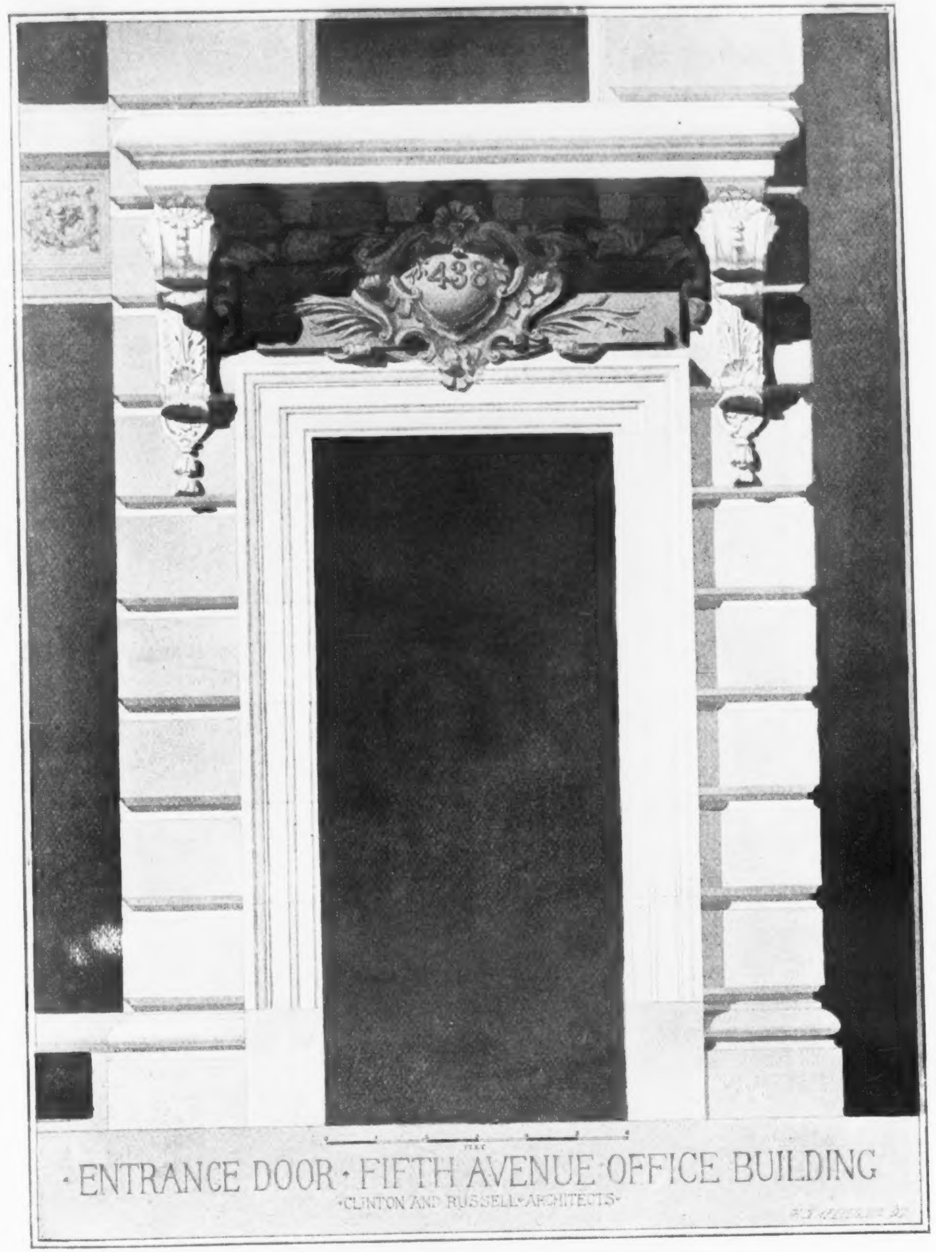
VIEW IN HALL.

VIEWS IN HOUSE FOR E. T. H. TALMAGE, BERNARDSVILLE, NEW JERSEY.

LORD, HEWLETT & HULL, ARCHITECTS, NEW YORK CITY.

DESIGN FOR FIFTH AVENUE OFFICE BUILDING, NEW YORK CITY.

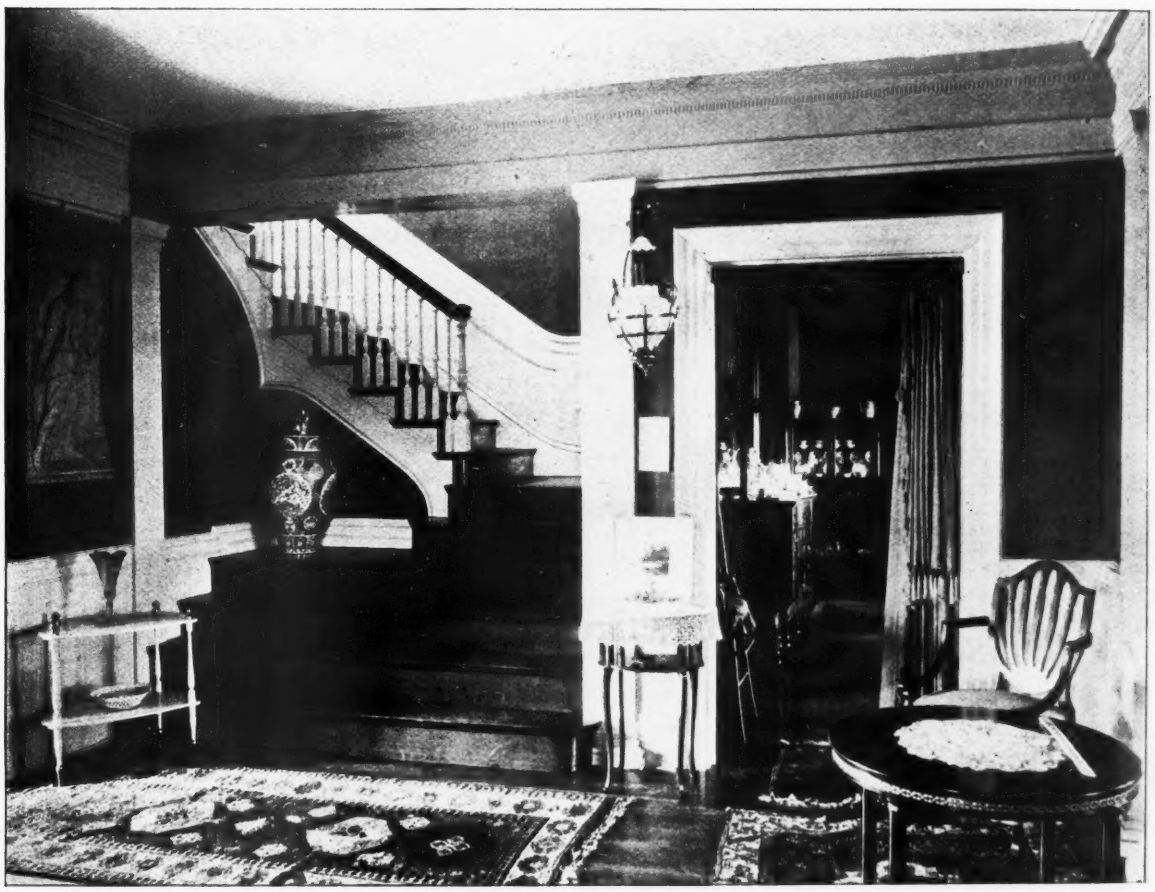
CLINTON & RUSSELL, ARCHITECTS.



DETAILS OF FIFTH AVENUE OFFICE BUILDING, NEW YORK CITY.

CLINTON & RUSSELL, ARCHITECTS.

VIEW FROM HALL.



VIEW IN HALL.

VIEWS IN HOUSE FOR MRS. J. A. HEWLETT, LAWRENCE, LONG ISLAND.

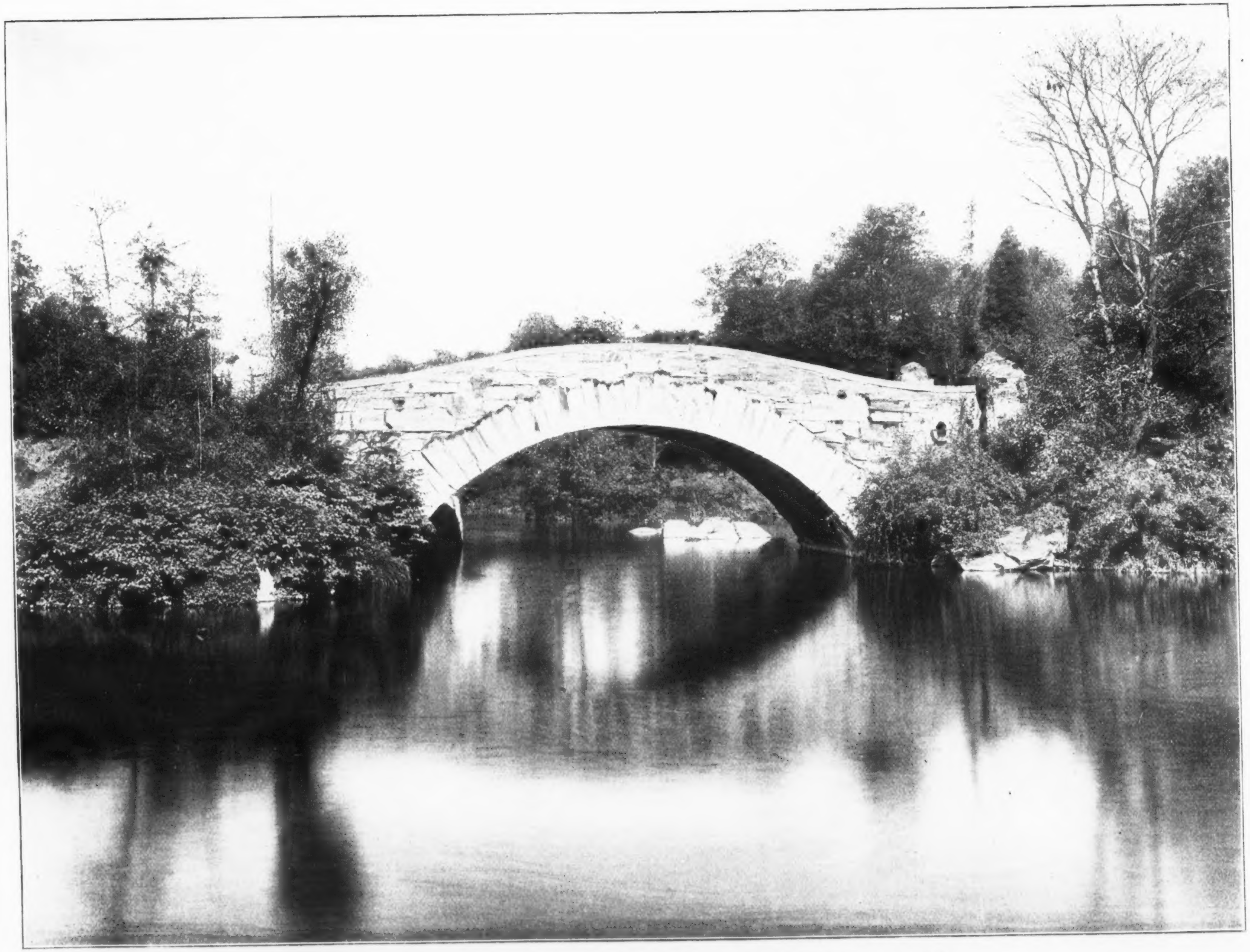
Lord, Hewlett & Hull, Architects, New York City.

NETTLETON & KAHN, ARCHITECTS.

INLAND ARCHITECT PRESS.

RESIDENCE OF L. S. HARRIS, DETROIT, MICHIGAN.

NETTLETON & KAHN, ARCHITECTS.

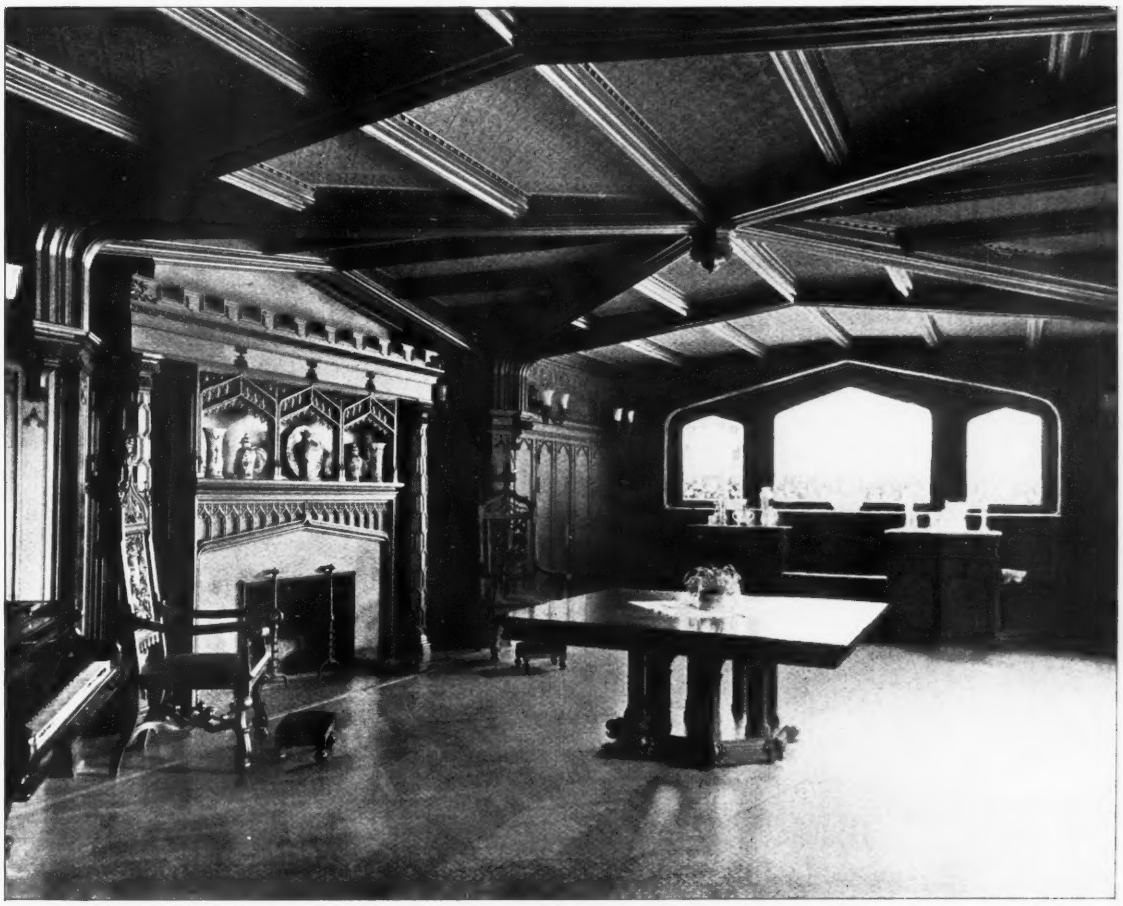


GAPSTOW BRIDGE, CENTRAL PARK, NEW YORK CITY

HOWARD & CAULDWELL, ARCHITECTS.

CHEST FOR LI HUNG CHANG.

GEORGE EDWARD HARDING & GOOCH, DESIGNERS.

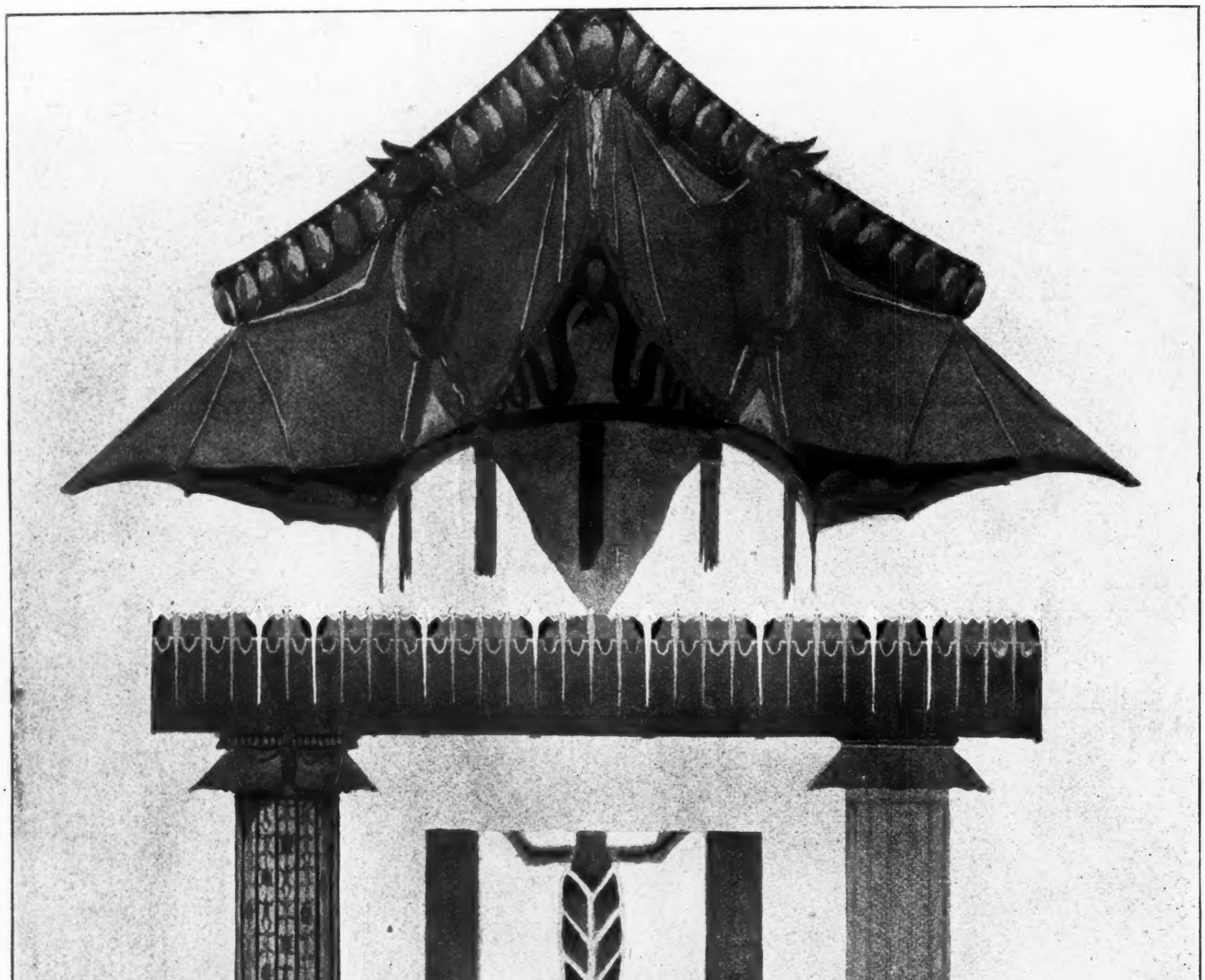


VIEW IN DINING ROOM.

MAIN STAIRWAY.

VIEW IN RESIDENCE OF E. M. THACKER, DAYTON, OHIO.

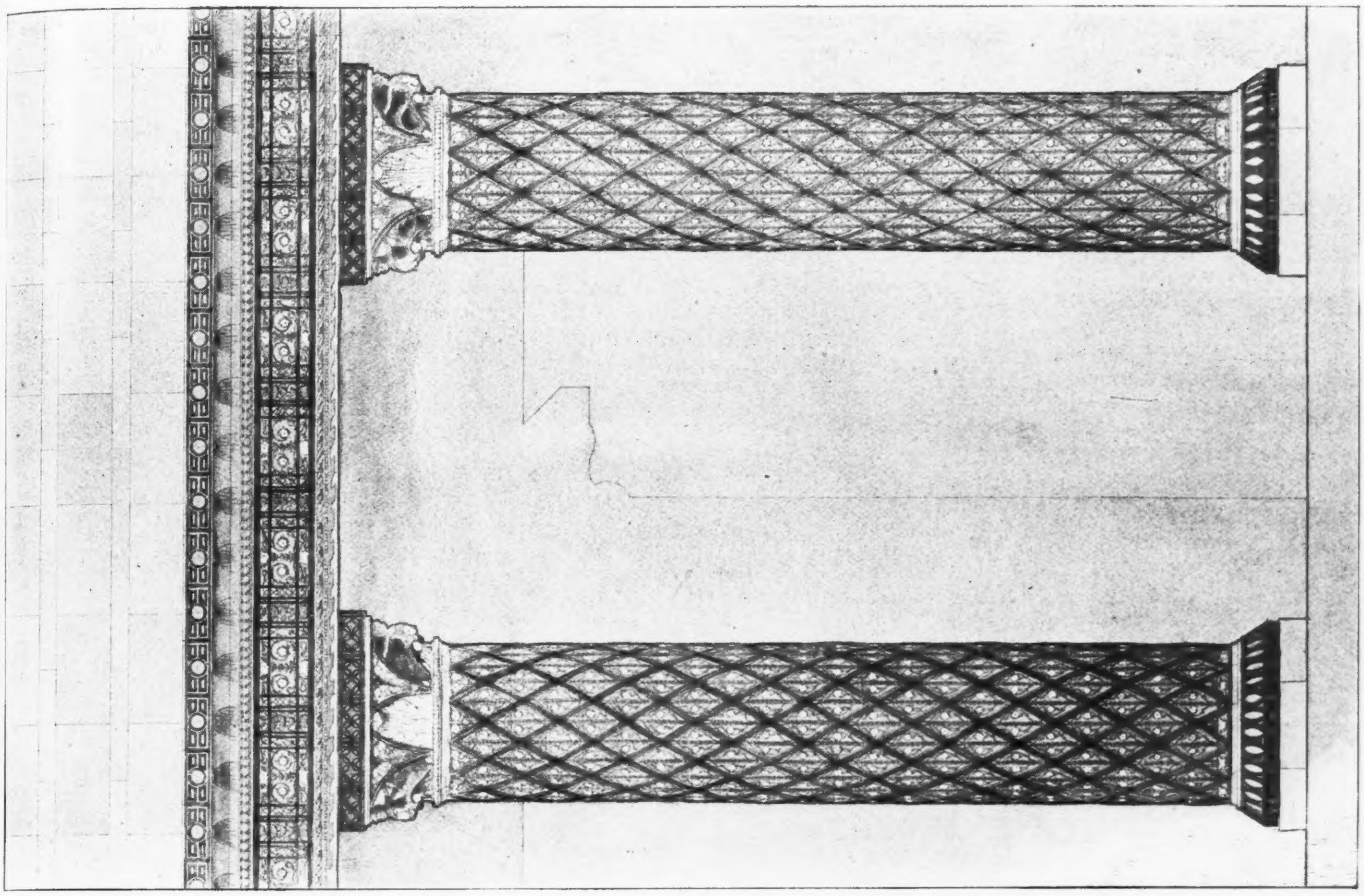
F. M. ANDREWS, ARCHITECT.



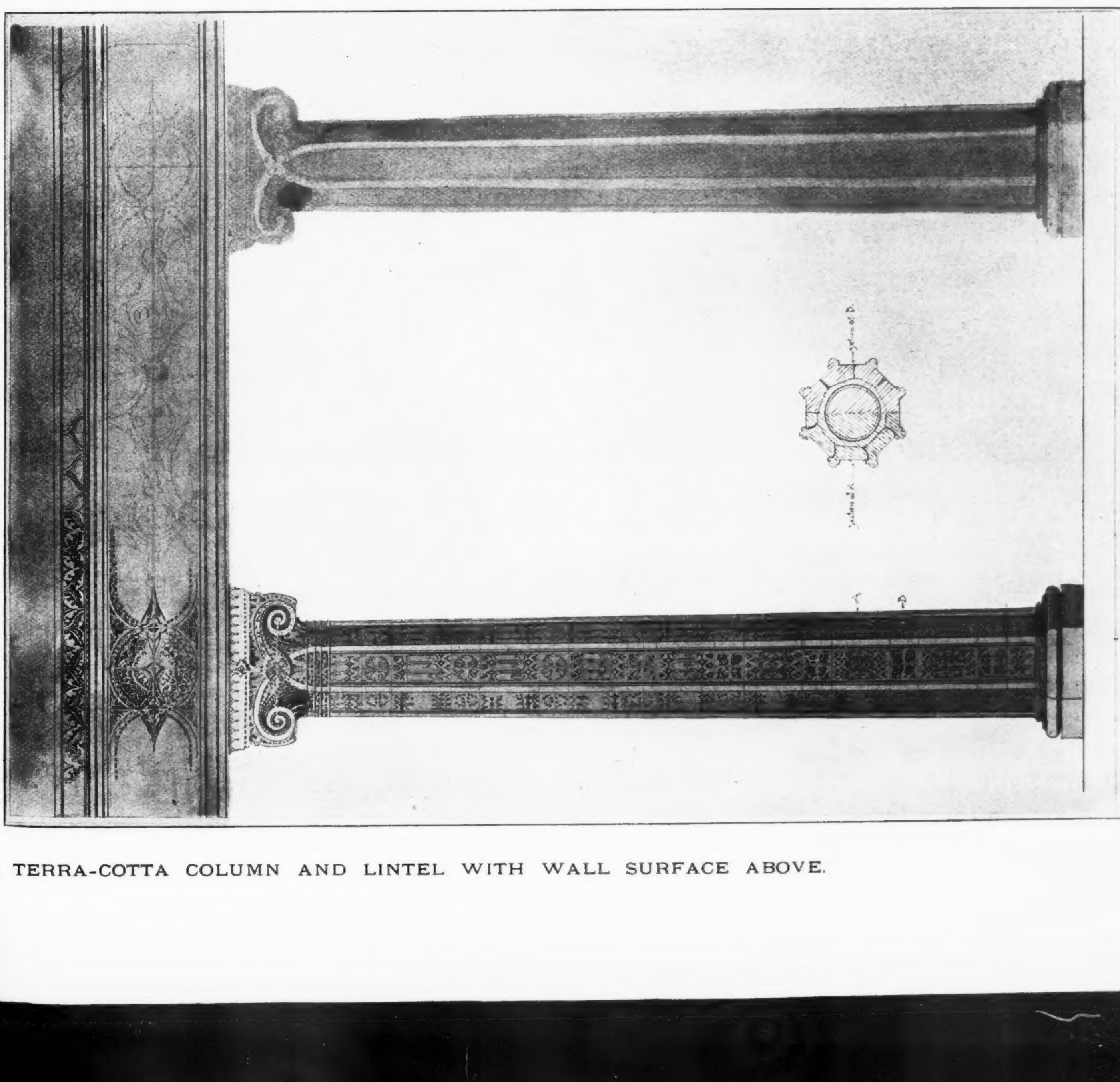
For Requirements see Vol. XXXII, No. 3.

FIRST PRIZE DESIGN, A ZOÖLOGICAL ENTRANCE, SUBMITTED BY GEORGE R. DEAN.

CHICAGO ARCHITECTURAL CLUB COMPETITION FOR THE FRITZ WAGNER PRI[Z]E A



THIRD PRIZE DESIGN, SUBMITTED BY BIRCH B. LONG.



SECOND PRIZE DESIGN, SUBMITTED BY AXEL SANDBLOM.

A TERRA-COTTA COLUMN AND LINTEL WITH WALL SURFACE ABOVE.

RESIDENCE, DETROIT, MICHIGAN.

ROGERS & MACFARLANE, ARCHITECTS.

INLAND ARCHITECT PRESS.

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RESIDENCE OF GEORGE H. PRENTICE, DETROIT, MICHIGAN.

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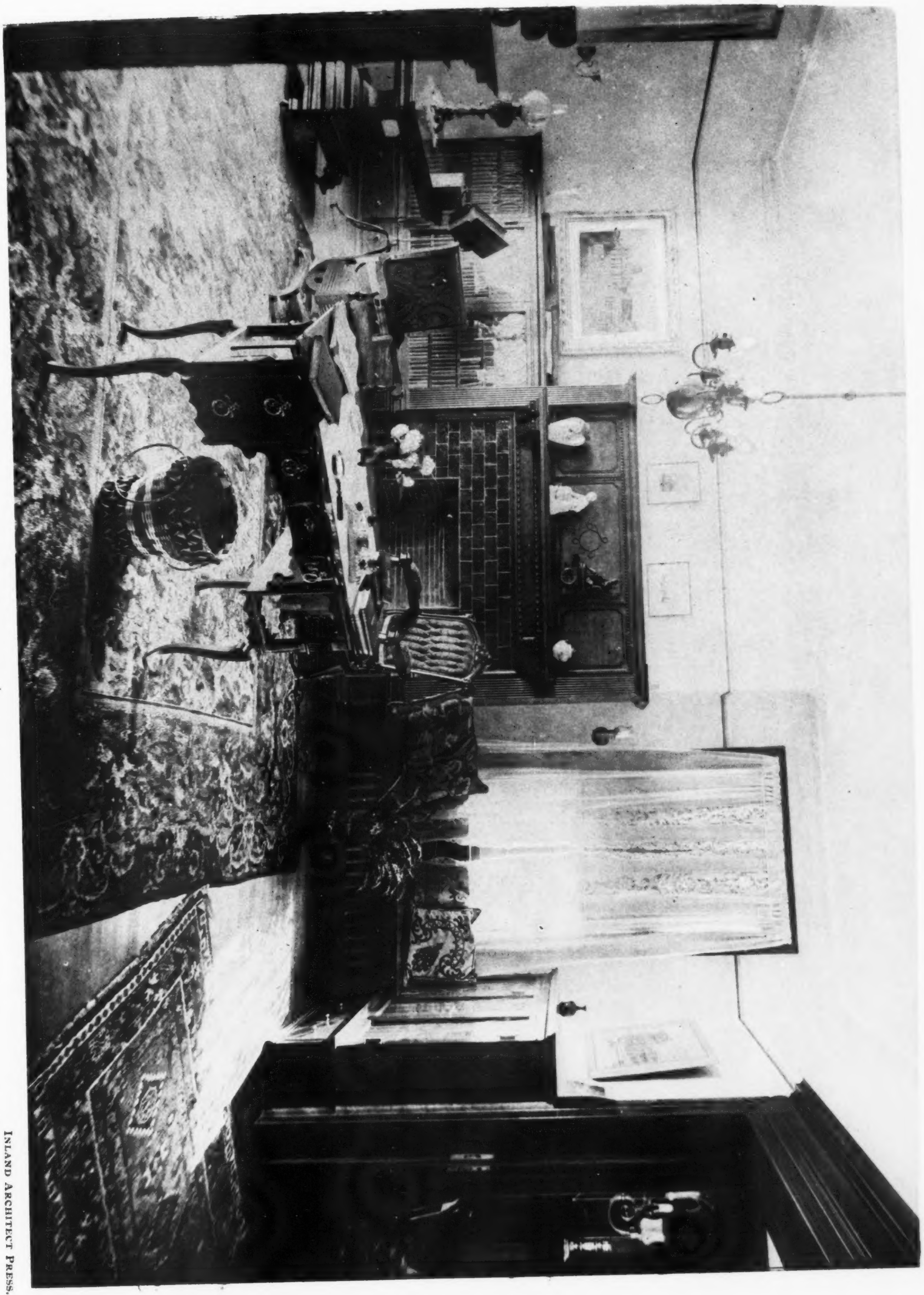

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ROGERS & MACFARLANE, ARCHITECTS.

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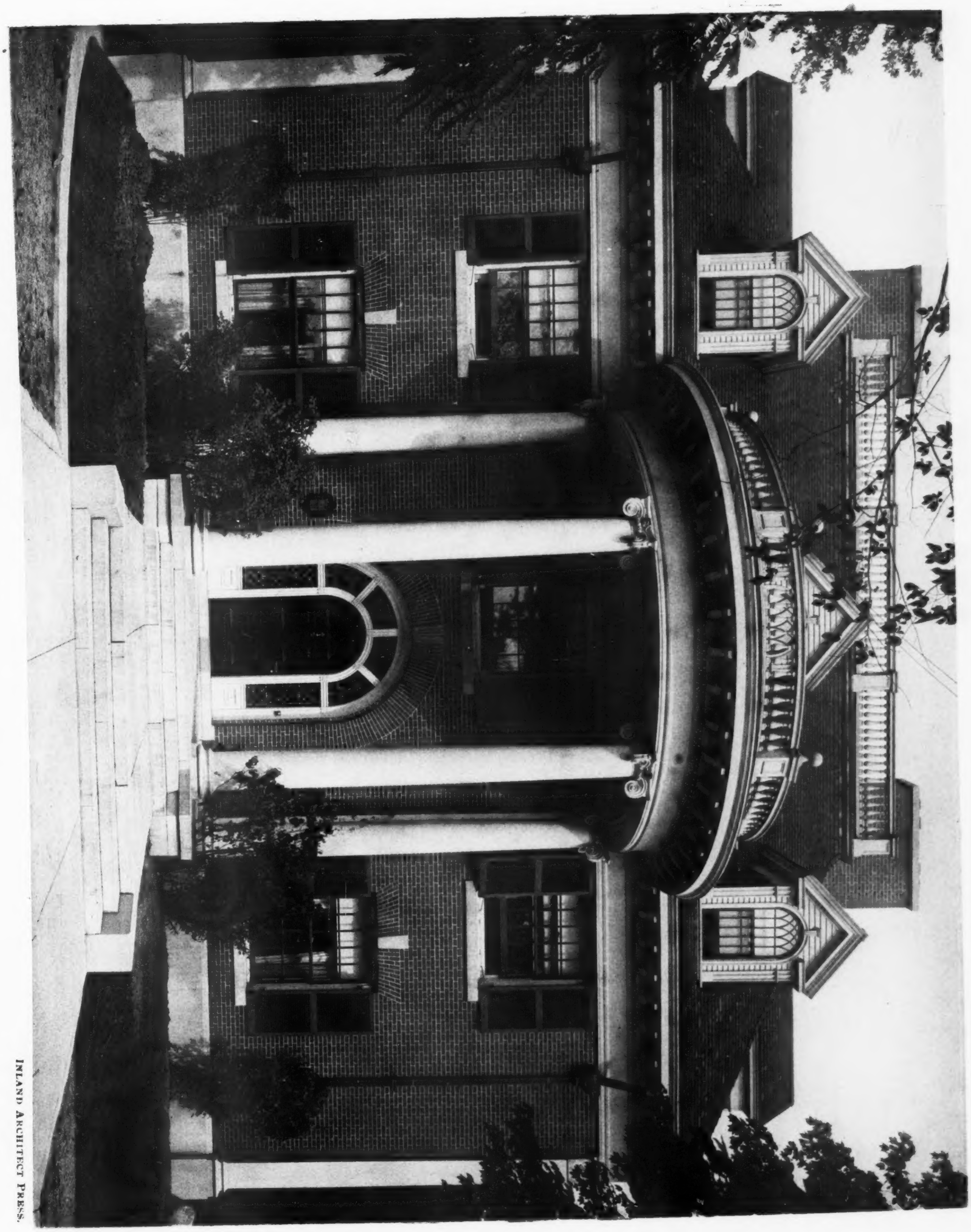

A COLONIAL RESIDENCE.

INLAND ARCHITECT PRESS.

NETTLETON & KAHN, ARCHITECTS.

RESIDENCE OF S. A. GRIGGS, DETROIT, MICHIGAN.

Nettleton & Kahn, Architects.

Inland Architect Press.