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THE LIGHTING OF CHURCHES

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IN this article no pretense is made of laying down any hard and fast rules governing the lighting of churches. Any generalization on the subject would be an absolute waste of time. Churches vary so widely in design, environment, and the uses to which they are put, that each problem becomes a distinct study in itself, and nothing more than suggestions as to the method of approaching each case, illustrated by a few definite examples, will be attempted.

No other instance of the use of artificial light presents such inherent complications, or demands an approach from so many sides. In the first place, church lighting is only to a very minor extent an engineering problem—indeed this is true of any building possessing æsthetic features to any marked degree, and to make clear our attitude on this question of illuminating engineering we shall quote from a recent paper read by the author before the Illuminating Engineering Society: (*) "the beauty and effectiveness of good architectural construction, both from æsthetic and utilitarian standpoints, depend upon a strict adherence to the principles of architecture outlined above, and the feeling of the design, dependent as it must be upon historical precedent, is

bound by centuries of usage to certain effects of color and light which have become established because of their appeal to the sentiments aroused by pleasurable visual perception. The business of the illuminating engineer is to modernize old methods of illumination

without destroying them. If we are to discard tradition altogether, then we may as well abandon the architecture of the past, and ignore its influence. This, as I have tried to make evident, is impossible, if not on æsthetic grounds, then on physiological grounds, and to deny its demands would be suicidal. . . .

The illuminating engineer who imagines that he will be permitted to introduce anything radically new into the illumination of buildings possessing historic feeling is doomed to disappointment. Rather is it his duty to maintain and conserve that feeling in spite of modern appliances and means. . . .

"The 'feeling' of the design must be carried out consistently even to the last detail of the fixtures. It is the duty of the architect to see that this is done.

His conception of the whole arrangement must include the lighting, for, as he sees it 'in his mind's eye,' so must it be seen objectively. The light that must be provided, its tone, its intensity, its quality, is a feature of his mental conception, and it is this ideal illumination that the

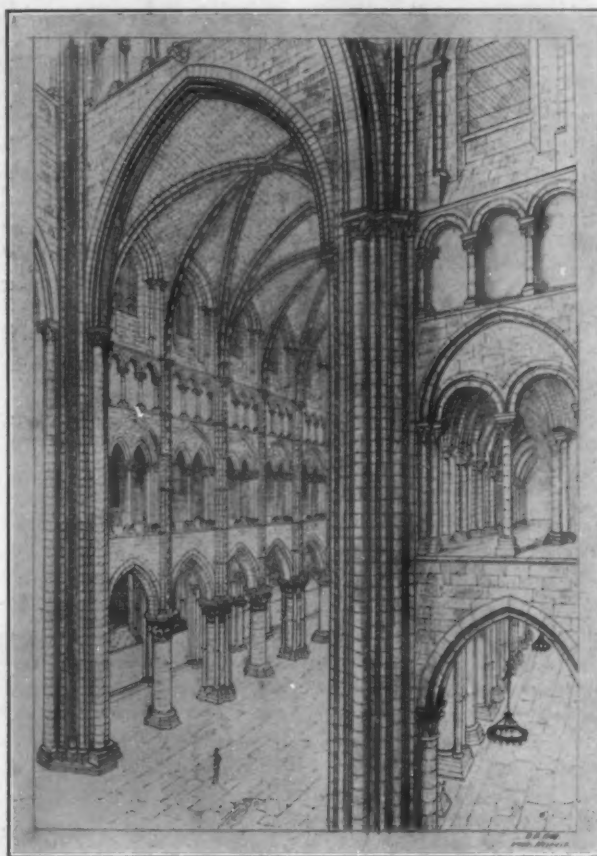


FIG. 1—LAON CATHEDRAL
FROM A SKETCH BY THE AUTHOR, AFTER NESFIELD

(*) "The Relation of Architectural Principles to Illuminating Engineering Practice." Trans. Ill. Eng. Soc. Vol. III, No. 1.



FIG. 9—WESTMINSTER CATHEDRAL, THE CHOIR

engineer must seek to approximate. Of course, he can only hope to do this when he, too, is able to see the design as the architect sees it, and not through the eyes of the illuminating specialist alone. The engineer must be able to discern where direct or indirect illumination is required, and the kind of fixtures associated historically and aesthetically with the general design by means of which he must obtain the proper results. . . .

"It seems, then, that a very important if not essential feature of the engineer's preparation is a study of the history of illumination and its relation to architectural design. He must make himself intimately acquainted with the means, methods and results of earlier work, and good work it is where any attempts were made to obtain adequate and suitable lighting. Because we alone can formulate and employ the laws governing the distribution of light, we must not think that good lighting has not been earlier achieved by empirical methods. We are simply in a position to do with less expenditure of energy what the masters have done in spite of their manifest limitations. . . .

"The question as to the proper location and arrangement of fixtures then resolves itself into the question as to the way in which the design is to be seen. The proportions of the structure, its constructive lines and the points where they originate and end—these are to be brought out in relative prominence, and to do this properly the individual responsible for the lighting must be

able to discern and select these features and modify his illumination accordingly. . . .

" . . . it is the writer's belief that no architectural design, conceived in the right spirit, and properly executed, can demand any suitable artificial illumination that is injurious in the optical sense. . . . Artistic illumination is, *ipso facto*, good illumination. And no illumination can be artistic that is not conceived as a feature of a truly artistic design."

It must be clear to everybody that no design is perfect that cannot be properly seen; for the perfection is not a quality that lies directly in the design, but is a quality of the mental activities aroused in the judicial beholder when the design is presented as a stimulus to his mental functions. It is nonsense to talk of the beauty of an unseen or unheard work of art.

Thus, in architecture, it appears that the most important thing after production of a good design is to arrange it so that it can be seen as the designer means it to be seen, and to him this seeing is an integral part of his conception. The self-exploiting basis of art is emphatic in its demands. Granted, then, the importance of properly seeing a design, the next question is concerned with the means of providing proper illumination.

That the great architects of Greece and Rome and of the Renaissance period considered this matter of proper lighting of great importance, is evidenced by the thoroughness with which the illumination of each interior was worked out even to the smallest detail of the fixtures. Furthermore, the fixtures themselves were never an after-thought, but formed an integral feature of the entire design. Take, as an instance, the Salon des Gardes in Fontainebleau (Fig. 2). Note the absolute harmony both in proportion and detail denoting throughout the expression of a single ideal. No other scheme of illumination and no other style or type of fixture could have been used without marring the entire effect.

Yet it would be no surprising thing to find this room practically copied and incorporated into a modern building, used possibly as a study and lighted appropriately (or inappropriately) therefore without regard as to whether the design adapted itself to this treatment or not. Nowadays it is not unusual to find designs turned

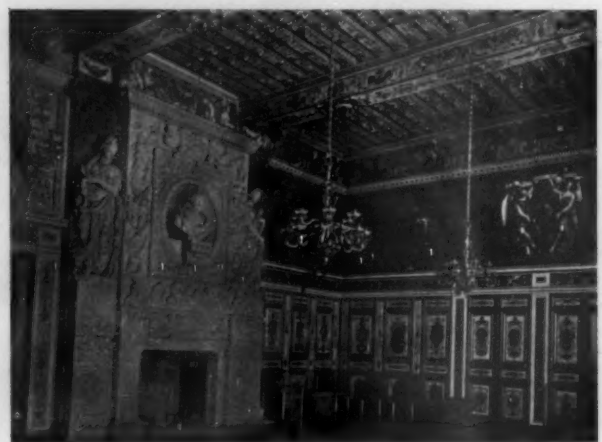


FIG. 2—SALON DES GARDES, FONTAINEBLEAU

out, in which no allowance for lighting fixtures of any kind has been made. They are to be added later; purchased from the stock of some dealer or else gotten up at the least possible expense, and it is needless to say that they will always appear as an after-thought—as something applied to the completed picture. Some one says, of course, that it costs entirely too much to build special fixtures for every interior, but if this is the case, why have interiors that demand expensive and special fixtures? Why not design the interior to fit the fixtures? But, seriously, does it not seem the height of folly to prepare an interior of a scale and detail that requires, if we are consistent, appropriate furnishings and then to disappoint the design by only meeting it half way? If you can't sing high C when the music calls for it, then sing something else.

The preliminaries to the selection of a method of



FIG. 4—CHURCH OF ST. SULPICE, PARIS

artificial illumination and the design of suitable fixtures consist in determining the character of the following factors:

1. The purpose indicated by the type of the structure. If the building is a church, to what denomination does it belong—Roman Catholic, Dissenting, Jewish, Christian Science, etc.? The character of the service will be a prominent feature in the problem of lighting. A Roman Catholic Church having no congregation singing or reading will require but little light in the nave, and this of a subdued and quiet, religious tone. On the other hand, the chancel and altar, with its elaborate images and decorations is the most prominent point for the attention of the communicants, and requires a carefully planned and rich lighting effect.

The service in most dissenting churches, particularly the Presbyterian, Congregational, Unitarian, Baptist

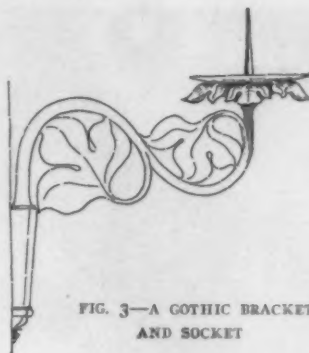


FIG. 3—A GOTHIC BRACKET AND SOCKET

not be employed primarily to accent the religious tone of the building.

In Jewish synagogues, on the other hand, we find the symbolism of early Eastern art and religions carried almost to the extreme. Each detail has its meaning determined by precedent even to the fixtures, and while a good general useful light is required by the congregation, much attention must be given to the study of special effects.

Buildings erected for the use of Christian Science and other similar modern sects are quite in a class by themselves, and require essentially modern treatment in both design and illumination.

2. The second broad preliminary consideration, after the general character of the illumination has been decided upon, has to do with the general form of the structure to be lighted. Is the design light or massive? And it must

be understood that the weight of the design has no necessary relation to the size of the building—it is not measured in avordupois. Some small Norman churches are essentially massive in design, while some of the largest cathedrals, such as Laon (Fig. 1) are particularly light and airy in feeling. The design will (or should) in each case represent the fundamental characteristic of the religious tone predominant in its period, and it is this tone that should be singled out and brought into prominence by the illumination. This effect can be produced principally by



FIG. 6

and Methodist, demand frequent use of the eyes by the members in reading responses and singing. Furthermore the symbolic features of the service and equipment so prominent in Roman Catholic and High Church Episcopal Churches are entirely absent. The lighting should, therefore, be ample for use and need

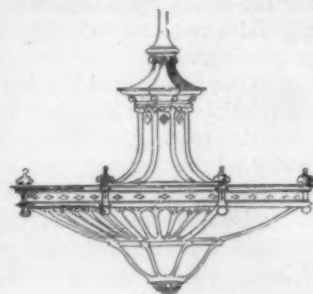


FIG. 5—ARC LAMP, DIFFUSING REFLECTOR AND CASING

the adaptation of the quality and color of light to its surroundings, and by the use of shadows whereby the structural motifs can be given prominence either by bringing them into the high lights or by marking them off dark against a lighter background depending upon the specific conditions in each case. But it must be

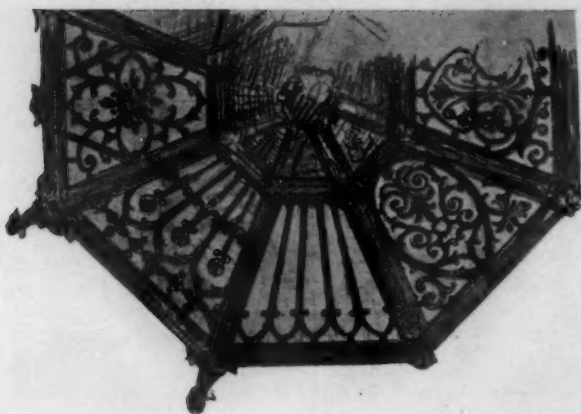


FIG. 5a—SUGGESTION FOR TRACERY WORK IN ARC LAMP CASING. THE TRACERY OPENINGS MAY BE GLAZED WITH AMBER TINTED GLASS

remembered that the shadows themselves must be luminous—not mere black patches of nothingness—and hence require careful detailed study. As we have above pointed out the design depends for its beauty upon the light enabling us to see it. The architect is thus largely dependent for his material upon light and shade. These are the scales upon which he builds his symphony and any false note may destroy its harmonies and ruin its proportions.

3. Our third consideration takes up the question of the relation of the decoration to the structural lines. In good design, where the structural lines form the chief beauty of the structure and where proper care has been taken to accent these lines, usually the decoration will be sufficiently pronounced. If, however, decoration is used, as it often is, to cover up a paucity of conception, it is sometimes necessary to accent the decoration in lieu of the structural motif; otherwise a feeling of unbalance may result. Or the very reverse of this treatment may be necessary.

4. A fourth consideration of special importance in church lighting relates to the matter of perspective. It is one of the fundamental physiological factors of illumination that bright points of light brought within the field of vision produce a corresponding loss of detail in the remainder of the field due to the automatic



FIG. 7

closing of the iris. This shuts off the quantity of light coming from less bright objects and may reduce the visual sensation they produce below the threshold of perception so that such objects are not seen at all. Lights so placed become unduly accented and appear much nearer the beholder than they are in reality.

It is therefore evident that we should avoid all horizontal rows of lights, particularly if placed low down and always if their intrinsic brilliancy cannot be materially decreased by the use of large globes, or deep reflectors. The use of such auxilliary globes or reflectors is usually an unfortunate feature as they destroy



FIG. 8

the largely decorative feature of the bare lamp and are often too conspicuous from an architectural standpoint.

Vertical rows of lamps are not generally open to the same objection, as the lines they accent are not normally parallel to the axes of the eyes and so do not tend to reduce the perspective to such an extent as in the case of horizontal rows.

The above notes may serve to indicate briefly where our problem lies—it is hardly expected they will even do that adequately, any detailed discussion being out of question within the space available.

A study of the history of church lighting will make one fact evident. The palpable artificiality of every kind of illumination presents an almost insurmountable difficulty. It is practically impossible to design any adequate system that would not seem totally out of place in such interiors as that of Durham and Amiens and the earlier portions of Canterbury or Westminster Cathedrals. The architecture of these great edifices makes its appeal purely through the sublimity of its

proportions. Decoration and ornament are unnecessary and have been but sparingly used. To attempt to light these buildings by any means less impressive in its effect than they are themselves would be little short of desecration, and artificial illumination is essentially decorative in its results. It may, in general, be taken as a rule that the simpler the architecture—provided it be good architecture—the more difficult becomes the problem of illumination.

In Norman and early Gothic churches no artificial illumination was provided. The churches were rarely used at night, and, when in use, candles at the altar and in the hands of the candle-bearers of the choir furnished all the light considered necessary. There were no hymnals or prayer books in those dark days except in the possession of the educated priests and monks, but the religious spirit so permeated the life of even the meanest individual that reading in church was not only unheard of but unnecessary. All of the lighting fixtures now used in historic English churches have been added during recent times, and, with the possible exception of the recent installation in St. Paul's, they are generally inappropriate. In the later French cathedrals and cathedrals of French and Italian influence alone was any attempt made to study the requirements of artificial lighting, and to them we must turn for suggestions.

In some early cases of Roman Catholic churches, a huge corona or crown of candles was suspended from the apex of the vaulting over the intersection of nave and transept. No illumination was furnished in the nave, and the resulting effect of the brilliantly lighted chancel and altar with the dimly lighted arches overhead must have been very impressive. In later times sconces were placed on the nave columns, or sockets were used, into which fitted wrought-iron brackets (see Fig. 3). In the designs of the Renaissance period more light was required in the nave, and smaller crowns, chandeliers, or lanterns were suspended from brackets at the spring of the vaulting arches (Fig. 4). Additional fixtures, brackets, standards and chandeliers were added



FIG. 10.—WELLS CATHEDRAL, NAVE, LOOKING EAST

at the altar screen and in the choir to maintain the contrast between the brilliantly illuminated chancel and the rest of the church. The effort was always to keep the lighting of the nave comparatively low, and to place the nave fixtures on or near the columns, so that the proportions of the church would be properly accented. The mistake was sometimes made of suspending fixtures from points that were not features in the construction, as from the groin of the vaulting or from the curve of the arches. To avoid this, some ornament or wreath was occasionally added to the neck of the nave columns, or some modification was made in the spandrels of the nave arches, and brackets were sprung from these points to which the fixtures were attached, not always with success, however, as an arch spandril is inherently difficult of treatment. The quality of the lighting was always subdued in tone and color. Everything in the nature of brilliancy was avoided excepting the glare of the diffused golden light in the chancel. Indeed anything in the nature of brilliant or festive lighting is usually impossible in churches of true Gothic design.

The use of glass was, of course, unknown in early work, and mica or skin shields formed the only means of concealing the brilliant flame. In many cases intricate tracery work in the lantern faces was used to subdue the quality of the light. Figs. 5 and 5a indicate a treatment in the decorated style of the modern arc lamp and diffuser used for church lighting, the lamp casing being of cast-iron. Fig. 6 shows the general form of the lighting fixture used in many of the early Christian basilicas. Fig. 7, from a design by Messrs. Bosworth and Holden, shows the same fixture adapted to modern methods and used with excellent effect.

The advent of the elec-



FIG. 12.—INTERIOR OF RODEF-SHOLEM SYNAGOGUE, PITTSBURG, PA.

tric lamp into the lighting field has given the architect almost perfectly flexible means of obtaining effects that were out of the question, with either oil or gas illuminants. In Fig. 1 is shown a pencil sketch after Nesfield of the interior of Laon Cathedral, in which rows of frosted incandescent lamps have been carried along the entire length of the shafts supporting the groined vaulting over the intersection of the nave and transept. Similar rows of

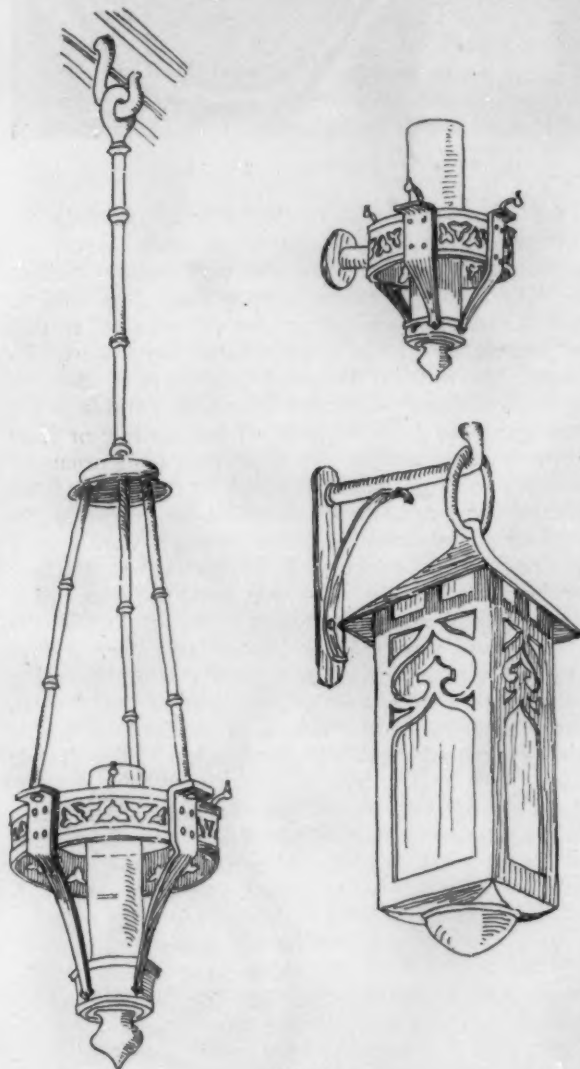


FIG. 11

lamps have been carried along the shafts supporting the groins of the nave vaulting, thus bringing into relief the exquisite lines and contours defining the principal structural features. These lamps may be set in a crocket band ornament applied to the central member of the shafting, as shown in Fig. 8, and should be of small candle power, giving a light of mellow quality obtained by the use of carbon filament lamps or high efficiency lamps with globes stained an amber tint. The author has found that the ordinary yellow waterproof ink used by draughtsmen applied to the surface of the lamp bulb produces a light of a tender golden hue without excessive absorption.

This example is given more as an indication of the possibilities of this kind of illumination than as an instance of appropriate illumination in this particular church. It would be a little too festive in appearance in a Roman Catholic cathedral except perhaps on gala occasions. The system would be much less expensive to install in a new building, however, than a system using appropriate fixtures. In this case, the fixtures indicated in the aisles are of simple wrought iron with wrought iron chain suspension.

A further suggestion in connection with the illumination of cathedrals of this size is to install reflectors on the floor of the passage behind the triforium between the columns, so set that they are not visible from the floor of the nave. This may be done by installing them in pockets between the triforium floor and the vaulting of the aisle ceiling, placing sashes inclined at some angle above the floor so arranged that the reflector will illuminate the opposite side of the church from the triforium to the apex of the nave vaulting without throwing light on its own side. By proper design the gradations of light may be modified to any extent. The principal difficulty in the use of this system is that the excessive diffusion of light would cause a weakening of shadows—a fault that would not occur in the earlier example.

The use of hanging fixtures in a church of this size has the effect of destroying the perspective and proportion unless the fixtures are so shaded that they throw the light directly down. This again leaves the upper portion of the church in darkness, and so one of its principal beauties is lost. Attempts have been made to correct this defect by using double fixtures, one hung high and one hung low on the same suspension. This of course results in an undesirable horizontal row of illuminants which in the nature of things cannot be entirely concealed and so again detract attention from the beauties of the church itself. A better scheme would be to use a combined double fixture, the lights in the lower part being shaded properly while the lights in the upper part are arranged so that they cannot be seen at all and throw their light entirely upward. The modern arc lamp and diffuser lends itself to good treatment as a church fixture as is illustrated in Fig. 5. The basin formed by the upper side of the reflector may serve to conceal a circle of incandescent lamps used to light the upper part of the church.

The inadequacy of the present methods used in lighting so many of the fine cathedrals is illustrated by the installation in Westminster Abbey, a view of which is shown in Fig. 9. The church is practically dark during evening service and but a meager glow is shed over the chancel and choir by means of the small candle lanterns placed on the choir desks. The single fixture suspended in the center of the chancel does little more than pick out an occasional bit of ornament against the general gloom of the background.

A bit of fine illumination is suggested by the tracery bars worked into the chancel arch in Wells Cathedral (Fig. 10). This idea might be carried out in a new building by working into the chancel arch a more or less elaborate tracery work the back of which facing the channel should be studded with lamps employing reflectors if necessary to project a flood of golden light

over the entire altar, choir and vaulting, against which the dark lines of the tracery would be set out in bold relief.

In smaller churches where the distances are not so great and where all points of the structure are comparatively near to those using the building we are unable to employ the bold rows of exposed lamps, even though these be low in candle power. It has been suggested that such rows of lamps might be set along the side of each nave arch toward the chancel, the arch itself serving as a shield for the sitters in the pews. This, unfortunately, is rather hard on the minister and choir who are compelled to face these lamps. Furthermore, any such scheme is certain to detract from the cozy effect of small churches which is one of their chief charms.

It would seem wiser to adhere generally to fixture lighting in such cases, using fixtures throwing plenty of light down where needed and carefully shaded in horizontal directions. The roof and vaulting being comparatively low will usually receive enough light by reflection. In Fig. 11 are shown some fixtures using the Bryan lamp designed by Mr. B. G. Goodhue, for a small church. The intrinsic brilliancy of these lamps could be well reduced by letting amber glass panes into the spaces between the supporting members. This would produce a softening of the illumination used by the congregation and at the same time would not interfere in any way with the general illumination of the body of the church.

Of course the principal difficulty in the use of fixtures is the fact that if hung low enough they interfere with the view, and if hung high people sitting in the back of the church will have the direct light in their eyes. If hung near the side walls or nave columns so as to be out of the view then those in the center pews get too little light. Again the architectural treatment of the fixtures made necessary by the environment may introduce still further difficulties in our efforts to secure good lighting. However, as we have said before, no definite rules for securing results can be given as each case must be studied in the light of its own merits. Good lighting is largely the result of the exercise of good taste and good judgment and only to a small extent is it the result of mathematical calculations.

We have space for but one more example—the lighting of a synagogue.

In Fig. 12 is shown the interior of the Rodef-Sholem Synagogue, in Pittsburg, designed by Messrs. Palmer and Hornbostle, which will serve as an illustration of symbolic lighting. The general illumination is obtained by means of a band of frosted incandescent lamps surrounding a large stained glass skylight let into the top of the dome over the auditorium. The walls of the dome serve as an excellent reflector and an illumination of practically even intensity is produced over the entire area. The huge wooden symbolic fixtures are suspended from the corners of the decorative band surrounding the skylight and serve a double purpose as illuminants and as a means of removing the vacancy of the enormous space over the heads of the congregation. Other symbolic fixtures are worked into the design of the platform and organ loft. The entire effect is exceedingly impressive.

GENERAL NOTES ON SPECIFICATIONS AND CONTRACTS

BY WM. BROKAW BAMFORD, A.M. Am. Soc. C.E.

PART II.

Building contracts might be said to be divisible into four parts or divisions:

1. *Conditions of Contract*—Being the terms under which a contract is awarded and giving the general information necessary before the execution of the agreement. It would include the "Form of Agreement" and "General Conditions."

2. *Agreement or So-Called Contract*—Being the instrument executed between the owner and contractor legally and formally binding them to fulfill their obligations.

3. *Specifications*—Being detailed written description of the method of construction and the quality and kind of materials to be furnished.

4. *Drawings*—Being the detailed, graphic design of the work to be done, with the quantity and sizes of materials.

The conditions of contract and the specifications are often combined and called simply specifications. The specifications and drawing together are often called the instruments of the contract, and the articles of agreement is popularly called the contract. This system of nomenclature is at times very confusing, but is extremely common.

Conditions of Contract—These cover in general "Invitations for Proposals," "Information for Bidders," "Proposals and Schedule of Prices," "Article of Agreement," or, so-called "Contract," and the "General Conditions." After the agreement is executed the requirements contained in the "Invitations for Proposals" and "Information for Bidders" should become obsolete as far as they affect the construction of the work, it being assumed that the requirements have been fulfilled before the execution of the agreement or that any article not fulfilled has been covered in some form by the agreement or general conditions of the specifications. Nothing should therefore be put exclusively into these two forms that would relate to the actual construction of the work.

The importance of having "Conditions of Contract" legally correct cannot be overestimated and reference is again made to the American works by John C. Wait and John M. Brown, mentioned under Legality. There are also several excellent British works on the subject.

Agreement or Contract—This is purely a legal document and seldom referred to concerning matters affecting the construction. Its provisions should be most carefully drawn. The books of Wait and Brown, mentioned under Legality, are also specially applicable to the agreement. The agreement should not contain any matter concerning the details of construction; these belong properly to the specification.

There are, however, a number of requirements of a more or less legal nature which could be included in the agreement, or in the specifications under the chapter, general conditions. The reason for placing them in the specification is primarily to keep all requirements constantly before the contractor, as the agreement is seldom referred to after execution. Legally they would be just as binding in one as in the other.

The author has developed a form of agreement with a set of general conditions which might be called an innovation in American building practise. He has long felt that the uniform contract, which is in more or less general use, was defective in many important respects. There are several fundamental questions in modern practise that are not definitely established, and these matters, together with a new form of agreement and general conditions, are now under consideration by a committee of the American Institute of Architects.

Several years ago the author found that the Royal Institute of British Architects had felt the need of a more equitable agreement between owner and contractor, and after some six years of labor, had approved for use, an agreement and set of conditions of contract on May 13, 1895. It would seem that they might fairly be considered much superior to the uniform contract at present having the approval of the American Institute of Architects, and even broader in their scope than those proposed by the author.

The uniform contract has been largely used in the past for lump sum building agreements, and while it has a number of defects, there has been nothing adopted by representative bodies in America to take its place.

Contracts are often designated by the manner in which the work is to be paid for, as:

1. Lump sum.
2. Cost, plus a percentage.
3. Cost, plus a percentage, where general contractor takes estimates for sub-branches of work and makes lump sum contracts with the architect's approval.
4. Cost, plus a percentage, with guaranteed limit.
5. Cost, plus a fixed sum.
6. Cost, plus a fixed sum, with a bonus if cost is less than a fixed sum and penalty if it exceeds such sum.

The lump sum form of contract is the most usual. This contract presumes that the drawings and specifications shall completely and accurately describe everything that the contract must do or furnish, especially where an expense is involved. If this is not done contractors' prices become mere gambles on probabilities and not accurate estimates of actual costs plus a legitimate profit. Contracts are too often lacking in definite information and they are certain to be the cause of continual friction between architects, owners and contractors. The blame for this state of affairs is usually laid to the contractor. It must not be forgotten that the primary reason why a contractor enters into a contract is his expectation of making a legitimate profit. Fair competition is healthy, obtaining prices on 20,000 bricks, 1000 barrels of cement, or other known quantities, is fair and open, because definite; but where quantities and work to be done are pure guesses, is it to be wondered at that a contractor will fight at every legitimate opening in order to protect his final profit? He is not always able to legally demand additional compensation for the work which has actually cost him more than the estimated amount, so his only opportunity to make up his losses and come out with a fair total profit is by obtaining good prices for additional work, or, if it does not appear that there will be any such worth while, the contractor must find flaws

with the contract and endeavor to get all the extra money he can through technicalities or otherwise.

With the irresponsible or dishonest contractor there need be no sympathy, but by far the greater number of contractors only desire their legitimate profit, and the prospect for making a fair profit by hard, honest work is none too bright under the usual lump sum contract.

The English method of quantity surveying is an excellent attempt to overcome the worst objections to the lump sum system of estimating, but as at present in use would be too cumbersome for American practise. There the owner or architect has the work to be done itemized in detail and this detailed statement is submitted to all contractors for them to fill in their prices. These lists go into matters in minute detail, and as all contractors estimate on the same list, the advantage is obvious. The practise in many cases is, however, to ignore the lists as a part of the contract and make the contractor responsible for any omissions, thereby destroying one of the main benefits of such a list—its encouragement of close competition.

Contractors have found that the easiest and most practical way for them to overcome the disadvantages of the lump sum estimates is by the various percentage systems. The contractor is thus assured of his profits and the owner and architect can change or increase the work to their hearts' content, as any additional expense involved is borne by the owner.

Assuming again that the contractor is honest and the bills and statements he presents for payment are correct, and have all discounts, except a cash discount deducted, the cost of percentage work is apt to exceed the cost of work done under a lump sum contract. The reasons for most of this increase are not hard to find. The contractor, not being responsible for the cost and having his profit assured, readily makes any changes and does work as directed, no matter how expensive or uneconomical such work may be, and the owner does not realize how expensive his fads or fancies will be until the work is completed. Then again, if the percentage is based on the total cost, there is not the incentive for the contractor to become as zealous in obtaining the closest prices for material as he would under a lump sum contract.

Another most serious objection to percentage work is due to the fact that mechanics are inclined to loaf, even under the most careful supervision, and it is hard to get as much work out of them as under the lump sum system. They seem to feel that as their employer, the contractor, won't suffer any loss there will be no harm done.

Many of the most serious objections to the percentage system have been overcome in varying degrees under systems 3, 4, 5 and 6. These systems have much to commend them, and with all their faults they will eventually supersede the lump sum system unless more care is taken to make the drawings and specifications complete and accurate.

It is worth noting that the United States Government, after serious study, prepared an excellent contract on the basis of system 6 for the construction of the Panama Canal, but owing to the difficulty in getting a single contractor who could successfully handle such

a large undertaking, the contract system was abandoned and the government itself took charge of the work.

Specifications—The specifications and contract drawings, together, should give the contractor a clear and complete knowledge of the work he must perform and the materials he must furnish, and should contain all the information necessary to permit him to make an accurate estimate and to properly carry out the work. No information essential to him should be withheld.

A specification can be short and general or long and detailed, according to the amount of information given on the drawings. As the drawings are usually referred to by the mechanics for information, it is preferable to make them as complete as possible. Figured dimensions should preferably be given on the drawings rather than in the specification.

If the drawings are completely detailed it will only be necessary to refer to such details in the specification. If, however, only general information is given on the drawings, or it is impossible to show certain portions, a full description of these parts should be given in the specification. The specification should supplement the drawings and not completely describe them, each being interdependent. It is unwise in practise to describe in detail in the specification work clearly shown on drawings, for while it may be theoretically a good thing, it will be found too often changes made in one have not been properly made for the other, or there is some disagreement between them. Such conflicts should be guarded against, as a contractor will have a good ground for extra compensation if he is put to too great an expense by reason of conflicts he could not reasonably have been expected to discover when making his estimate.

Care is not always used in the selection of the requirements which should properly be contained in the specification. The design and the construction of buildings are each governed by a series of requirements which are distinctly peculiar to their separate fields and should not be confused or overlapped. The new building law and the sanitary regulations of New York and other cities, and the rules of the National Board of Fire Underwriters are examples of specifications containing matter which govern both the design and the construction of structural work. With such regulations as his legally authorized guide, the architect should completely design the structural as well as the artistic part of the work, and work out the sizes, etc., of the various parts to make them conform to the safe working stresses for the allowable loads, etc., for the work, and there should then be no need to encumber the specification with matter relating to the design of such parts.

(To be continued)

The attic of the façade of the Hotel des Monnaies, Paris, built 1771 from designs of Antoine, has been decorated with six statues in stone symbolizing respectively Law, Prudence, Force, Commerce, Plenty, and Peace. The originals, the work of Le Comte, Mouchy and Pigalle, had been removed on account of their crumbling condition. The new statues have been modeled on casts taken of the originals.

CHARLES FOLLEN McKIM

Charles Follen McKim, founder of the firm of McKim, Mead & White, architects, died September 14, at his country residence in St. James, L. I.

Mr. McKim was born in Chester County, Pa., in 1847. After a course of study at the Lawrence Scientific School, Harvard University, Mr. McKim, as a pupil of Daumet, entered the École des Beaux Arts at Paris. In 1870 he returned to New York and began the practice of his profession.

In 1877 Mr. William R. Mead became a partner of Mr. McKim, and, in 1879, the late Stanford White joined the firm.

Probably no single member of the architectural profession in America has done more to uphold its dignity and secure the respect that exists throughout the civilized world for architecture in this country than has Mr. McKim.

His remarkable facility in design soon placed him in the front rank. The buildings with which his name is connected are among the best erected in this country.

Mr. McKim has received at the hands of the governing body of American architects every honor that it has been possible for them to bestow. As president of the American Institute of Architects, his administration was marked by many measures that have helped to promote the unity and welfare of the profession. Not only has Mr. McKim received recognition from his own countrymen, but his achievements have attracted unusual attention abroad.

In 1900 he received a gold medal at the Paris Exposition, and in 1903, King Edward of England awarded him a gold medal for his share in promotion of architecture. That Mr. McKim was keenly interested in the promotion of art outside the interests of his own profession is instanced by the fact that he was the founder of the American Academy at Rome.

To enumerate the many honors and distinctions that have been conferred on this man, to set down a list of the notable structures with which he has been identified and which his genius has created, would be to write the history of the growth of architecture in America.

Certain it is that his death marks the passing of a great mind, that beautified everything it approached, and his memory will be held in the highest reverence wherever the universal language of good architecture is spoken.

THE ROCHESTER, N. Y., COMPETITION FOR SMALL HOUSES.

In the spring of 1908 the Rochester Chamber of Commerce inaugurated their competition for single or detached cottages, the object being to assist in providing low cost dwellings for the working men living in the suburbs or outskirts of the city.

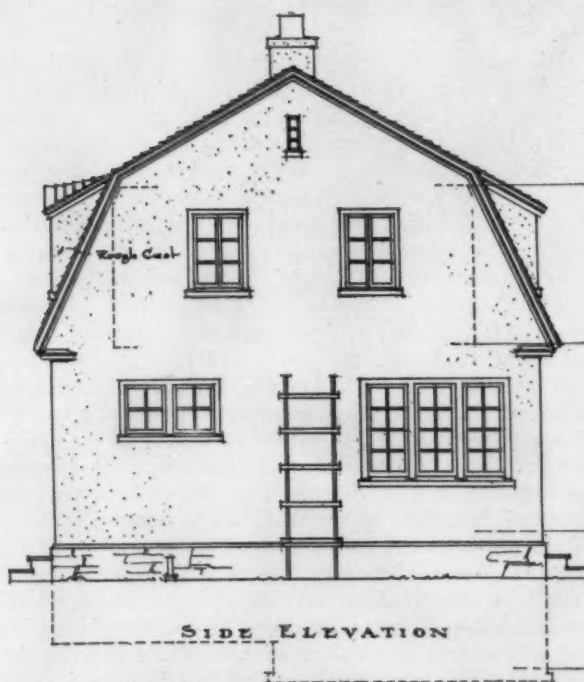
The program called for three classes of cottages, \$1,500, \$1,200 and \$1,000. Prizes were offered for the three best designs in each class. The prizes for the first

class were respectively, \$135, \$70 and \$35; for the second class, \$115, \$55 and \$30, while for the thousand dollar cottage, the most difficult problem, only \$90, \$45 and \$25 were offered.

The houses were to be built upon city or town lots not less than 40 by 100 feet, in blocks of ten, each house to contain a bathroom with three fixtures, a kitchen sink, sewer, water and gas connection to street, heat pipes and registers for future furnace, cellar and foundation excavations to be in earth.

The program stated that the style of construction and materials used was optional.

With a liberal interpretation of a very liberal program the material selected by Johnson & Schenck for the exterior was lime plaster upon wood lath. A precedent for this material is found throughout Quebec and Ontario, Canada, where it has been successfully used for more than seventy years, proving conclusively that plas-



ter when well applied can be depended upon as an exterior wall covering. Exterior plastering may be applied in several ways, and below we show three sketches, any one of which could be followed in this competition.

No. 1. The exterior lath is directly nailed to the

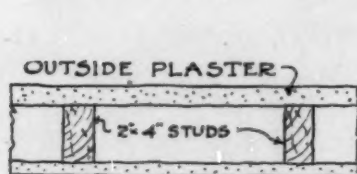


FIG. 1

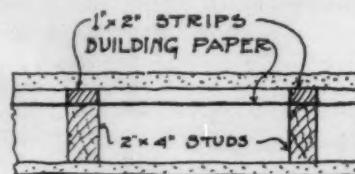


FIG. 2

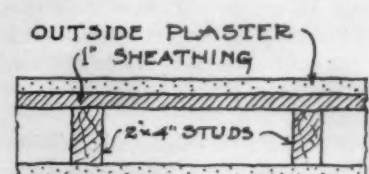
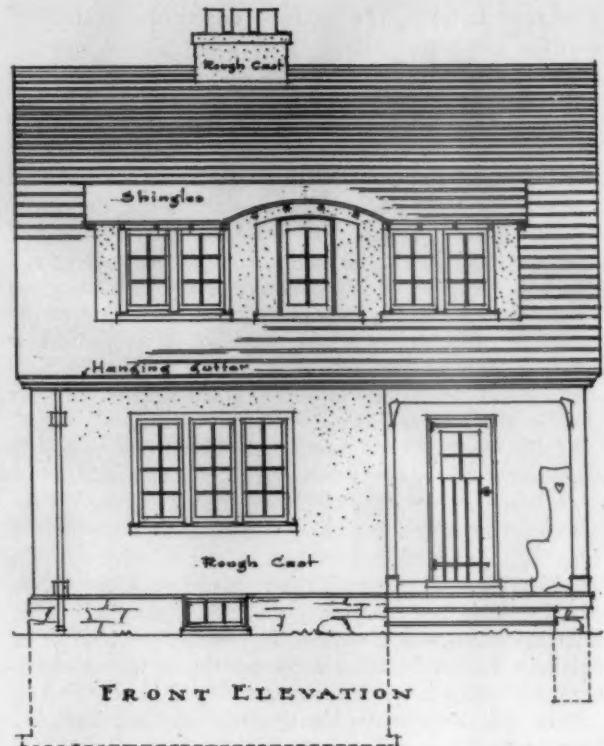


FIG. 3

studding in a diagonal manner with a space of one inch between laths; over this in the opposite direction another layer of lath is nailed, this diagonal lath forming a good system of bracing for the entire building.



No. 2 has good thick building paper applied directly to the studding; over this paper and to the studding are nailed strips of 1 by 2 inch, to which is nailed the lathing in the regular way.

No. 3. The $\frac{7}{8}$ -inch boarding is nailed to the lath, and over this sheathing is applied the building paper fastened by having strips of lath nailed vertically, as shown in No. 2, these strips giving a key for the exterior plaster.

The surface of exterior plaster can be made thoroughly waterproof with an application, after one year or eighteen months, of three coats of lead and oil.

For economic reasons sketch No. 1 was followed in this competition.

The next important economical point in construction was the introduction of casement sash with small lights of glass 9 by 12 inches, the sash opening outward to admit of the use of fly screens. The frames were solid, thus making a saving in the omissions of either outside or interior casing.

Another item was the introduction of girders in the

floor construction, which allowed the use of smaller joist 2 by 4 inches minus 16 inches on centers, and the omission of the usual bridging.

(Continued on page 116)

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ILLUSTRATIONS:

Some Recent Work in Domestic Architecture by Mr.
Aymar Embury II.

Frontispiece:

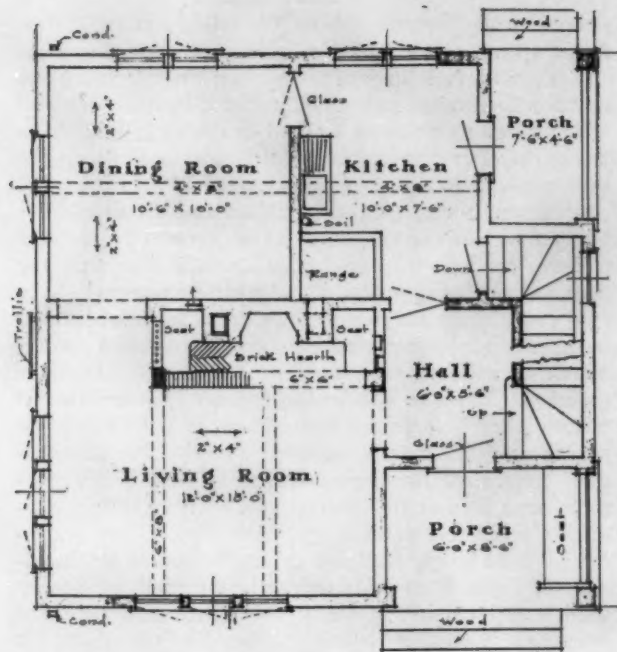
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WHILE the architect has responded in a manner little short of marvelous to the demands of progress, and has amply earned the position which he now occupies as chief of building operations generally, whether complex or simple, it would obviously be beyond the power or capacity of a single individual, alone and unaided, to produce the design and then perfect all the plans and specifications for a modern building of any considerable size or importance. He must build up an organization and surround himself with lieutenants who will work under his direction and will provide for, subject always to his approval, the various requirements made manifest by the character of structure under consideration and the broadly determining lines laid down. The structural and sanitary features, as well as the heating, ventilating, lighting and power equipment are ordinarily handled in accordance with latter day practice, under the direction and supervision of the architect, by engineers in his employ. These men become not infrequently highly developed specialists, whose ingenuity and resourcefulness have added not a little to the success of modern buildings; have, in fact, probably made some types possible, and they are entitled to full credit for their achievements.

AMONG those things that, taken together, have revolutionized buildings and their equipment during the past fifty years, electricity is not the least

striking or important. From the tallow candle of our father's time, to the electric lights that both illuminate and adorn the buildings of to-day, is a long step, and one that has been taken so hurriedly that it is probable there still remains much to be learned concerning lighting as a science. The development of this science and its practical application will doubtless devolve largely upon the engineer who can give the subject undivided and intelligent attention, and Mr. Jones' article in another column, the first of a series, is an indication that the matter is not being neglected. Architects generally have long realized the importance of correct lighting, but too frequently a pleasing result seems to have been more a matter of accident than design, for it is not invariably repeated. Many an interior has appeared flat and insipid when viewed by artificial light, due entirely to a lighting arrangement that has completely nullified the architectural treatment. In other instances the architectural features have been unduly accentuated by the lighting, producing an almost equally unhappy effect. Very apparently it is no longer sufficient to simply furnish an abundance of light, it must be properly disposed, of proper kind and intensity, properly controlled, and then the questions of cost and efficiency obtrude themselves. It seems plain that correct lighting is a subject the architect will do well to study, and a careful consideration of the points developed by Mr. Jones will be of undoubted assistance.

CHARLES F. MCKIM has passed beyond the power of man to aid or injure. In his death the profession that was proud to claim him has suffered the loss of its most illustrious member. We realize how vain it is to undertake to soothe a grief or adequately express our sense of loss with words. And yet the little solace, the small relief perhaps, afforded by such thoughts as they will stimulate, do sometimes give us hope and comfort. Here was a man whose genius was acknowledged by the world. A truly great man. One who met criticism and endured attack with quiet dignity, proclaiming him above his critics. For he had detractors. Who has not if he possess sufficient talent to distinguish him from his compeers? His attitude and bearing when approached with bickerings and calumnies of ignorance or envy, served alike to bring distinction to the calling and inspire the younger men of his profession. The pure unselfishness displayed by him toward those less gifted, or perhaps young men just starting in the race, exalts McKim—the man even above McKim—the genius. Many young firms there are who owe existence to encouragement and aid supplied by this big-hearted man. His deeds in this regard contrast with those most often seen as red with yellow. A thoroughly normal man, entirely lacking those eccentricities of mind possessed or feigned by many who have attained less measure of distinction. On his achievements there is no need to dwell. When in the fullness of time true values are assigned and history is written, his name will light the page on which is chronicled our art and its development.



(Continued from page 114)

The doors were designed of V-jointed boards placed vertically with cross battens and long strap hinges. The jambs were solid of 3 by 5 inches and flush with the plastering, avoiding the use of an interior trim.

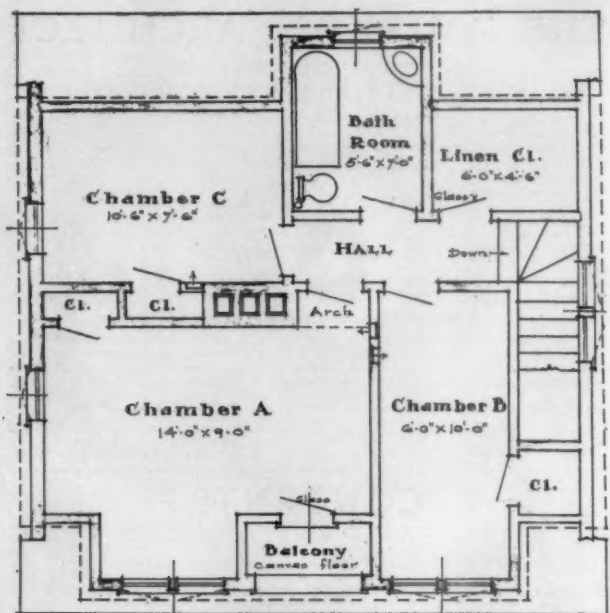
In the planning of the house the square form of plan was adopted, as it presents a greater amount of floor area than the long, narrow plan. This can be easily illustrated by comparing the cubic contents of a plot 4 by 4 feet or 16 square feet and a rectangle 8 by 2 feet in which the former has 16 feet of wall surface against 20 feet in the latter case, yet the areas are precisely the same.

The stair hall was separated from the living room and the stairs made convenient to the front door, which, in turn, is of easy access to the kitchen. The dining room is separated from the living room by an arched opening, and so placed that, while it is convenient to the kitchen, it also has the privacy which is so desirable in a house of this kind where the family can dine without being disturbed by the stranger who is likely to step in at unexpected moments.

The single nook in the living room is the predominant "feature" of the plan. It has two comfortable high back seats at each side far enough away from the blazing logs to make the heat agreeable. The projecting mantel shelf supported by heavy wood brackets and the dark stained wood wainscot at either side form a rich contrast to the rough brick fireplace with wide mortar joints between the brick.

It will also be noted that the entire heating system is controlled through the one chimney. This has its decided advantage when the matter of cost is considered, especially since, owing to its central location and construction, no face brick is required on the exterior of the building.

On the second floor there is a large double bedroom with a balcony on the front. There are two smaller bedrooms. Each room has a closet and there is also a



large linen closet or storeroom. There is absolutely no space wasted in the hall, and the bathroom is easily accessible from all the rooms.

Another economical feature was the arrangement of placing the bathroom plumbing directly over the line of the kitchen plumbing in the first floor.

The chimney flues are all lined with terra cotta pipes their full length, and the latter extend about 15 inches above the top, giving the effect of chimney post at a much less cost. By the use of flue linings the thickness of brick around the flues is reduced to a minimum of four inches.

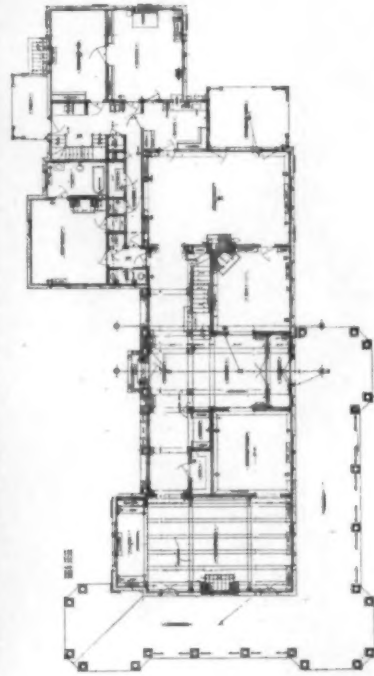
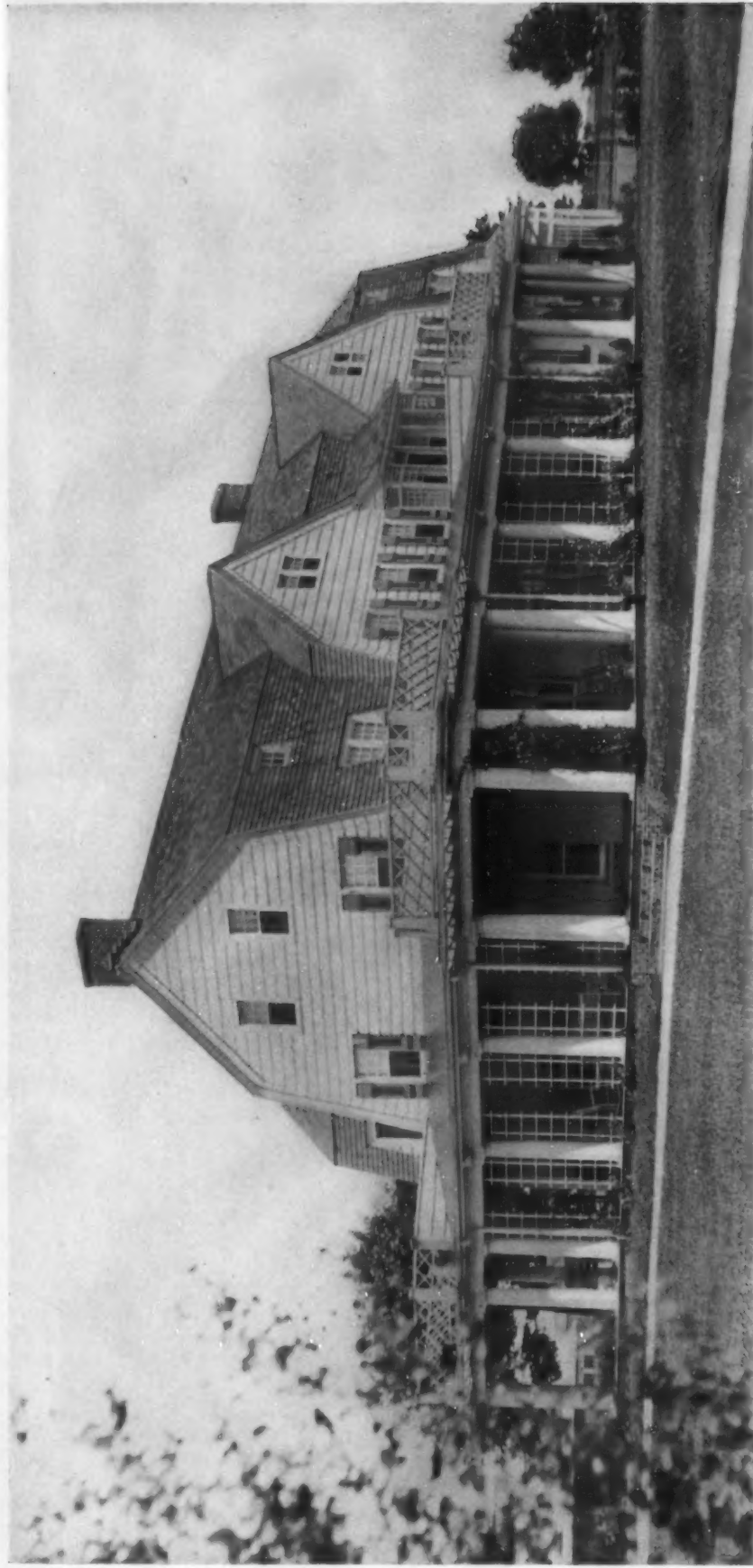
In designing the exterior Johnson & Schenck have made the idea of simplicity in form and detail a predominating factor. There are no unnecessary brackets or dentils and no overloaded masses of dormers and projecting bays. The gambrel roof brings the main cornice nearer the ground than any other form of roof, and thereby aids in preserving the low effect, which is a difficult problem in designs of this nature.

The curved line over the balcony and the irregular cut end of the porch seat break up the horizontal line effect of the front elevation. There is abundant light in all the rooms. The casement windows, consisting of a number of unit sash, are a saving to the millman, and also give dignity and harmony to the exterior.

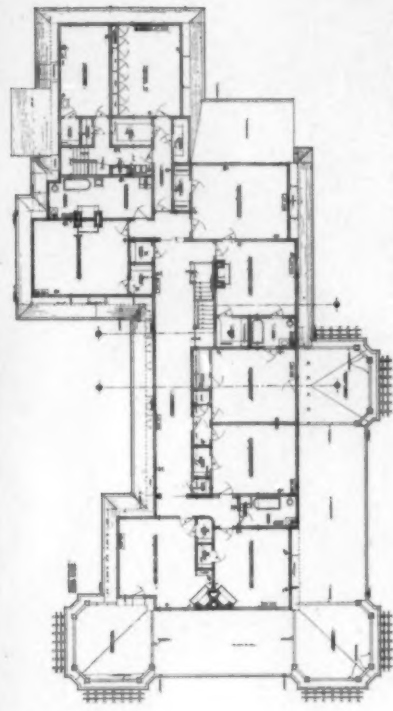
The interior woodwork of this house is intended to be stained throughout a rich brown color and all exterior wood to be stained a darker shade, including the roof shingles, which should be a trifle lighter in tone. The muntins and sash should be painted white, and the exterior plaster left its natural color. The interior walls may be plastered with a rough sand finish, and in this case no papering will be necessary.

Johnson & Schenck have succeeded in producing an eight-room cottage 23 feet 6 inches by 24 feet with all the conveniences of an attractive modern home.

The builder who submitted the bid agreed to build ten cottages from the drawings and specifications for \$15,000, which is about 14½ cents per cubic foot.



HOUSE OF RALPH PETERS, ESQ., GARDEN CITY, L. I., N. Y.



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MR. AYMAR EMBURY II, ARCHITECT

This design was the result of an attempt to do a large house in the low and rambling Dutch style. The materials are buff colored stucco over terra cotta blocks in the first story, white shingles in the second story and brown for the roof.

The interior of living room is finished in oak with the remainder of the house in white paint.



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ENTRANCE HALL



LIVING ROOM

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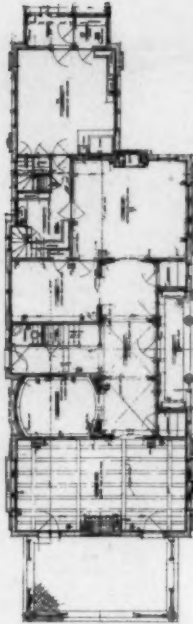
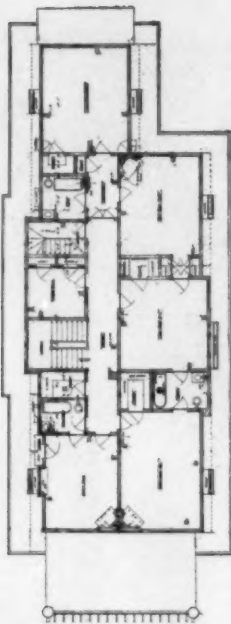
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COTTAGE OF HENRY S. ORR, ESQ.
GARDEN CITY, L. I., N. Y.

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MR. AYMAR EMBURY II
ARCHITECT



This house is built of terra cotta blocks in the first story with buff stucco over it, and hand rived cypress shingles painted white above, roof dark brown. The pergola arrangement at the end of the porch gives possibility for vines along the ends. The porch floor is of brick. The first story, with the exception of the dining room, is of oak, stained in different tones of gray. The dining room in second story is painted white.

COTTAGE OF HENRY S. ORR, ESQ.
GARDEN CITY, L. I., N. Y.

MR. AYMAR EMBURY II
ARCHITECT



LIVING ROOM

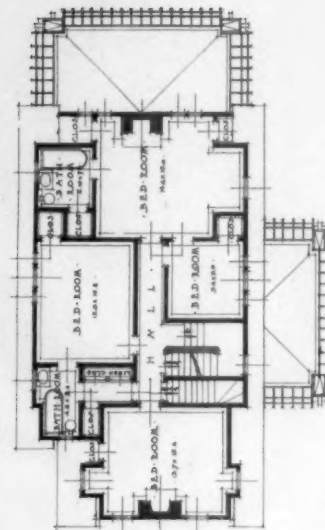
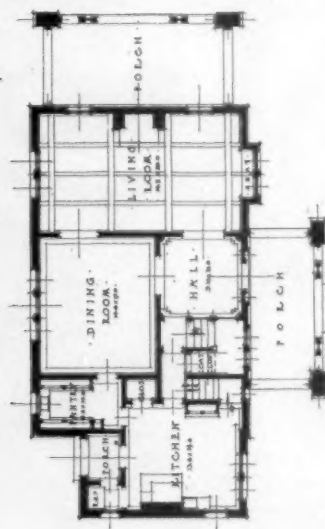
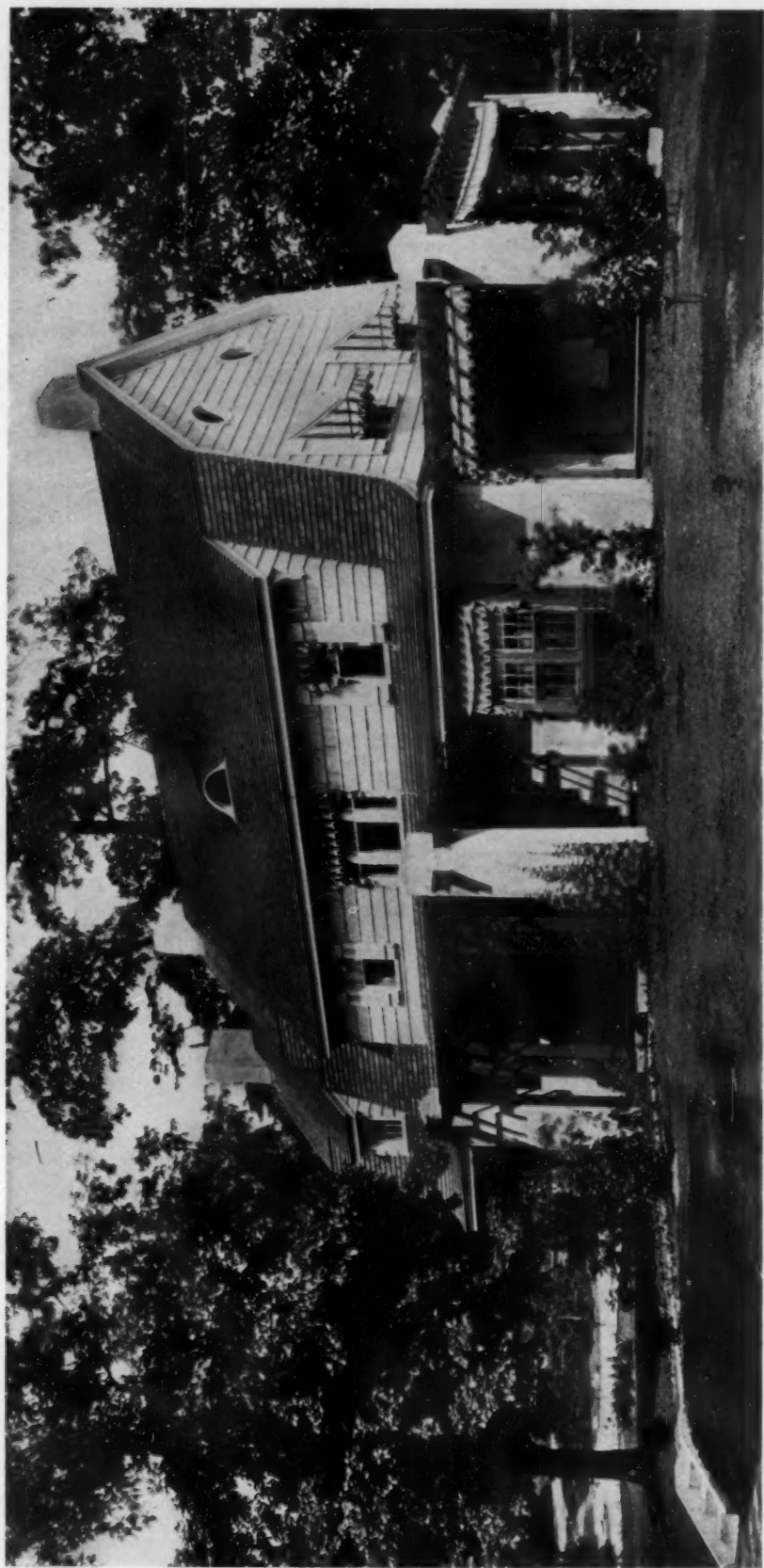


HALL

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COTTAGE OF HENRY S. ORR, ESQ.
GARDEN CITY, L. I., N. Y.

MR. AYMAR EMBURY II
ARCHITECT



This house is built of terra cotta blocks stuccoed on the outside and plastered on the inside directly on the blocks. Woodwork is of chestnut; all outside work is stained dark brown, the stucco finished buff, the shingles were hand rived cypress ten inches to the weather and painted white. On the inside the ground floor and hall in second story were stained and the second floor was painted. Provision was made for two rooms and bath-room in the third story which were not completed at this time.

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